

The New World tarantula-hawk wasp genus *Pepsis* Fabricius (Hymenoptera: Pompilidae).

Part 3. The *P. inclyta*- to *P. auriguttata*-groups

C.R. Vardy

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In this part the remaining 78 species of the genus *Pepsis*, belonging to ten species-groups, are described and figured, and their phylogenetics and biogeography are discussed. 14 of the species are described as new: *P. achterbergi* spec. nov., *P. adonta* spec. nov., *P. boharti* spec. nov., *P. caliente* spec. nov., *P. dayi* spec. nov., *P. esmeralda* spec. nov., *P. ianthoides* spec. nov., *P. jamaicensis* spec. nov., *P. krombeini* spec. nov., *P. martini* spec. nov., *P. multichroma* spec. nov., *P. nanooides* spec. nov., *P. wahisi* spec. nov., and *P. willinki* spec. nov. Three species-names, *P. infuscata* Spinola, 1841, *P. lampas* Lucas, 1895, and *P. thoreyi* Dahlbom, 1845, are recalled from synonymy.

The following 293 names are newly synonymized (the valid names are listed first): *P. atalanta* Mocsáry, 1885 = *P. nitens* Mocsáry, 1894, *P. mocsaryi* Lucas, 1895; *P. inclyta* Lepeletier, 1845 = *P. mutabilis* Lepeletier, 1845, *P. vagabunda* Lepeletier, 1845, *P. cupripennis* Taschenberg, 1869, *P. violaceipennis* Mocsáry, 1885, *P. clotho* Mocsáry, 1888, *P. spengeli* Mocsáry, 1888, *P. sickmanni* Mocsáry, 1888, *P. nireus* Mocsáry, 1894, *P. atrovirens* Lucas, 1895, *P. cerastes* Lucas, 1895, *P. pygidialis* Brèthes, 1908, *P. guaranitica* Brèthes, 1908, *P. parca* Lucas, 1919, *P. atahuvalpa* Banks, 1946, *opimicornis*, Haupt, 1952, *atropos*, Haupt, 1952, *azurea* Haupt, 1952; *crassicornis* Mocsáry, 1885 = *P. sappho* Brèthes, 1908, *P. nitocris* Brèthes, 1908, *P. vivida* Brèthes, 1908, *P. archavaletai* Brèthes, 1908, *P. lynchii* Brèthes, 1908, *P. operosa* Brèthes, 1908, *P. ataraua* Banks, 1946, *P. splendida* Haupt, 1952; *P. sommeri* Dahlbom, 1845 = *P. azteca* Cameron, 1893; *P. xanthocera* Dahlbom, 1843 = *P. nigrescens* Smith, 1855, *P. fulgidipennis* Mocsáry, 1885, *P. junco* Brèthes, 1908, *P. ismare* Banks, 1946, *P. nigroprasina* Haupt, 1952; *P. seifferti* Lucas, 1895 = *P. cornuta* Lucas, 1895, *P. moebiusi* Lucas, 1895, *P. stygia* Lucas, 1895; *P. luteicornis* Fabricius, 1804 = *P. strenua* Erichson, 1848, *P. tinctipennis* Smith, 1873, *P. citreicornis* Mocsáry, 1894, *P. venosa* Banks, 1945, *P. alector* Banks, 1946; *P. asteria* Mocsáry, 1894 = *P. luridicornis* Brèthes, 1926; *P. convexa* Lucas, 1895 = *P. humeralis* Brèthes, 1914; *P. helvolicornis* Lucas, 1895 = *P. bahiae* Brèthes, 1914; *P. vitripennis* Smith, 1855 = *P. obscura* Lepeletier, 1845, *P. amabilis* Mocsáry, 1885, *P. centralis* Cameron, 1893, *P. margarete* Lucas, 1895, *P. venezuelae* Kaye, 1913, *P. aeneipennis* Banks, 1946, *P. helenae* Haupt, 1952, *P. coeruleoviridis* Haupt, 1952; *P. fumipennis* Smith, 1855 = *P. pallidicornis* Mocsáry, 1885; *P. amyntas* Mocsáry, 1885 = *P. vicina* Lucas, 1895, *P. clarinervis* Brèthes, 1908, *P. amyntoides* Lucas, 1919, *P. eurydice* Lucas, 1919; *P. dimidiata* Fabricius, 1804 = *P. vittigera* Lucas, 1897, *P. argentina* Brèthes, 1908, *P. sanctaeannae* Brèthes, 1908, *P. virgo* Brèthes, 1908, *P. externa* Brèthes, 1908, *P. transversa* Brèthes, 1908, *P. cordubensis* Brèthes, 1908, *P. banghaasi* Lucas, 1919; *P. menechma* Lepeletier, 1845 = *P. elegans* Lepeletier, 1845, *P. dubitata* Cresson, 1867, *P. prismatica* Smith, 1855, *P. advena* Mocsáry, 1885, *cinctipennis* Mocsáry, 1885, *P. guatemalensis* Cameron, 1893, *P. nestor* Mocsáry, 1894, *P. nigricornis* Mocsáry, 1894, *P. auranticornis* Lucas, 1895, *P. fruhstorferi* Lucas, 1895, *P. concolor* Lucas, 1895, *P. cerberus* Lucas, 1895, *P. euchroma* Lucas, 1895, *P. nigrocincta* Lucas, 1895, *P. mordax* Lucas, 1895, *P. inermis* Fox, 1898, *P. roberti* Brèthes, 1908, *P. janira* Brèthes, 1908, *P. cultrata* Brèthes, 1908, *P. novitia* Banks, 1921; *P. decipiens* Lucas, 1895 = *P. similis* Lucas, 1895; *P. minarum* Brèthes, 1914 = *P. pulchra* Brèthes, 1914; *P. basifusca* Lucas, 1895 = *P. angustimarginata* Viereck, 1908; *P. chrysoptera* Burmeister, 1872 = *P. exigua* Lucas, 1895, *P. smaragdina* Lucas, 1895, *P. nebulosa* Lucas, 1895, *P. karschi* Lucas, 1895, *P. anisitsii* Brèthes, 1908, *P. indistincta* Brèthes, 1908, *P. dimidiatipennis* Brèthes,

1908, *P. chloroptera* Brèthes, 1908, *P. culta* Brèthes, 1908, *P. recta* Brèthes, 1908, *P. tornowii* Brèthes, 1908, *P. schrottkyi* Brèthes, 1908, *P. itinerata* Brèthes, 1908, *P. miniata* Brèthes, 1908, *P. spegazzinii* Brèthes, 1908, *P. paulistana* Brèthes, 1914, *P. chloe* Brèthes, 1914, *P. coronaria* Brèthes, 1914, *P. semilucana* Haupt, 1952, *P. bruneipes* Haupt, 1952, *P. brachynotus* Haupt, 1952, *P. diagonalis* Haupt, 1952, *P. discrepans* Haupt, 1952; *P. elongata* Lepeletier, 1845 = *P. purpurascens* Smith, 1855, *P. fuscipennis* Smith, 1873, *P. longula* Banks, 1946; *P. australis* Saussure, 1867 = *P. centaurus* Lucas, 1897; *P. cyanescens* Lepeletier, 1845 = *P. micans* Mocsáry, 1885, *P. jucunda* Mocsáry, 1885, *P. balloui* Banks, 1946, *P. diversa* Haupt, 1952; *P. lampas* Lucas, 1895 = *P. venturii* Schrottky, 1902; *P. nitida* Lepeletier, 1845 = *P. lucidula* Smith, 1855, *P. vaualba* Smith, 1855, *P. pruinosa* Mocsáry, 1894, *P. cylindrica* Lucas, 1895, *P. andina* Brèthes, 1908, *P. dilatata* Brèthes, 1908, *P. holmbergi* Brèthes, 1908, *P. concava* Brèthes, 1908, *P. ephebus* Brèthes, 1908, *P. vaga* Brèthes, 1908, *P. fuscobasalis* Brèthes, 1908, *P. cordata* Brèthes, 1914, *P. impatiens* Brèthes, 1914, *P. tricolor* Brèthes, 1914, *P. joergenseni* Brèthes, 1914, *P. cleone* Brèthes, 1914, *P. dorsata* Brèthes, 1914, *P. aretheas* Brèthes, 1914, *P. lassonis* Lucas, 1819, *P. consors* Banks, 1946, *P. interrupta* Banks, 1946, *P. analis* Haupt, 1952; *P. seladonica* Dahlbom, 1843 = *P. deuteroleuca* Smith, 1855, *P. kohli* Lucas, 1895, *P. venezolana* Brèthes, 1908, *P. burmeisteri* Brèthes, 1908; *P. cybele* Banks, 1945 = *P. weberi* Banks, 1946; *P. thoreyi* Dahlbom, 1845 = *P. lurida* Lucas, 1895, *P. euterpe* Brèthes, 1908; *P. flavescens* Lucas, 1895 = *P. periphetes* Lucas, 1895, *P. limbatella* Brèthes, 1908, *P. discoidalis* Brèthes, 1914, *P. limbatica* Brèthes, 1914, *P. militaris* Brèthes, 1914, *P. cavillatrix* Haupt, 1952, *P. arcuata* Haupt, 1952, *P. recterugosa* Haupt, 1952, *P. adversatrix* Haupt, 1952; *P. nigricans* Lucas, 1895 = *P. troglodytes* Brèthes, 1908; *P. montezuma* Smith, 1855 = *P. quitonensis* Packard, 1869, *P. sibylla* Mocsáry, 1885, *P. circe* Mocsáry, 1885, *P. occidentalis* Cameron, 1893, *P. peruanus* Lucas, 1895, *P. fulva* Lucas, 1895, *P. nessus* Lucas, 1895, *P. fusca* Lucas, 1895, *P. andicola* Cameron, 1903, *P. chilloensis* Cameron, 1903, *P. patagonica* Brèthes, 1908, *P. fasciculata* Brèthes, 1908, *P. pisoensis* Strand, 1911, *P. pacifica* Brèthes, 1914, *P. huascar* Banks, 1946; *P. completa* Smith, 1855 = *P. quichua* Brèthes, 1908, *P. comes* Banks, 1946; *P. smaragdina* Dahlbom, 1843 = *P. thunbergi* Dahlbom, 1843, *P. lara* Mocsáry, 1888, *P. satrapes* Lucas, 1895, *P. nupta* Lucas, 1895, *P. erynnis* Lucas, 1895, *P. fraterna* Lucas, 1895, *P. diabolus* Lucas, 1895, *P. mystica* Lucas, 1895, *P. thalia* Brèthes, 1908, *P. brasiliensis* Brèthes, 1908, *P. pallida* Brèthes, 1908, *P. iheringi* Brèthes, 1908, *P. dromeda* Brèthes, 1908, *P. sepulchri* Lucas, 1919, *P. strickeri* Lucas, 1919; *P. discolor* Taschenberg, 1869 = *P. sinnis* Lucas, 1895, *P. jujuyensis* Brèthes, 1908, *P. modesta* Brèthes, 1908, *P. comparata* Brèthes, 1908, *P. neutra* Brèthes, 1908, *P. terebrans* Brèthes, 1908, *P. procera* Haupt, 1952, *P. plaumanni* Haupt, 1952, *P. ogloblini* Haupt, 1952, *P. deletrix* Haupt, 1952; *P. limbata* Guérin, 1831 = *P. richteri* Brèthes, 1908, *P. polita* Brèthes, 1908, *P. limbella* Haupt, 1952, *P. artemis* Haupt, 1952; *P. basalis* Mocsáry, 1885 = *P. erdmanni* Lucas, 1895, *P. basinigra* Haupt, 1952; *P. infuscata* Spinola, 1841 = *P. niobe* Mocsáry, 1885, *P. sagana* Mocsáry, 1894, *P. incerta* Banks, 1946; *P. hyalinipennis* Mocsáry, 1885 = *P. sub-ruficornis* Haupt, 1952; *P. festiva* Fabricius, 1804 = *P. pulchella* Lepeletier, 1845, *P. solitaria* Smith, 1879, *P. gallardoi* Brèthes, 1908, *P. hora* Brèthes, 1914, *P. amok* Lucas, 1919, *P. riojaneirensis* Lucas, 1919; *P. gracilis* Lepeletier, 1845 = *P. diana* Mocsáry, 1885, *P. hecate* Mocsáry, 1885, *P. spathulifera* Lucas, 1895, *P. sphinx* Lucas, 1895, *P. ierensis* Banks, 1945, *P. alceste* Banks, 1946, *P. scalaris* Haupt, 1952; *P. mildei* Stål, 1857 = *P. charon* Mocsáry, 1885, *P. cyanoptera* Lucas, 1895, *P. dryas* Lucas, 1919; *P. filiola* Brèthes, 1914 = *P. denserugosa* Haupt, 1952; *P. ruficornis* Fabricius, 1804 = *P. saphirus* Palisot de Beauvois, 1805, *P. violacea* Mocsáry, 1885, *P. hexamita* Lucas, 1895, *P. omniviolacea* Haupt, 1952; *P. brunneicornis* Lucas, 1895 = *P. glabripennis* Lucas, 1895; *P. purpurea* Smith, 1873 = *P. pan* Mocsáry, 1885, *P. parthenope* Mocsáry, 1885, *P. sagax* Lucas, 1895, *P. clypeata* Brèthes, 1914, *P. consimilis* Banks, 1946, *P. laconia* Banks, 1946; *P. viridisetosa* Spinola, 1841 = *P. eximia* Smith, 1873; *P. viridis* Lepeletier, 1845 = *P. errans* Lepeletier, 1845, *P. chlorotica* Mocsáry, 1885, *P. excelsa* Lucas, 1895, *P. selene* Lucas, 1895, *P. fimbriata* Lucas, 1895, *P. calypso* Brèthes, 1908, *P. fluminensis* Brèthes, 1908, *P. argentiniacus* Strand, 1910, *P. mimetica* Brèthes, 1914, *P. garbei* Brèthes, 1914, *P. erecta* Brèthes, 1914, *P. tandilensis* Brèthes, 1914, *P. meridionalis* Brèthes, 1914, *P. minor* Lucas, 1919, *P. basifulgens* Lucas, 1919, *P. nebulosipennis* Lucas, 1919, *P. purpurea* Lucas, 1919, *P. koerberi* Lucas, 1919, *P. inimicissima* Lucas, 1919, *P. debilitans* Lucas, 1919, *P. itapaca* Banks, 1946; *P. aciculata* Taschenberg, 1869 = *P. nero* Lucas, 1895; *P. atripennis* Fabricius, 1804 = *P. flavilis* Brèthes, 1908; *P. ianthina* Erichson, 1848 = *P. fulvicornis* Mocsáry, 1885, *P. sirene* Lucas, 1895, *P. balboae* Lucas, 1919, *P. herodes* Lucas, 1919, *P. curti* Lucas, 1919; *P. nana* Mocsáry, 1885 = *P. mapiariensis* Lucas, 1919, *P. vinciens* Lucas, 1919, *P. ilione* Banks, 1946, *P. moesta* Banks, 1946, *P. orestes* Banks, 1946, *P. amautas* Banks, 1946, *P. inaequalis* Haupt, 1952; *P. hirtiventris* Banks, 1946 = *P. viridaurea* Haupt, 1952, *P. aequalis* Haupt, 1952; *P. auriguttata*

Burmeister, 1872 = *P. aurimacula* Mocsáry, 1885, *P. flavicornis* Mocsáry, 1894, *P. guttata* Lucas, 1895, *P. incendiaria* Lucas, 1895, *P. pubiventris* Lucas, 1895, *P. planifrons* Lucas, 1895, *P. lestes* Lucas, 1895, *P. villosa* Brèthes, 1908; *P. sabina* Mocsáry, 1885 = *P. astioles* Banks, 1946; and *P. purpureipes* Packard, 1869 = *P. chlorana* Mocsáry, 1885, *P. antennalis* Cameron, 1893, *P. sulcifrons* Cameron, 1903, *P. carinata* Brèthes, 1914, *P. equatoriana* Brèthes, 1914, *P. angusta* Banks, 1946.

Keys to all forms are given. The mimicry-groups of *P. atripennis* Fabricius, 1804, and *P. completa* Smith, 1855, are defined and described and a comparative account of mimicry based on all four mimicry-groups in *Pepsis* is given. Lists of excluded species (with their current taxonomic placement and depository where ascertained), unplaced names, and a *nomen nudum* are given.

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Introduction

Some highly distinctive males and females occur at random in the various species-groups that were not treated in Parts 1 and 2 of this work (Vardy, 2000 and 2002, respectively). These need to be keyed out early, and because the keys therefore cannot follow systematic order, the taxonomic treatment of the entire remainder of the genus is included here in Part 3.

Part 3 is based on the examination of 20,667 specimens. Since all the species-groups not already treated in Parts 1 and 2 of this revision have now been studied, it has become possible to gain a comprehensive picture of the phylogenetics and biogeography of the genus. Further notes are given on associating the sexes of certain species, and a new prey record is noted. The two remaining mimicry-groups are treated, with a fuller discussion based on all four mimicry-groups.

Abbreviations and special terms

AE index	= Antennal/eye index: AS3 divided by UID, multiplied by 100; exceptional values in parentheses, e.g. (82-)91-108
APT	= Anterior propodeal tubercle
AS3	= Antennal segment 3 (or its length)
Axial	= Denotes a vein which is parallel, or nearly so, to the longitudinal axis of the wing
BL	= Body length, given in millimetres; exceptional values in parentheses
DC	= Discoidal cell
DTC	= Dorsal transverse carinae of propodeum
Lacuna	= A bubble-like space, found as sub-basal pairs inside some SGPs.
MG	= Median groove of propodeum
MPN	= Metapostnotum
MT	= Mesopleural tubercle
OOD	= Ocular-ocellar distance: the shortest distance between an eye and the nearest ocellus
PDV	= Postero-distal veinlet of SMC2 in forewing
PFC	= Posterior face carinae of propodeum
PPT	= Posterior propodeal tubercle
PPV	= Postero-proximal veinlet of SMC2 in forewing
Propodeal hair	= As used in comparison with PST or MPN length, the hair located just behind and below the APT
PST	= Postscutellum
PTC	= Posterior transverse carina of propodeum (divides dorsal and posterior faces)
S	= Sternite
SGP	= Subgenital plate in male
SMC	= Submarginal cell of forewing
Stigmal fenestra	= In the forewing, the narrow translucent band running obliquely inwards from the base of the stigma; sometimes reduced to a narrow line
T	= Tergite
UID	= Upper interocular distance (minimum, at level of ocelli)
VR	= Vertical ridges of propodeal posterior face

Depositories

List of depositories and their staff, and private collectors, whose loans or gifts of material are gratefully acknowledged.

- AEIG = American Entomological Institute, Gainesville, Florida (Dr D. Wahl)
- AFZD = Agricultural and Forest Zoology Department, University of Helsinki (Dr M. Koponen, Dr M. Viitisaari)
- AMNH = American Museum of Natural History, New York (Dr E.L. Quinter; now Prof. J. Carpenter)
- ANSP = Academy of Natural Sciences, Philadelphia (Dr D. Azuma)
- BMNH = British Museum (Natural History) [now The Natural History Museum, London] (Mr T. Huddleston; now Sue Ryer)
- BONELLI = Padre B. Bonelli, Cavalese (private coll.)
- BPBM = Bernice P. Bishop Museum, Honolulu (Dr G.M. Nishida)
- BRIO = Biosystematics Research Institute, Ottawa (Dr J. Huber)
- CARRASCO = Prof. F. Carrasco, Cusco (private coll.)
- CAS = California Academy of Sciences, San Francisco (Dr W.J. Pulawski)
- CMNH = Carnegie Museum of Natural History, Pittsburgh, Pennsylvania (Dr J.E. Rawlins, Dr C.W. Young)
- COOPER = Mr M. Cooper, Lyme Regis (private coll.)
- CSU = Colorado State University, Fort Collins (Dr B. Kondratieff)
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- EMMSU = Entomology Museum, Michigan State University, East Lansing (the late Prof. R.L. Fischer; Prof. F.W. Stehr)
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- MZEL = Museum of Zoology and Entomology, Lund (Dr R. Danielsson)
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- MZLAU = Musée de Zoologie, Lausanne (Dr M. Sartori)
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- NHMBAS = Natural History Museum, Basle (Dr M. Brancucci)
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- RMNH = Rijksmuseum van Natuurlijke Historie [now Nationaal Natuurhistorisch Museum, Leiden] (Prof. Dr Ing. C. van Achterberg)
- ROIG = Dr A. Roig A., Buenos Aires (private coll.)
- RSM = Royal Scottish Museum, Edinburgh [now Royal Scottish Museums, Natural History (Edinburgh)] (Dr M. Shaw)
- SEMKU = Snow Entomological Museum, Kansas University, Lawrence, Kansas (Dr R.W. Brooks)
- SMF = Natur-Museum Senckenberg, Frankfurt-am-Main (Dr J.-P. Kopelke, Dr D.S. Peters)
- SMTD = Staatliches Museum für Naturkunde, Dresden (Dr R. Eck)
- TEXAM = A & M University, College Station, Texas (Mr E.G. Riley)
- TMB = Természettudományi Múzeum, Budapest (Dr J. Papp)
- UCALB = University of California at Berkeley (Dr H.V. Daly, Dr J.A. Chemsak)
- UCALD = University of California at Davis (Prof. R.M. Bohart)
- UCMB = University of Colorado Museum, Boulder (Dr U.N. Lanham, Dr M. Weissman, Dr P. Robinson)
- UCV = Universidad Católica de Valparaíso (specimens seen by courtesy of Prof. H. Toro, UMCE)
- UFPCUR = Universidade Federal de Paraná, Curitiba (Dr V. Graf, Prof. Gabriel Melo)
- UFVIC = Universidade Federal de Viçosa, Minas Gerais (Dr J.R. Cure)
- UMB = Übersee Museum, Bremen (Dr H. Hohmann)
- UMCE = Universidad Metropolitana de Ciencias de la Educación de Santiago (Prof. H. Toro)
- UMOX = Hope Entomological Collections, University Museum, Oxford, England (Mr C. O'Toole)
- UNALM = Universidad Nacional Agraria, La Molina, Lima (Dr C.E. Vergara, Dr M. Ortiz)
- UNAN = Universidad Nacional Autónoma de Nicaragua, Museo Entomológico (Dr J.-M. Maes)
- UNCBOG = Universidad Nacional de Colombia, Bogotá (Dr F. Fernández, Dr W. Cubillos)
- UNCUS = Universidad Nacional de Cusco (Dr J.A. Escalante G., Dr W. Tagle E.)
- UNLAMB = Universidad Nacional P. Ruiz Gallo, Lambayeque (Dr Bravo Calderón, Dr D. Ojeda)
- UNPBOG = Universidad Nacional Pedagógica, Bogotá (Prof. R. Torres N., Sr C.E. Sarmiento, Srta A.R. Amarillo)
- UNTRUJ = Universidad Nacional de Trujillo (Dr G. Ayquipa A.)
- UPAN = Universidad de Panamá: Museo de Invertebrados G.B. Fairchild, Dept. de Zoología, Facultad de Ciencias Naturales (Dr Diomedes Quintero A., Sr. Roberto Cambra, Sr. Alberto Mena)

USNM	= United States National Museum [now National Museum of Natural History], Washington, D.C. (Dr A.S. Menke)
USPRIB	= Universidade de São Paulo, Riberão Preto (Dr R. Zucchi, Dra M.R. Mechi)
USU	= Utah State University, Logan (Dr F.D. Parker, Dr T. Griswold)
UZMC(K)	= University Zoological Museum, Copenhagen (Kiel collection) (the late Dr B. Petersen, the late Dr O. Lomholdt; now Dr Nikolai Scharff)
WAHIS	= Monsieur R. Wahis, Chaudfontaine, Belgium (private coll.)
WASBAUER	= Dr M.S. Wasbauer, Sacramento, California (private coll.)
WILLIAMS	= Mr D.M. Williams, Santa Ana, California (private coll.)
ZIUK	= Zoologisches Institut der Universität, Kiel (Dr V. Haeseler, Dr R. König, Dr P. Ohm)
ZMHEL	= Zoological Museum, Helsinki (Dr P. Nuorteva, Dr A. Jansson)
ZMMICH	= Zoological Museum, University of Michigan, Ann Arbor (Dr M.F. O'Brien)
ZMMOSC	= Zoological Museum, University of Moscow (Dr A. Antropov)
ZMPUCEQ	= Zoology Museum, Pontificia Universidad Católica del Ecuador, Quito (Dr G. Onore)
ZSM	= Zoologische Staatssammlung, Munich (Mr E. Diller)

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General notes

Types of *Pepsis* species described by Lucas (1919)

Further to the note on Lucas, 1919 types (Part 1, p. 27), the types so far recognized are in MNCN and SMTD.

Sex associations

Because sex associations have to be made primarily on the basis of distributional ranges in this taxonomically difficult group, it follows that the difficulties are increased in cases where only a few specimens have been seen. This problem occurs especially in southeastern Brazil, where there is an exceptionally high proportion of endemic species, which are also rare in collections. This problem is further exacerbated by many of these species appearing to be old ones, which are often difficult to assign correctly to species-groups. Species concerned are: *P. adonta*, *P. boharti*, *P. catarinensis*, *P. convexa*, *P. helvolicornis*, *P. taschenbergi* and *P. wahisi*.

Problematic placements

In Parts 1 and 2 of the present work, the species are placed in species-groups with a high degree of confidence. However, in this Part 3 it was difficult to decide the appropriate placements of a few species, which exhibited characters pointing to more than a single group. While recognizing that some of them may just possibly be ancestral to more than a single group, for the present each has been placed within the species-group which seems most appropriate. Perhaps the most problematic species is *P. pilosa* (*montezuma*-group), today found isolated at higher altitudes and surely an old species whose affinities have become obscured by time. The female characters suggest placement in the *menechma*-group, but those of the male contradict this.

Colour cline

An important and interesting case of an east-west colour cline in the USA, with further discussion, is treated under *Pepsis menechma*.

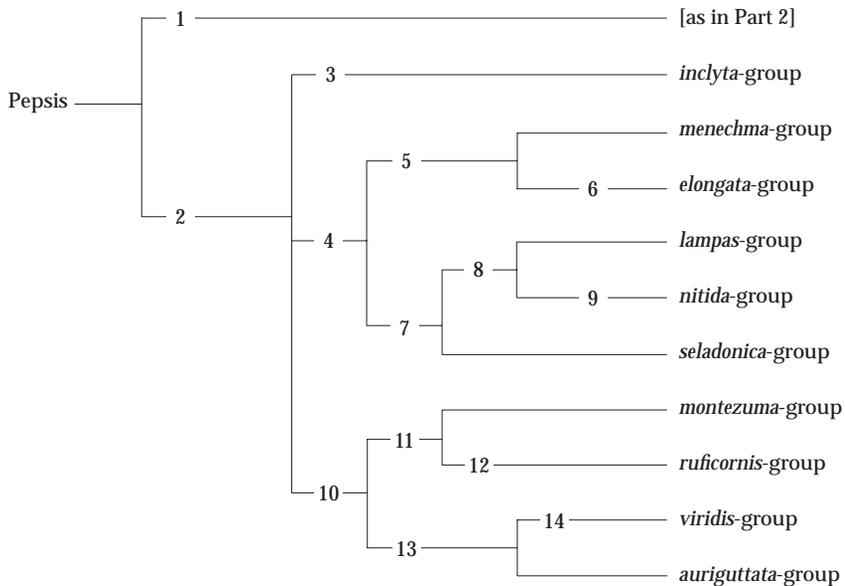
Host records

Since the list of species whose hosts had been recorded was published in Part 2 (p. 9) of this work, a record has been found for *Pepsis infuscata* Spinola (q.v.).

Pepsis preying on arboreal spiders: with reference to my earlier remarks (Part 2, p. 27) on this subject, I have since been informed by Michael C. Day that not all Pompilidae jump away from the spider immediately after stinging it. Instead, some of them hold the spider tightly in such a way that its chelicerae cannot be positioned to inflict a bite. Some *Pepsis* species may well employ similar techniques for securing arboreal spiders.

Phylogenetics and biogeography

General cladogram for species-groups of *Pepsis*



Characters:

1. Small to extremely large species; forewing apex pale; S.5-6, or none, with weakly modified hairs; SGP more-or-less strongly modified [as in Part 2].
2. S.4 with strongly modified hair; S.5 with modified hair.
3. Body medium to large; S.4 and S.5 hair evenly distributed across respective segments.
4. Body small, very robust; MT very strong; female MPN very strongly compressed; AS3 very short; MG narrow but sharp; gaster dorsoventrally compressed; abundant subfemoral hair; tibial spurs apically curved.
5. Female MPN groove very narrow; propodeum with median ridge, strong PTC; teeth of hind tibia small, spurs long.
6. Female gaster strongly dorsoventrally compressed.
7. Hindwing margin white (both sexes); S.4 hairs short, apices not touching; propodeum strongly angled at junction of dorsal and posterior faces; dorsum with coarse sculpture.
8. Wings with silvery-metallic markings; S.4 lateral brushes short; female gaster polished, pygidium partly polished; femora with strong dorsal bristles.
9. Hind coxa strongly carinate; last gastral segment of female directed strongly downwards.
10. Body slender; males with brilliant green body.
11. Body size medium; male wings clear with dark apex; S.4 hairs long.
12. Proximal vein of SMC3 strongly outslowing (both sexes); S.4 hairs laterally dense, with numerous central hairs; SGP parallel-sided; digitus with inner, apical projection blunt; female AS3 long; wings entirely dark.
13. Body size very small, slender; S.4 hairs short; female head strongly transverse; PPV very short; with abundant subfemoral hair.
14. Male S.4 hairs short, forming a complete, dense, transverse band.

Discussion of general cladogram and biogeography

The three major groups in Part 3 (character suites 3, 4 and 10 in the main cladogram) display clear divisions of general habitus, as well as of more detailed characters. However, they also exhibit similarities, for example the *menechma* complex (character suite 4) shares with the *inclyta*-group (suite 3): SGP with upturned edges; female mid and hind tibial spurs more-or-less strongly curved (rather than straight). In common with the remaining complex (suite 8) they have: body size medium to small; S.4 hairs denser laterally, forming brushes. Thus we have a situation where three major groups appear to have equal status: no two are more closely related than the other. It follows that a straightforward, dichotomous cladogram would not adequately reflect the relationships between the major groups. In view of past geographical events, the possibility of trichotomous (or even multichotomous) vicariance phenomena cannot be excluded; on the contrary, this is highly likely in view of the diverse, major divisions of habitat brought about in the neotropical region at various times by the interaction of the Andes, Brazilian highlands and Amazon seaways (see Räsänen et al., 1995) with climate changes, not to mention the complex events which have occurred in the Caribbean area (Reddish, 1996).

The *menechma* complex (character suite 4) is one of the most clearly-defined units in the genus and is especially interesting for several reasons. It has the most characters shared with other pompilid genera, for example *Anacyphononyx* (Hennig's "ground-plan" characters): the small but very robust body; very short MPN often with a deep furrow; swollen propodeum with reduced or absent PTC; swollen head; short AS3; gaster with emarginate tergal hind margins; femora with strong hairs; hooked tibial spurs. These characters are therefore regarded as ancestral; this situation may be the result of an early reversal phenomenon (as opposed to competitive pressure towards size

reduction); the advantages conferred by considerable size reduction in individuals (compared with co-existing groups) enabled early proliferation and spread. This scenario is made more attractive by the wide distribution of only a single species of the genus, *menechma* itself, in southeastern USA. The occurrence of such species as *marginata* (Part 2, *elevata*-group) in Florida is here regarded as an instance of secondary spread from the West Indies. Hurd (1952: 300) suggests it is native in Florida, but the records may be based on wind-blown specimens; it is necessary to bear in mind that suitable prey-species must first exist in the territory to be colonized, and that tarantulas cannot cross water barriers.

It is also noteworthy that, of the groups treated in Part 3, only the ones in this complex appear to display the same phylogenetic patterns as the groups in Part 2; within this framework, *nitida* may be regarded as the survivor of a species-pair in which the northern counterpart has become extinct. While the status of *seladonica* is unclear, it does not obscure the main pattern, and it may be a remnant of a group comparable to that of *elevata* in Part 2.

Although species-pairs do exist in the remaining groups of Part 3, and their distribution patterns are reminiscent of those of the pairs in Part 2, they differ from them in that the species of each pair do not exhibit such unusual characters. Consequently, it seems more appropriate to include them within species-groups as more-or-less distinct units rather than forming separate sister-groups. If they are not the exact counterparts of the Part 2 pairs, then different vicariance events produced somewhat similar results.

Yet another interesting aspect of this complex is the strong southern bias in its distributional range, in which even the comparatively large *menechma*-group has only a single species (*basifusca*) endemic to the northern part of the range; the only other species of the group occurring there (*menechma* itself) is extremely wide-ranging, so does not influence this bias either way. I hope to discuss such matters more fully in a further part of this work.

The mimicry-groups in *Pepsis*

The four mimicry-groups of *Pepsis* treated in this work are called by the names *discolor*, *plutus* (both treated in Part 2), *atripennis* and *completa*. The last two are treated here because they are made up exclusively of species which belong taxonomically in this Part. The two are very similar (see key below) and both of them include (and often share) species belonging to a variety of the taxonomic species-groups recognized here.

The area occupied by the *discolor* mimicry-group extends approximately from the Mato Grosso eastwards to the Brazilian coast, and southwards to Uruguay; most of the area is at moderate altitudes (above 200 m) (figs 16, 19, 668). The *plutus* mimicry-group, however, displays a quite different distributional pattern; most species are found at low altitudes, together occupying the entire Amazon watershed, Guianas, and parts of east coastal Brazil. However, a few species are found in the northern Andes and their western watershed, with some aberrant males of one species in Central America (figs 15, 20). I had hoped to give maps for all four mimicry-groups together, but it has proved impossible to produce comparable maps for the *atripennis* and *completa* mimicry-groups because of their extreme complexity. In reading the following account, reference must therefore be made to the maps of the individual species.

The mimicry-groups of *Pepsis atripennis* and *P. completa*

The *atripennis* and *completa* mimicry-groups include only medium-sized to small species, whose males have the sternal hairs modified rather than the SGP (except *sabina*, whose male has both structures modified). Both groups have dark wings, with a transverse, pale band (yellow, occasionally off-white) nearer to the base of the forewing than to the apex (except sometimes in *auriguttata*). The two groups are distinguished by a small but usually constant difference in the position of the wing band (see key below; transitional forms are keyed out under both groups).

Note that the phrase “sympatric with the *atripennis* mimicry-group” refers only to the distributional range of *P. atripennis* itself; likewise with *completa* (the black individuals of *atripennis* are sympatric with some of those pertaining to the mimicry-group).

Members of these mimicry-groups fall into several categories, some of which are represented in both the *completa* and *atripennis* mimicry-groups. These two names represent the main models in the two groups, because they are the species with the most constant colours in all or most individuals (the exceptions are not imperfectly coloured; they do not resemble the mimicry-group at all). These groups, like other mimicry-groups, consist of large complexes of Müllerian and Batesian elements including other groups of creatures (not only insects).

Species pertaining solely to a single mimicry-group; *P. completa* itself (map fig. 665) is straightforward in that all specimens are virtually identical in colour. Some species are entirely sympatric with it, and likewise all specimens belong to the mimicry-group; examples are *P. decipiens* (map fig. 656) and *P. maeandrina* (map fig. 656).

In a second category are species which are only partly sympatric with the main model; in the zone of sympatry, only some specimens belong to the mimicry-group: in some cases perfectly, e.g. *P. flavescens* (map fig. 664), in other cases they are only very poor mimics in that they resemble the models imperfectly, e.g. *P. inclyta* (map fig. 646) and *P. xanthocera* (map fig. 648). One species, *dayi* (map fig. 681), is parapatric to the *completa* mimicry-group and is a poor mimic of it, the yellow wing bands being reduced and variable. A special case is formed by *P. auriguttata* (map fig. 685), which displays its own geographical cline of yellowish marks on the wings whereby some forms are better mimics of the *completa* mimicry-group than others.

In the case of the *atripennis* mimicry-group, the matter is more complicated, especially as some specimens in the northern part of the range of *atripennis* itself (map fig. 682) are entirely black-winged. Species which are entirely sympatric with the model for this mimicry-group are *P. ianthoides* (map fig. 683), in which all specimens are perfect mimics; and *P. cybele* (map fig. 663) and *P. gracillima* (map fig. 670) where only some specimens are more-or-less good mimics. A partly sympatric species with only some specimens belonging to the mimicry-group is *P. chrysoptera* (map fig. 658); however, especially in the southern part of its range, some specimens belong to the *atripennis* mimicry-group despite being sympatric with the *completa* mimicry-group; however, this is very variable and represents only part of a more-or-less continuous range of variation. Both *P. amyntas* (map fig. 653) and *P. dimidiata* (map fig. 654) are sympatric with both *completa* and *atripennis* mimicry-groups, to which some specimens belong (usually perfectly) in their respective areas, except that in the *completa* mimicry-group area, only a single *P. amyntas* female (from the Mato Grosso) has been seen with reduced yellow band; it is included in the *atripennis* mimicry-group key.

The cases so far mentioned are fairly straightforward; one might speculate that those species in which only a proportion of specimens belong to a mimicry-group may be more recently adventive to the area occupied by the latter, and thus joined the group later rather than founding it; Vane-Wright (1981: 164) already came to the same conclusion: "In each mimicry-group area, a different species would tend to be the most abundant, and that this dominant species would act as a focal model, 'capturing' the patterns of many of the other species by Müllerian mimicry." If this scenario is correct, the timing sequence clearly has biogeographical implications and the current situation may represent ongoing evolution, but one must also bear in mind the influence of continuing gene-flow, especially between mimics and non-mimics in species which are not totally sympatric with the mimicry-group area.

However, the following cases illustrate that the situation involving these two mimicry-groups is far more complicated than the foregoing would suggest; indeed, the number of different categories approaches that of the number of species representing them.

The species *P. nana* (map fig. 684) is partly sympatric with both mimicry-groups; where sympatric with the *atripennis* mimicry-group, some specimens are perfect mimics, but where sympatric with the *completa* mimicry-group, some specimens are intermediate between *atripennis* and *completa* mimicry-groups. This species differs from *P. amyntas* and *P. dimidiata* in that a large part of its range lies outside the area of both mimicry-groups. The species *P. nanooides* (map fig. 684) and *P. schlinkei* (map fig. 687) are entirely sympatric with the *completa* mimicry-group; yet all specimens of *P. nanooides* (perfectly), but only some of *P. schlinkei* (imperfectly), nevertheless belong to the *atripennis* mimicry-group. However, *P. sabina* (map fig. 686) is sympatric with the *atripennis* mimicry-group; some specimens belong to that mimicry-group, but others to the *completa* mimicry-group. On the other hand, *P. pilosa* (map fig. 663) is sympatric with the *atripennis* mimicry-group, yet some specimens belong to the *completa* mimicry-group but none to the *atripennis* mimicry-group. The species *P. viridis* (map fig. 680) is sympatric (except in the southernmost part of its range) with the *completa* mimicry-group; in this area some specimens are transitional between black-winged, *completa*, and *atripennis* mimicry-groups. Finally, *P. martini* (map fig. 682) is sympatric with the *completa* mimicry-group but the wing-band is very variable; resembling either *completa* or *atripennis* mimicry-groups more-or-less imperfectly, with the band often reduced to near-disappearance.

A comparison of the maps of the species *Pepsis atripennis* and *completa* shows that the two are sympatric only in a relatively small area around the Amazon delta (the record for *P. completa* from Guyana is questionable). This degree of allopatry suggests that the mimicry-groups based on the two species arose separately and came together only later. Such a scenario comprising two colour patterns, which are extremely similar yet independently evolved, is not so unlikely as it might seem at first sight. It may well be that, from an evolutionary viewpoint, this is one of the most likely aposematic patterns to develop; a contrasting, transverse, sub-basal band on the wings is one of the simplest (and perhaps most effective) aposematic patterns for a flying creature to possess. One has to bear in mind what it looks like in flight; a narrower, or more apical, band might be less effective; also, if a simple pattern is easier to produce, it will be of benefit with regard to the competitive constraints imposed by Müllerian mimicry. Furthermore, it could be precisely the great similarity between the two mimicry-groups,

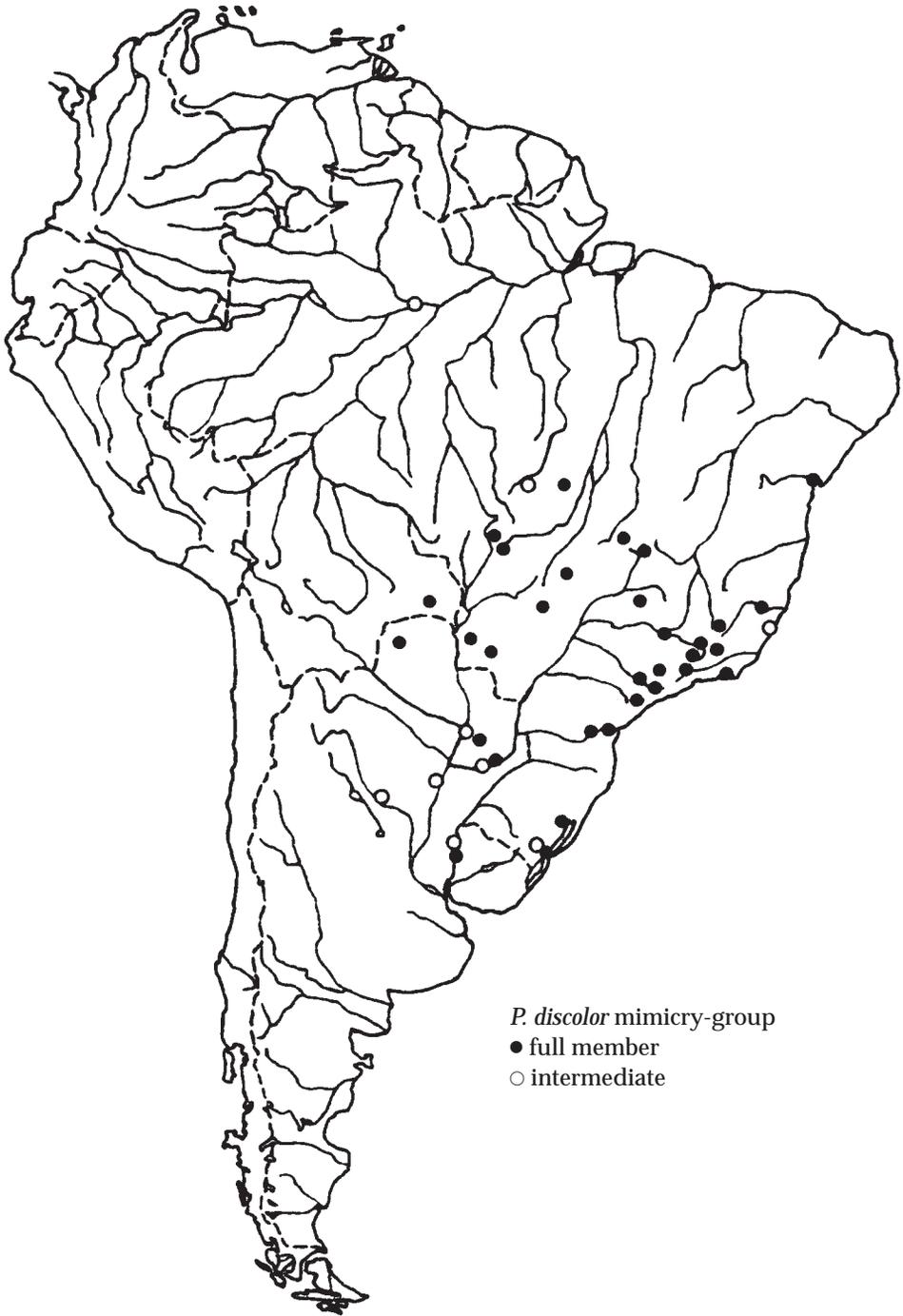


Fig.19. Overall range of *Pepsis discolor* mimicry-group.

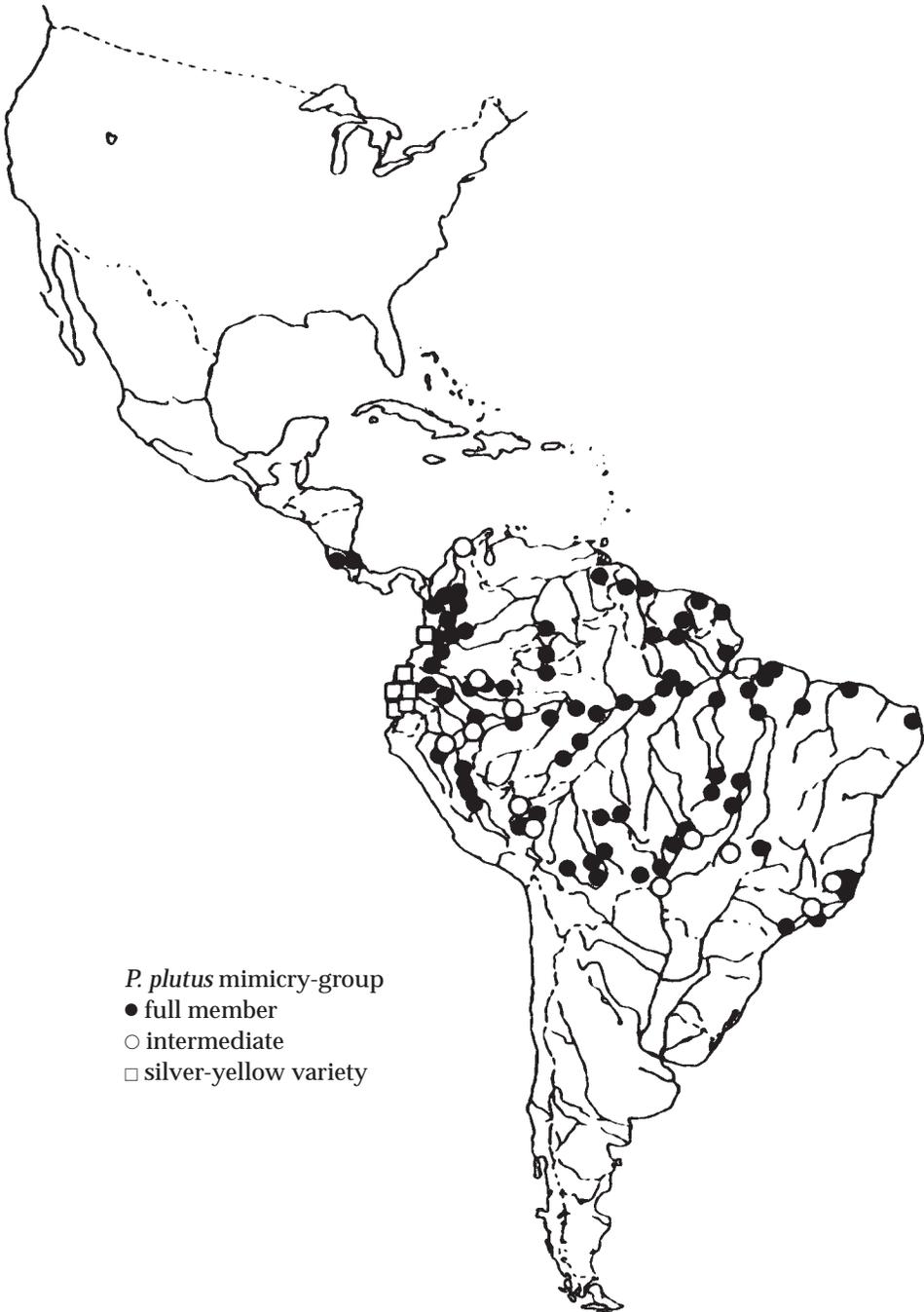


Fig. 20. Overall range of *Pepsis plutus* mimicry-group.

which obviates any pressure for them to merge; most importantly, intermediate forms occur almost anywhere except where *P. atripennis* and *P. completa* are sympatric. A further point of interest is that when two species fall into the same mimicry-group category, they are almost always closely related.

Since the main purpose of this account is to give the facts about the mimicry-groups in *Pepsis*, no attempt is made to explain the more anomalous situations portrayed here. For the same reason, in-depth discussion of mimicry in general is also avoided; many authors have already done this - see, for example, Beccaloni (1997a, b) and the references given therein. Perhaps a biologist who has an in-depth knowledge of the genetics of mimicry may be able to explain the situation in *Pepsis*.

The mimicry-group species are catered for also in the general keys.

Key to distinguish *P. atripennis* and *completa* mimicry-groups

1. Forewing with basal infusate band much narrower than pale band; usually narrower still (sometimes almost absent) on hindwing (figs 10, 18) ***P. atripennis* mimicry-group**
- Forewing with basal infusate band slightly narrower to much broader than pale band, and continued equally broadly, or almost so, on hindwing (fig. 17) (but see *P. dayi*, p. 22) ***P. completa* mimicry-group**

Key to males of the *P. atripennis* mimicry-group

Notes.— Particularly the yellow-banded forms of *P. viridis* and *P. nana* are impossible to distinguish without examining the parameres, especially as the species may be partly sympatric. The proportion of specimens belonging to the mimicry-group is given; the distributional data (within parentheses) pertains only to these.

1. S.4 with lateral hairs markedly different from those in centre (or with none in centre), forming a pair of more-or-less distinct brushes 2
- S.4 with all hairs more-or-less similar (outer ones sometimes slightly curved inwards or backwards) 5
2. S.4 with outer hairs very strongly hooked apically; S.5 with band of rather short, dense hairs (pale band usually reaching distad just over half of forewing, boundary very diffuse; some specimens; northwestern South America) ***P. gracillima* p. 205**
- S.4 outer hairs with at most tiny apical hooks; S.5 with at most small, lateral tufts of weak hairs 3
3. SGP extremely narrow, parallel-sided, scarcely wider than minimum thickness of hind tibia in profile, slightly narrower than maximum antennal width, apex strongly rounded, with hair fringe at least as long as maximum SGP width (pale band extremely broad, poorly-defined; many specimens, eastern Amazon to Mato Grosso) ***P. schlinkei* p. 279**
- SGP broader, wider than antennal thickness, more-or-less expanded apicad (pale band variably wide, with fairly sharp but more-or-less irregular boundaries) 4
4. SGP slightly thickened around middle, tending to form a weak keel basad; flattening out apicad, the apex more-or-less truncate and slightly bent up, forming a

- pre-apical, transverse depression; MPN longer than PST, its centre depressed, its furrow narrow and carinae very fine, almost matt (Magdalena valley and Lower Amazon, with well-defined yellow band; southern South America, with variably defined pale band; many specimens) ***P. chrysoptera*** p. 144
- SGP virtually flat, with sides slightly raised around middle, apex more-or-less rounded; MPN equal to or shorter than PST, its furrow broad, its surroundings not markedly depressed, carinae rather coarse, polished (pale band reaching distad less than half of forewing; some specimens; Amazonian Colombia) ***P. dimidiata*** p. 125
5. S.4 with apical half covered by very sparse hairs about as long as maximum width of hind femur, curved weakly inwards and backwards (pale band reaching distad to about half of forewing, quite well defined but irregular apically; some specimens; Colombia and Venezuela; transandean, sometimes at high altitude) .. ***P. cybele*** p. 171
- S.4 hairs dense, at most a little shorter than maximum width of hind femur; pale band variable 6
6. Paramere extremely short, slightly shorter than rest of genitalia, apex broad and squarely truncate or almost so; lateral furrow of propodeum sinuate anteriorly; base of mid femur (often also hind) with a few thin hairs of mixed lengths below 7
- Paramere either longer than rest of genitalia, or its apex narrower and rounded or obliquely truncate; propodeal furrow normal, slightly arcuate; femora without hairs below 8
7. Habitat eastern Andes; paramere usually parallel-sided with apex squarely truncate (some specimens in Colombia with yellow bands; some in Bolivia with off-white bands) ***P. nana*** p. 265
- Habitat eastern Brazil; paramere usually expanded apicad and apex slightly obliquely truncate (band yellow; all specimens) ***P. nanoides*** p. 268
8. S.4 hairs long, almost double maximum SGP width, moderately dense; paramere distinctly longer than rest of genitalia (band ochre-yellow to off-white; all specimens; eastern Brazil) ***P. ianthoides*** p. 264
- S.4 hairs scarcely as long as maximum SGP width, sometimes very dense; paramere equal to or scarcely longer than rest of genitalia 9
9. S.4 hairs moderately dense throughout; SGP almost squarely truncate apically (band almost always yellow, extremely variable in size and definition; many specimens; Bolivia, central and western Argentina) ***P. viridis*** p. 248
- S.4 hairs extremely dense except for a few lateral hairs which are sparser, the transition to these quite abrupt; SGP round-ended with slightly angulate corners 10
10. Habitat northern and eastern South America; paramere virtually parallel-sided, with apex rounded; body size rather larger (BL 13-20), more robust (band well-defined; most specimens - all in Brazil) ***P. atripennis*** p. 257
- Habitat eastern Brazil to Paraguay; paramere weakly expanded apicad, with apex strongly, obliquely truncate; body size smaller (BL 14-17), more slender (band variable; most specimens in Brazil but none in Paraguay) ***P. martini*** p. 260

Key to females of the *P. atripennis* mimicry-group

Notes.— *P. amyntas* and *P. dimidiata* are very similar except for the teeth of the hind tibia; see also main keys. I have been unable certainly to assign any females to *P.*

ianthoides; they may be indistinguishable from specimens of *P. atripennis* with shorter AS3.

1. Teeth of hind tibia vestigial; head strongly transverse, in dorsal view temple scarcely swollen 2
 - Teeth of hind tibia normal, small to medium; head shape various 3
2. DTC very coarse (about 8 only); PTC narrow, very strongly raised; MPN equal in length to PST, its furrow moderately broad; MT usually very strong and sharp; SMC3 with anterior vein scarcely longer than proximal (pale band irregular; few specimens; Colombia) ***P. sabina*** p. 275
 - DTC moderately coarse (about 12-20); PTC broad, very weak; MPN much shorter than PST, its furrow extremely broad (posteriorly almost as broad as MPN central length); MT moderately strong; SMC3 with anterior vein much longer than proximal (about 1.5 times) (pale band irregular; some specimens; Guyana and Suriname) ***P. amyntas*** p. 123
3. Spur of fore tibia strongly flattened apically, spatulate; PTC narrow, the median ridge on which it is situated is increasingly strongly raised posterad; MPN slightly longer than PST, its centre broadly depressed, carinae very fine, almost matt (Colombia: Magdalena valley, and Lower Amazon, with well-defined, yellow band; southern South America, with variably-defined pale band, distal margin often irregular and sloping strongly inwards anterad, forming an obtuse angle with the costa; many specimens) ***P. chrysoptera*** p. 144
 - Spur of fore tibia normal, tapered and pointed; PTC not very narrow, median ridge of propodeum not strongly raised posterad; MPN equal to or shorter than PST, its centre not broadly depressed, carinae moderate to coarse, usually polished 4
4. MPN a little shorter than PST; habitat northern South America [some specimens of *P. schlinkei* may run here but can be recognized by the characters given in couplet 6 and the different distributional range] 5
 - MPN equal to PST; habitat often different 6
5. MPN furrow extremely broad, V-shaped, often as broad posteriorly as MPN length; with 2-3 strong carinae; temple in dorsal view scarcely swollen, antenna quite slender; femora without hairs below (pale band reaching distad less than half of forewing; some specimens; Venezuela, Caracas area) ***P. dimidiata*** p. 125
 - MPN furrow moderately broad, more-or-less parallel-sided; with more and weaker carinae; temple in dorsal view strongly swollen, antenna robust; basal parts of femora with fairly abundant but sparse hairs below (pale band reaching distad to about half of forewing, quite well defined but irregular apically; some specimens; Colombia and Venezuela) ***P. cybele*** p. 171
6. Head swollen overall (especially in front and above) and eyes smaller than usual, imparting a somewhat globular appearance; thorax and gaster flattened dorso-ventrally (especially noticeable in the propodeum); body rather elongate, slender (pale band variable, but usually with distal boundary irregular; many specimens; eastern Amazon to Mato Grosso) ***P. schlinkei*** p. 279
 - Head more transverse (swollen posteriorly if at all), eyes normal; thorax and gaster not markedly flattened; body sometimes slender but not elongate 7
7. Femora (especially mid and hind) with fairly abundant, long hairs below; lateral furrow of propodeum more-or-less sinuate anteriorly 8

- Femora without hairs below; lateral furrow of propodeum normal, shallowly arcuate 9
 - 8. Habitat east of the Andes in Colombia and Bolivia (pale band usually well-defined; some specimens in Colombia with yellow bands, some in Bolivia with off-white bands) *P. nana* p. 265
 - Habitat eastern Brazil (band as in *P. nana*, but always yellow; all specimens) *P. nanooides* p. 268
 - 9. Basal infuscation of hindwing almost as extensive as that on forewing; habitat Bolivia, northwest and central Argentina; in dorsal view, head with temple rather strongly swollen, head fairly robust (band usually yellow, sometimes off-white, extremely variable in size and definition; many specimens) *P. viridis* p. 248
 - Basal infuscation of hindwing much less than that of forewing, scarcely evident; habitat elsewhere; head rather transverse, in dorsal view with temple scarcely swollen 10
 - 10. Habitat northern South America and eastern Brazil; body size and shape very variable, BL 16-29 (band well-defined, distal margin virtually straight and perpendicular to the costa; most specimens) *P. atripennis* p. 257
 - Habitat eastern Brazil to Paraguay; body small and slender, BL 17-19 (band variable; most specimens in Brazil, none in Paraguay – see *completa* mimicry-group) *P. martini** p. 260
- Note.— * Females of *P. atripennis* and *P. martini* are not distinguishable where sympatric in eastern Brazil.

Key to males of the *Pepsis completa* mimicry-group

Notes.— A female ?*Anacyphononyx* (Hymenoptera: Pompilidae) from Paraguay (TMB) (det. M.C. Day) is a perfect member of this mimicry-group. See also notes in the discussion of mimicry-groups.

1. S.4 with apical 2/3, and S.5 entirely, covered with short, dense hairs; large species, BL 24-40 (pale band usually poorly-defined, situated about middle of forewing, usually reduced or absent on hindwing; some specimens; south-eastern South America) *P. inclyta* p. 89
- S.5 never with more extensive hair-cover than S.4 2
2. S.4 with a continuous, transverse band of short (at most twice as long as maximum SGP width), virtually straight and mostly dense hairs almost equal in length 3
- If the S.4 hairs are short, they are markedly uneven in length, and/or form distinct lateral brushes with or without other hairs between 6
3. S.4 hair band narrower in profile than the height of the hairs 4
- S.4 hair band at least as broad in profile as the height of the hairs 12
4. Lateral hairs of S.4 slightly longer than central ones, so that their outline is flat or shallowly concave centrally; paramere a little longer than rest of genitalia and apically pointed; SGP more-or-less strongly expanded apicad. Antenna usually with only a small orange spot at the apex; (intermediates between these and all-black wings exist; some specimens; central and western Argentina) *P. viridis* p. 248
- Lateral hairs of S.4 slightly shorter than central ones, so that their outline is shallowly

- convex; paramere scarcely as long as rest of genitalia. SGP virtually parallel-sided. Antenna with up to 3 apical segments orange 5
5. Paramere apex strongly obliquely truncate (band variable; all specimens in Paraguay, few in eastern Brazil) ***P. martini*** p. 260
 - Paramere apex squarely truncate or almost so (many specimens yellow-banded in Colombia, off-white-banded in Bolivia) ***P. nana*** p. 265
 6. S.4 with outer hairs much longer than any others, forming a distinct brush, incurved but not hooked apically, those of opposite sides touching centrally to form a perfect arc; if there are any hairs between the lateral brushes, they are sparse 7
 - If outer hairs of S.4 form distinct, incurved brushes, they are not or scarcely long enough to touch centrally 8
 7. S.4 with lateral hairbrushes isolated (all specimens; yellow-banded in eastern Brazil, transitional in southern Brazil and Paraguay, off-white-banded in central and western Argentina) ***P. completa*** p. 186
 - S.4 with some hairs between lateral brushes, their insertion-points forming a semi-circle, decreasing in length centrad (only two males of this common species; from Brazil, Chapada [dos Guimarães] and Vianópolis) ***P. flavescens*** p. 176
 8. S.4 hairs forming a pair of distinct, lateral brushes with no, or scarcely any, hairs between 9
 - S.4 hairs forming a continuous band right across centre 10
 9. S.4 hairs forming a very dense, lateral brush directed strongly backwards and inwards, and with strongly hooked apex; if it touches that of the opposite side it therefore does so pre-apically; sometimes with a few short, fine hairs between the brushes. S.5 sometimes with a patch of very short, fine hair. SGP polished, strongly expanded to the rounded apex, which has a fringe of long hairs (forewing with also white apex; one specimen, Colombia) ***P. sabina*** p. 275
 - S.4 with a pair of poorly-defined lateral brushes, each consisting of rather few, long but thin hairs, those of opposite sides separated by a large gap virtually without hairs. S.5 with similar but fewer hairs. SGP with a blunt median keel (pale band often irregular; all specimens; southern Brazil and Paraguay) ***P. decipiens*** p. 136
 10. S.4 in profile with a thin band of long hairs in front, and a dense, broad band of shorter hairs (about half the height) behind; S.5 with a narrow band of short, dense hair about half as high as the shorter ones of S.4; larger species, BL 19-31 (pale band usually irregular; few specimens; north-central Perú) ***P. xanthocera*** p. 98
 - S.4 in profile not with 2 distinct hair bands of different height; smaller species, BL 12-20 11
 11. S.4 with a thin, transverse line of hairs, the outer ones incurved, with tiny hooks apically; centrad gradually shorter, thinner and sparser; sides of thorax strongly punctate. Thorax and femora with rather sparse hair (pale yellow band rather broad, irregular, incomplete posteriorly; all specimens; Paraguay, Bolivia, southern Brazil) ***P. maeandrina*** p. 137
 - S.4 with an evenly very dense, transverse band of hairs, the outer ones rather long and incurved; centrad a little shorter, straight but not thinner; sides of thorax smooth but most of thorax and femora with dense, black hair (with wing-band variable in colour and definition; some specimens; Venezuela) ***P. pilosa*** p. 171
 12. S.4 hair band entirely dense, in profile covering about a width equal to its height; S.5

- hairs dense; SGP scarcely expanded towards the truncate apex; BL 22-24; (only entirely dark-winged specimens so far known [see females]; Amazonian Ecuador and Perú) ***P. dayi*** p. 256
- S.4 hair band only dense near the posterior margin, in profile covering an area about twice its height; S.5 hairs very sparse; SGP strongly expanded towards the rounded apex; BL 15 (band broad, yellowish-white; only one specimen known, from south-eastern Brazil) ***P. wahisi*** p. 283

Key to females of the *Pepsis completa* mimicry-group

Notes.— The female of *P. ianthoides* is unknown; it should resemble that of *P. ianthina* (which see) in structure. The female of *P. flavescens* is also omitted (see note under male). All pale-banded female *P. nana* seen belong to the *atripennis* mimicry-group.

1. Hind tibial teeth absent or vestigial; small, slender wasps 2
- Hind tibial teeth normal in size; body often robust 3
2. Hind tibial teeth absent (pale band extremely variable, often irregular; often also with amber subapical mark in forewing; some specimens in southern Brazil and east-central Argentina only – not in rest of range) ***P. auriguttata*** p. 272
- Hind tibial teeth vestigial (pale band variable, often irregular; few specimens; Colombia and Venezuela) ***P. sabina*** p. 275
3. Entire body including legs and gaster heavily punctate to punctate-rugose (band rather broad, irregular, most extensive in large individuals; all specimens; Paraguay, Bolivia, southern Brazil) ***P. maeandrina*** p. 137
- Body much less heavily sculptured 4
4. Inner, posterior edge of hind tibia with a strong, sharp carina; lateral extensions of S.2 groove short or absent; femora (especially front one) with rather dense, coarse hair below; inner side of AS3 with short bristles near base; antenna all black, except some segments with at most obscure, brown, apical rings (pale band often narrow and irregular; all specimens; southern Brazil and Paraguay) ***P. decipiens**** p. 136
- Inner, posterior edge of hind tibia only angulate; lateral extensions of S.2 groove usually well developed; femora usually without much hair below; antenna often with several apical segments totally orange 5
5. Spur of front tibia in lateral view blunt, flattened, spatulate; MPN with median groove very narrow, the surrounding surface depressed; the carinae very fine, oblique; median ridge of propodeal dorsum distinctly higher and narrower apicad; inner spur of hind tibia reaching to almost half basitarsus length (pale band irregular; a single specimen labelled only “Brazil” [but see *atripennis* mimicry-group]; BMNH) ***P. chrysoptera*** p. 144
- Spur of front tibia normal, pointed; MPN with median groove wider, not set in a depression, the carinae often coarser; median ridge of propodeal dorsum evenly high and broad or replaced by a groove; inner spur of hind tibia often shorter 6
6. MPN much shorter than PST**, its groove broad; head quite strongly swollen behind; PTC absent or weak; robust species 7
- MPN not or scarcely shorter than PST, its groove often narrower; other characters variable 8

7. Most of body and below femora covered with dense hair; anterior vein of SMC3 very short, shorter than its proximal vein; VR absent or very weak; temple in dorsal view strongly swollen; inner spur of hind tibia reaching to less than half basitarsus length, outer spur straight; AE index 76 (only a single specimen with all-black wings is so far known, but other females may belong to this mimicry-group [see males]; southern Venezuela, at high altitude) ***P. pilosa*** p. 171
- Body and femoral hair not dense; anterior vein of SMC3 normal, longer than its proximal vein; VR strong; temple in dorsal view moderately swollen; inner spur of hind tibia very long, reaching to half basitarsus length; outer spur at least slightly curved near the apex; AE index 77-89 (pale band usually irregular; some specimens; at low altitudes in Argentina, also a single female from Brazil, Santarém (paralectotype of *P. lucidula*) ***P. dimidiata**** p. 125
8. Yellow forewing band very narrow, irregular, basal infuscation 2-3 times as broad as band; body robust, head quite strongly swollen behind (?all females; Amazonian Ecuador and Perú) ***P. dayi*** p. 256
- Forewing band broader; body and head variable 9
9. Basal infuscation of forewing at least as wide as pale band, usually wider; the band regular; medium-sized species (all specimens; yellow-banded in eastern Brazil, off-white banded in central and western Argentina, transitional in southern Brazil and Paraguay) ***P. completa*** p. 186
- Basal infuscation of forewing slightly narrower than pale band, which is often irregular; medium to small species 10
10. Small species, BL 17-19; pale band irregular; basal infuscation continued almost as broadly on hindwing; head constricted behind eyes (all specimens in Paraguay, few in Brazil) ***P. martini*** p. 260
- Small to medium species, BL 23-38; pale band usually regular; basal infuscation reduced on hindwing; head moderately swollen behind eyes (some specimens in central and western Argentina; intermediates between these and all-black wings exist) ***P. viridis*** p. 248

Notes.— **P. decipiens* (especially abraded specimens) can be difficult to separate from *P. dimidiata*; in *P. decipiens* the forewing SMC3 usually has the anterior vein very short, shorter than the proximal vein, whereas the reverse is usually true in *P. dimidiata*; also, in the latter species, the pale forewing band is very broad and very poorly defined, while in *P. decipiens* it is either broad and well-defined or narrow and irregular.

**Almost as short in some *P. dimidiata*; but such specimens do not run well via couplet 8.

General key to males

Notes.— Male genitalia **must** be extracted before using this key, and are best mounted upside-down and splayed open on card pinned under the insect; since they will then be viewed ventrally, such expressions as “SGP bent down at mid-point” are as viewed, not as in life. Notes on females are given here in case they are conspecific with males taken at the same time, and because the keys to females alone are more difficult to use.

1. With modified hairs on one or more sternites anterior to S.4 (as well as on others); either short or long (when sometimes curved) but always very dense (includes some *P. limbata*, but these will not run in complet 2) 2

- Strongly modified, very dense hairs only on S.4 and/or subsequent ones 3
- 2. S.2 and 3 both with very dense, short hairs (about equal to maximum width of hind tibia); also very dense hair on S.4, less so on S.5. Wings dirty amber with dark apical border, to all black, but always with pale extreme forewing apex. South-eastern Brazil across to Bolivia; figs 21-26. [Female with gaster dorsoventrally compressed, polished, tergites 2-5 shallowly emarginate posteriorly; similar only to *P. elongata*, see text] ***P. australis*** p. 152
- Without modified hairs on sternite 2; strongly modified hairs on S.3 and 4 are very similar but less dense on S.4, and consist of long, dense lateral brushes curved inwards and backwards. Wings black. Eastern Brazil; figs 27-32. [Female colour as in male; body robust; junction of radial vein with costa very shallow, as in the *P. rubra*-group, hence like *P. assimilis* but that species is distantly allopatric in northern South America (see description for other structural differences); PTC very strong and sharp, rounded] ***P. taschenbergi*** p. 148
- 3. S.3 with small, rather sparse, postero-lateral tufts of long hair with apexes slightly hooked (almost as long as those on S.4, which form dense lateral brushes with apexes very strongly hooked); wings entirely dark 4
- S.3 without long, hooked hairs 5
- 4. Basal half of SGP slightly flattened, with narrowly upturned margins; propodeum with strong PPT and PTC. Bolivia across to southeastern Brazil, south to northern Argentina. [Female colour as in male; head in dorsal view very strongly swollen behind eyes, hence similar to *P. discolor*; see description for other differences] aberrant ***P. filiola*** p. 230
- SGP narrow, of even cross-section throughout; propodeum with very weak PPT and no PTC. Venezuela, Bolívar (See Variation under *P. purpurea*). [Female colour usually as in this male; body slender, without strong distinctions; see full description] aberrant ***P. purpurea*** p. 238
- 5. S.4 without conspicuous hairs; S.5 with a semicircle of long, very dense, curved hairs (sparser anteriorly). Wings orange-amber with broadly dark base and apex, the boundaries diffuse. Central America; figs 33-38. [Female colour as in male; hind tibial spurs of equal length; see description for other differences] ***P. chiron*** p. 92
- S.4 always with modified hairs (sometimes restricted to very short lateral tufts only) 6
- 6. Both S.4 and S.5 each with a short, lateral, longitudinal line of extremely short, dense, bristle-like hairs (at first sight appearing to be abraded remnants of longer hairs). Wings amber, narrowly dark basally, more broadly but weakly apically. South-eastern Brazil to north-eastern Argentina; figs 39-44. [Female colour as in male; head in dorsal view very strongly swollen behind eyes, forewing with proximal vein of SMC3 strongly sloping anterodistally. spurs of hind tibia equal in length] ***P. laetabilis*** p. 108
- S.4 and/or 5 with hairs much more conspicuous; if on both sternites, those on S.4 sometimes very short and dense but different from those on S.5 and usually covering more of S.4; sometimes in transverse lines but not longitudinal 7
- 7. S.5 with hairs much longer than those on S.4. Wings black with metallic reflections. Amazon mainstream south to Buenos Aires; figs 45-50. [Female colour as in male;

- head in dorsal view very strongly swollen, MT strong, propodeal dorsum punctate between DTC, VR widely spaced without carinae between] ***P. crassicornis*** p. 94
- S.5 hairs, when present, equally as long or shorter than those on S.4 8
 - 8. S.5 hairs covering more of the segment than those on S.4, the latter not reaching anterior margin; all hairs short (about equal to SGP width) and dense 9
 - S.5 hairs covering less of segment than those on S.4 10
 - 9. S.4 hairs limited to about posterior one-third of segment; those of both S.4 and S.5 of even length throughout; SGP strongly expanded apicad, almost spatulate. Wings orange-amber, with very variable infuscation. Mexico and Central America; a few records from Colombia and Venezuela; figs 51-56. [Female colour as in male, except antenna orange from AS3 onwards; propodeum with strong median ridge, hind tibia with inner spur scarcely longer than outer, very similar to sympatric *P. optima*; see description for differences] ***P. atalanta*** Mocsáry p. 87
 - S.4 hairs reaching forwards to about two-thirds of segment; those of S.5 much shorter in centre-line than laterally; SGP weakly expanded apicad. Wings entirely black to almost entirely orange-amber. Most of South America except north-western Colombia, desert west coast and Patagonia; figs 57-62. [Female wing colour as in male; body robust, very variable but usually with at least some subfemoral hair, teeth of hind tibia usually rather large and more-or-less upright and distant; see also description] ***P. inclyta*** p. 89
 - 10. MT extremely sharp, thorn-like; hindwing often with white apico-posterior margin; S.4 hairs forming short, dense, lateral brushes, strongly incurved but apexes not touching, often with small hooks; SGP transversely convex, more-or-less ovoid in outline (*P. lampas*-group) 11
 - MT at most pointed; hindwing rarely with white margin; other characters usually not as above 14
 - 11. Wings entirely black except hindwing sometimes with white margin. Central America, southern West Indies and southwards east of the Andes to central Brazil; figs 63-68. [Female colour as in male; gaster polished, with polished pygidium; see description] ***P. cyanescens*** p. 154
 - Wings not entirely black; hindwing always with white margin 12
 - 12. Antenna mainly orange. Southern Ecuador and northern Perú (coast and up to 900 m); figs 69-74. [Female wing colour more variable than in male; see text.] ***P. multichroma*** p. 156
 - Antenna mainly black. Found elsewhere 13
 - 13. Wings with off-white to silvery markings. Eastern Brazil, Paraguay and extreme north-eastern Argentina (Misiones); figs 75-77. [Female colour as in male; gaster as in *P. cyanescens* but pygidium different; see description] ***P. varipennis*** p. 158
 - Wings with amber, orange or red markings. Southern Perú, southern Brazil to Argentine Patagonia; figs 78-80. [Female colour as in male but very variable extent of light colour; specimens with reduced markings are very similar to *P. varipennis*; see description] ***P. lampas*** p. 159
 - 14. Posterior margins of tergites shallowly, arcuately emarginate [S.4 hairs forming sparse lateral brushes curved inwards and backwards, their apexes touching; SGP transversely convex, weakly keeled in basal half. Wings weakly to strongly infuscate]. Panamá, southwards east of the Andes to the Amazon mainstream, with a few

- records beyond it; figs 81-86. [Female colour as in male, or sometimes orange; structure as in *P. australis*; see description for differences ***P. elongata*** p. 150
- Posterior margins of tergites virtually straight 15
15. Hind coxa with sharp angle at junction of upper and outer faces; S.4 hairs in lateral brushes which are short, incurved but widely separated; between them is a patch of much shorter, dense hair, also on anterior part of S.5 in larger specimens. Wing colour extremely variable. Everywhere east of the Andes between the latitudes of Buenos Aires and central Bolivia; isolated records north to Amazon mainstream; figs 87-92. [Female gaster with last tergite swollen, so that whole segment is directed almost downwards; hind coxa as in male but angle very sharp] ***P. nitida*** p. 161
- Hind coxa with upper and outer faces joining in a rounded angle 16
16. S.4 with short, dense hairs, all of approximately equal length and forming a complete, transverse band at least apically; sometimes covering the whole segment, when they are extremely short (not exceeding SGP width) 17
- S.4 hairs not simultaneously short and dense, usually arranged differently and of various lengths 28
17. S.4 hairs covering more than the posterior half of the segment 18
- S.4 hairs forming a transverse band close to the posterior margin of the segment, covering at most half the surface 20
18. Wings orange-amber with dark base and apex; head in dorsal view strongly swollen behind eyes; anterior hairs on S.4 curved backwards, the laterals inwards. Larger, robust species, BL 13-24. Paraguay, Uruguay, northern and eastern Argentina; figs 93-98. [Female colour as in male; head in dorsal view very strongly swollen behind eyes; DTC fine, dense, regular; PFC forming semicircles centred on petiole socket; hind tibial inner spur short, no longer than 1.5 times as long as outer] ***P. aciculata*** p. 254
- Wings otherwise coloured; head scarcely swollen behind eyes; S.4 hairs erect, straight; smaller, very slender species, BL 13-18 19
19. S.5 covered with hairs virtually identical to those on S.4; SGP flat, strongly shining, with apical hairs longer than SGP width; wings black or with amber spots or markings, but these never form a complete, broad, central, transverse band (if they do so, the band is more proximal). Widespread from the latitude of Buenos Aires north to the Amazon mainstream; very sparse northwards from there to Central America; figs 99-104. [Female wings black, or sometimes with amber spots or patches; with abundant subfemoral hair] ***P. auriguttata*** p. 272
- S.5 with a few hairs posteriorly; SGP transversely convex, weakly shining; apical hairs much shorter than SGP width; centre of wings with a complete, broad, transverse, central, yellow-amber band. Known only from two localities in eastern Brazil; figs 105-110. [Female wings amber-orange with weakly infusate apical border; hind tibia without teeth] ***P. wahisi*** p. 283
20. S.4 band in profile about as wide as the length of its tallest hairs; these decrease slightly in height posterad. Wings entirely black. Amazonian Ecuador and Perú; figs 111-116. [Female wings black, with orange-amber spot in centre of both, but larger and more diffuse on hindwing; propodeum very robust; see also Description] ***P. dayi*** p. 256

- S.4 band in profile much narrower than height of hairs, which are of more equal length 21
- 21. S.4 hairs extremely short, about as long as maximum SGP width 22
- S.4 hairs at least 1.5 times as long as SGP width 23
- 22. Paramere apex bluntly pointed; east of the Andes from the Caribbean coast to some distance south of the Amazon; wings black with yellow band, sometimes entirely black in northern part of range; figs 117-123. [Female without distinctive characters, but usually distinguishable from those of sympatric species (except *P. ianthoides*, which see) by the latter's strong characters – see key to mimicry-group species] ***P. atripennis*** p. 257
- Paramere apex strongly, obliquely truncate on inner side; Paraguay and Uruguay to south of Amazon; wings with more-or-less distinct yellow band; sometimes wings entirely black (with intermediates) in southern part of range; figs 124-127. [Female not possible to distinguish from that of *P. atripennis* where sympatric; see text.] ***P. martini*** p. 260
- 23. Paramere very short, more-or-less truncate, not longer than rest of genitalia; SGP very short, slightly bent down in the middle; S.5 with very narrow, more-or-less distinct band of hairs about half as long as those on S.4 24
- Paramere longer, more-or-less pointed, distinctly longer than rest of genitalia; SGP longer, straight; if S.5 has hairs, they are very weak, and do not form a distinct band 26
- 24. S.4 hairs 2-3 times as long as apical width of SGP, of slightly differing length so that their tips form an uneven outline in anterior view; S.2 & 3 with some fairly long, thin hairs like those on S.5 but in diffuse patches, not forming bands; paramere apex obliquely truncate; species of eastern Andes, Colombia to Bolivia; figs 128-133. [Female gaster with a distinct constriction between S.1 & 2 in dorsal view; all sternites from S.2 groove onwards densely pilose; S.2 groove weak, without lateral extension; all femora with long hair below in fresh specimens] ***P. hirtiventris*** p. 269
- S.4 hairs 1.5-2.5 times as long as apical width of SGP, of even length so that their tips form a shallow, arcuate outline in anterior view; preceding sternites with very few, much shorter hairs, only about as long as thickness of S.4 hair-band; paramere apex squarely or slightly obliquely truncate; species of eastern Andes and eastern Brazil 25
- 25. Paramere apex squarely truncate; species of eastern Andes from Venezuela to northern Argentina, and Upper Amazon; wings black, sometimes with yellow or off-white band; figs 134-142. [Female: all femora long-pilose below; hairs below S.2 & 3 sparse, but increasingly dense to S.6; lateral groove of propodeum sinuate anteriorly] ***P. nana*** p. 265
- Paramere apex slightly obliquely truncate on inner side; species of eastern Brazil; wings black with yellow band; figs 143-148. [Female: among sympatric east-Brazilian species with yellow-banded wings, is distinguished by pilose femora and sinuate lateral groove of propodeum] ***P. nanoides*** p. 268
- 26. S.4 hairs 2-3 times apical width of SGP; smaller species, BL 13-23 27
- S.4 hairs 1.2-1.5 apical width of SGP; larger species, BL 15-25. Southeast Brazil across to Bolivia, and all lowland areas southwards to Argentine Patagonia (see text for colour forms); figs 149-158. [Female: no very distinctive characters; very variable in

- size and all structural characters (see text for colour forms). Usually robust body, propodeum broad with dorsal hair more-or-less obscuring sculpture; distinguished from many sympatric species by partly orange antenna, and from the rest by the latter's strong characters.] ***P. viridis*** Lepeletier p. 248
27. Wings black; Panamá, northern South America south to Amazon mainstream, west coast; figs 159-164 [Female: AS3 very short; antenna usually bright orange from AS3 onwards] ***P. ianthina*** p. 261
- Wings black with yellow band; antenna mainly black; north-east and central Brazil; figs 165-170. [Female: not distinguishable from sympatric *P. atripennis*] ***P. ianthoides*** p. 264
28. S.4 hairs in profile medium to long, the anterior hairs distinctly higher than posterior; virtually erect, forming a moderately dense, transverse band covering at least the apical half of the sternite; SGP very strongly expanded apicad 29
- S.4 hairs in profile not decreasing in height posterad, usually differently arranged 31
29. S.4 with some anterior and also some lateral hairs longer than the posterior ones; antenna usually with some apical segments creamy-white; wing colour varies from entirely black to slightly infusate with broad, dark, usually poorly-defined apical border. A few records from Mexico and Central America; South America southwards to a little beyond Amazon mainstream; figs 171-176. [Female colour as in male; head in dorsal view scarcely swollen behind eyes; AS3 long (AEI 110-126); propodeum usually with regular, coarse DTC and strong VR; hind tibia with many backward-curved bristles, its inner spur short, only 1.25 times as long as outer] ***P. fumipennis*** p. 117
- S.4 with only some anterior hairs longer than posterior; S.5 with similar pattern but shorter hairs overall; antenna usually with some apical segments orange 30
30. S.4 hairs in profile decreasing in height gradually posterad; S.5 with almost equally broad band of hairs; antenna and wings usually mostly orange. Northern Mexico to Colombia and Venezuela; figs 177-181. [Female colours as in male; AS3 long (AEI 121-141), propodeum slender, with fairly dense, long hairs; S.2 groove without lateral extension; inner spur of hind tibia short, about 1.2 times as long as outer] ***P. sommeri*** p. 96
- S.4 hairs in profile decreasing in height suddenly posterad (forming a step); S.5 with only a narrow band of hairs; antenna and wings usually black, the latter sometimes with a central orange patch, but colour often the same as that of *P. sommeri* where sympatric. A few records from Central America; South America to northern Argentina; figs 182-186. [Female difficult to separate from that of *P. sommeri*; see table under *P. xanthocera* description] ***P. xanthocera*** p. 98
31. S.5 hairs identical to those on S.4 but slightly fewer; forming long, very thin, lateral brushes with few or no hairs between, inclined backwards but scarcely inwards, extreme apex with small but strong hook; SGP very strongly bent up from near the base and very strongly expanded to the rounded apex, which has a long hair fringe. Entire body brilliant blue-green, antenna all black or with some apical segments bright orange-yellow; wings all dark or with variable amber patches. Mainly trans-andean in Colombia and Ecuador; a few records from Panamá and Amazonian central Perú; figs 187-196. [Female colour as in male, but body sometimes blue-violet;

- wings likewise variable but sometimes entirely orange-amber with only apical border dark. Structurally very variable, very slender with very long legs; usually MT small but sharp, SMC3 very long, MPN often shorter than PST and with median groove obsolescent anteriorly; lateral extension of S.2 groove usually very short; fairly abundant subfemoral hair, especially on anterior femur]
 ***P. purpureipes*** p. 277
- If S.5 has any hairs, they are very different from those on S.4; SGP never strongly bent 32
 - 32. S.4 with lateral brushes of short hairs, not or scarcely longer than apical width of hind tibia, curved inwards or backwards but not hooked 33
 - S.4 lateral hairs much longer, often with apical hooks 36
 - 33. With few or no hairs between the lateral brushes; [wings with broad, yellow-amber transverse band (*completa* mimicry-group); SGP robust, almost rectangular, with a strong keel; without a long, apical hair fringe]. South-eastern Brazil, Paraguay; figs 197-202. [Female wing colour as in male; coarse, fairly dense, subfemoral hair on all legs; lateral extension of S.2 groove vestigial or absent; mid and hind femora sharply carinate behind] ***P. decipiens*** p. 136
 - With many hairs (sometimes very short and thin) between the lateral brushes 34
 - 34. All S.4 hairs together forming a semicircle, the lateral brushes composed of many hairs in a dense patch; SGP weakly expanded towards the rounded-truncate apex, which has no long hair fringe; hindwing usually with a white marginal band or patch postero-distally; in the south of its range, both sexes of this species often have an amber patch in the middle of both wings; these patches are extremely variable and can occupy most of the wings. Most of South America east of the Andes, south to the latitude of Buenos Aires; figs 203-208. [Female wing colour as in male, not otherwise strongly characterized; individuals without the white hindwing marking are very difficult to recognize except by direct comparison with usual specimens] ***P. seladonica*** p. 166
 - Lateral brushes and hairs between them altogether forming a narrow, virtually straight line, the lateral brushes composed of few hairs; SGP elongate, flattened, shining, expanded apicad, the margins narrowly upturned near the base, apex strongly rounded and with a fringe of long hair almost as long as basal width of SGP (but may be abraded) 35
 - 35. MPN furrow extremely narrow, suture-like, paramere scarcely tapered towards the rounded apex. Wings entirely black. East and south-east Brazil; figs 209-214. [Female wing colour as in male; body robust; head in dorsal view strongly swollen behind eyes; antenna very thick, AS3 appearing shorter than it really is (AEI 95-100); very similar to female *P. viridis*, but the antenna is yellow, not orange, and the APT and PPT are sharper. The two species are also partly allopatric (see maps)]
 ***P. helvolicornis*** p. 114
 - MPN furrow broad, deep, polished; paramere strongly tapered to the pointed apex. Wings black in the Guianas, dark in the eastern Amazon, both with bright yellow antenna; westwards along the Amazon, wings becoming paler to amber with narrow dark border, and antenna darker to all black in Perú and Bolivia; figs 215-220. [Female in Guianas with wings dark brown in basal two-thirds, yellow-amber in

- apical (virtually unique in genus); over rest of range similar to male but antenna with a few apical segments orange, not yellow] *P. luteicornis* p. 104
36. Apical half of S.4 covered with more-or-less equally long hairs which are evenly sparse and without any tendency to form lateral brushes; sometimes inclined slightly backwards, or outer hairs curved very weakly inwards; [SGP quite strongly expanded towards the squarely truncate apex. Wings variable: with clear basal half and dark apical, the junction usually very diffuse, or with a bright orange-amber, sub-basal, transverse band on a dark ground (*atripennis* mimicry-group).] Colombia, Venezuela and Trinidad; figs 221-226. [Female wing colour varies as in male; otherwise not well characterized, see Distinctions in text] *P. cybele* p. 171
- If S.4 hairs are all equally long, they are either dense and/or cover the whole segment 37
37. S.4 hairs all of about equal length and height, and arranged in a semicircle, the anterior hairs curved backwards, the laterals inwards, so that altogether they form an approximate quarter-sphere; all of about equal spacing, without defined lateral brushes; SGP flattened, shining, very strongly expanded over its whole length to the rounded apex, which has a long hair fringe; paramere longer than rest of genitalia, also with long apical hairs. Wings black with extremely strong blue-green to yellow metallic reflections. Central America; in South America found in most areas east of the Andes south to Amazon mainstream, and transandean southwards to Bolivia; figs 227-232 [Female colour as in male; transverse groove of S.2 lacking lateral extensions, propodeum rather broad, with a flattened median ridge and strong, tooth-like PPT; hind tibial teeth very low, reaching at most half the height of the subtending spines.] *P. vitripennis* p. 115
- If S.4 hairs are all of about equal length and form a quarter-sphere, they are denser laterally, forming brushes; metallic wing reflections (when present) not as strong, and at least some of the other characters disagree 38
38. S.4 hairs in profile covering at least half the segment and always forming a broad band; all equally spaced (whether dense or sparse) and always erect in profile, although curved more-or-less strongly inwards; the laterals not grouped into brushes, but longer than the central ones 39
- Either S.4 hairs form differentiated brushes (i.e. are at least a little denser) laterally, and/or they cover less than half the surface; in either case, they are usually directed backwards; central hairs may be lacking (occasionally S.4 has also an apical band of dense, very short hair) 41
39. S.4 hairs covering only the apical half of the segment; sometimes S.5 with a narrow, apical band of short, thin hairs; SGP expanded to the strongly truncate apex; paramere short, scarcely longer than the rest of the genitalia. Wings dark, sometimes with variable amber patches, occasionally with a transverse, yellow band (*completa* mimicry-group). Higher elevations in southern and eastern Venezuela; figs 233-238. [Female (only a single one seen) with dark wings; head in dorsal view strongly swollen behind the eyes, the latter smaller and further apart than usual, the head transversely rectangular; anterior vein of SMC3 very short (about equal to first abscissa of radial vein); MPN shorter than PST, its furrow strongly expanded posterad; propodeal tubercles weak, PTC absent; head, thorax, propodeum and femora with abundant, bristly hair] *P. pilosa* p. 171

- S.4 hairs covering the entire segment; other characters disagree 40
- 40. Wings black with only moderately strong violet-blue reflections; SGP short, robust, expanded from the mid-point to the rounded apex; paramere very short, scarcely as long as the rest of the genitalia and ending in a sharp, inwardly-directed spine. Lower Amazon, central and eastern Brazil; figs 239-244. [Female colour as in male; SMC3 of unusual shape: anterior vein long, about as long as second abscissa of posterior vein, distal end of the cell more transverse than usual; anterior part of propodeum with very fine DTC, coarse on the median ridge posteriorly; hind tibia with many backwardly-curved bristles.] ***P. seifferti*** p. 101
- Wings usually orange-amber with narrowly dark base and apex; often (especially in north-west Argentina) black with orange marks or patches on wings; SGP expanded apicad over its whole length; paramere longer than rest of genitalia, with rounded apex. Ranges from Argentine Patagonia north to Bolivia and southeastern Brazil, with isolated records to Amazon mainstream; figs 245-250. [Female most often with forewing infuscate-amber contrasting with paler amber hindwing, but in some females the wings are entirely orange-amber with narrow, dark, apical border, while occasional females have entirely dark wings, as in males; the head in dorsal view is strongly swollen behind the eyes; the propodeum is very robust, with APT and PPT narrow, tooth-like, and the propodeal hair is slightly shorter than the PST length; the inner spur of the hind tibia is usually long, reaching to 0.3-0.45 basitarsus length.] ***P. discolor*** p. 193
- 41. Lateral brushes of S.4 sparse, scarcely or not denser than central hairs; either posterior margin of sternite with short, often dense hairs, or hind tarsal claw very sharply bent 42
- Lateral brushes of S.4 usually dense; if sparse, the other characters do not apply; posterior margin of sternite often without short hairs 44
- 42. Body small but robust (BL 19-21), dark green; hind tarsal claws strongly bent, almost at a right angle; S.4 without short, dense hairs on posterior margin; SGP slightly depressed in centre. Wings amber with pale extreme apex. South-east Brazil and Paraguay; figs 251-256. [Female wing colour as in male but more variable, sometimes belonging to the *discolor* mimicry-group; body very robust, head in dorsal view strongly swollen behind eyes, AS3 with bristles on inner side, femora (especially anterior) with coarse hairs below, inner spur of hind tibia very short (about equal to outer spur and reaching only to 0.2-0.25 basitarsus length)] ***P. minarum*** p. 140
- If the body is small, it is slender and brilliant green; some other characters also disagree 43
- 43. Body larger (BL 18-28), black (sometimes with golden hairs forming patterns), antenna bright yellow, SGP spatulate, the rounded apex with a long hair fringe; paramere much longer than rest of genitalia. Wings dirty amber to dark, with the extreme apex often slightly paler. Middle Amazon westwards, south to Perú; transandean in Colombia and Ecuador (but not recorded from Panamá); figs 257-262. [Female forewing with pale apex more evident than in male; AS3 long (AEI 116-128), head in dorsal view scarcely swollen behind eyes, MT strong, propodeum with strong, very regular DTC and often with a fine, golden to violaceous pile but no long hair] ***P. asteria*** p. 106

- Body smaller (BL 16-18), very slender, brilliant green, wings almost glass-clear with a dark, apical band; SGP strongly transversely convex, paramere equal in length to rest of genitalia. Guianas and lower half of Amazon mainstream; figs 263-268 [Female wings entirely very dark; body very slender, especially legs; propodeum very distinctive: shallowly curved throughout in profile, MG distinct and of almost equal width throughout, continued right down the posterior face; APT and PPT weak, no PTC] ***P. esmeralda*** p. 281
- 44. S.4 hairs forming a single (one hair thick), but evenly dense line, which is usually shallowly curved, central hairs often shorter than the laterals and sometimes sparse at mid-centre; most hairs, especially the laterals, usually with small apical hooks 45
- S.4 hairs forming a line which is several hairs thick, or is strongly curved, or both; central hairs sometimes absent, so that the laterals form an isolated group on each side 49
- 45. Propodeum and sides of thorax uniquely rugose-punctate; wings dark with central, transverse, yellow band (*completa* mimicry-group). Central and eastern Brazil, Paraguay; figs 269-274. [Female wing colour as in male; unique body sculpture even stronger.] ***P. maeandrina*** p. 137
- Thorax smooth, propodeum with only the usual DTC 46
- 46. Wings glass-clear or very pale amber, with at most the apical quarter dark (but see *infuscata* below); body often brilliant green 47
- If the wings have a pale base, either almost the apical half is dark, or the basal part is dark orange-amber; body dark green or blue-green (occasionally violaceous) 48
- 47. Body brilliant green or blue-green, sides of thorax usually with dense yellowish-silver hair; antenna with orange tips; S.4 central hairs many, dense, in profile more erect than laterals and usually brown (laterals black); SGP parallel-sided, transversely weakly convex; paramere scarcely longer than rest of genitalia. [See under Variation for exceptional wing colours]. Most of lowland South America east of the Andes, from Colombia to Paraguay; commonest in the west; figs 275-282. [Female wings entirely dark; AS3 long (AEI 105-125), head in dorsal view slightly swollen behind eyes; MT sharp (but not always large); MPN furrow narrow, obsolescent anterad; DTC rather fine, regular, almost without hair; MG fairly distinct, PTC weak or absent but VR strong.] ***P. infuscata*** p. 214
- Body dark green or blue-green, sides of thorax without dense, pale hair; antenna with white tips; S.4 central hairs few, sparse, in same plane as laterals, all black; SGP expanded apicad, concave with raised margins; paramere much longer than rest of genitalia. Wings entirely black, or with basal half yellow (*atripennis* mimicry-group). Lowland South America from Amazon northwards, and central Brazil to Argentina; figs 283-288. [Female wing colour variable: entirely dark; dark with broad, sub-basal yellow band (*atripennis* mimicry-group); or orange-amber with dark apical border. Structure very variable, but usually head in dorsal view weakly swollen behind eyes; MPN very short with very broad furrow; hind tibial teeth sometimes very small and inner spur very long (reaching to 0.4-0.5 basitarsus length). Variation overlaps that in *P. dimidiata* - see table under that species.] ***P. amyntas*** p. 123
- 48. MPN slightly longer than PST, its furrow narrow; propodeum with MG usually distinct, especially anteriorly; SGP parallel-sided or weakly expanded apicad, with

- straight sides, scarcely swollen in distal half, sometimes with a weak keel over most of its length; immediately before the apex is a small, transverse impression, deepest centrally. Wings entirely black, or with basal half yellow (*atripennis* mimicry-group); South America south to northern Argentina, but absent from upper Amazonas and much of eastern Brazil; figs 289-295. [Female wing colour as in male. Front tibial spur apically spatulate; MPN depressed centrally, its furrow narrow, obsolescent anterad and not reaching anterior margin, its carinae very fine; propodeum with median ridge becoming higher and narrower posterad, ending in a more-or-less strongly raised PTC.] ***P. chrysoptera*** p. 144
- MPN slightly shorter than PST, its furrow strongly expanded apicad; propodeum with MG absent or almost so; SGP very variable: apical half more-or-less strongly expanded and swollen, basal half with a pair of longitudinal impressions. Wing colour very variable - see Variation. Everywhere from the USA to Argentine Patagonia and west of the Andes south to Ecuador, absent only from the West Indies; figs 296-303. [Female wing colour as in male. Structure very variable but usually body very robust; head in dorsal view strongly swollen behind eyes, AS3 very short (AEI 63-86); MPN short with broad furrow; hind tibia with many strong, backwardly-curved bristles, all mid and hind tibial spurs more-or-less strongly hooked apically (specimens from Central America often with hind tibial teeth tiny, curved hairs few, spurs straighter).] ***P. menechma*** p. 131
49. S.4 hairs in a pair of small, isolated, lateral brushes; very long, gradually incurved from about their mid-point, so that those of opposite sides form a complete arc; no hairs whatever between the two brushes 50
- If the lateral brushes exhibit this configuration, either there are at least a few (sometimes only 5-6 very weak) hairs between them, or if there are no such hairs, the brushes have extremely strongly hooked tips and are usually larger and denser 51
50. Wings with a broad, well defined, off-white to yellow, transverse band, approximately its own width from the wing-base. Found from central Brazil to northernmost Argentina, but sparse in east Brazil from the Amazon delta southwards; figs 304-312 ***P. completa*** p. 186
- Wings usually orange-amber with a dark, apical band, sometimes wholly dark but never with a well-defined, central, transverse band (see Variation in text for wing colours). Very common throughout the higher mountains of Mexico, Central and South America; also on the Peruvian coast and at lower altitudes in Chile and Argentina; figs 313-318. [Female not strongly characterized except for very dense body hair; resembling females of other species where sympatric in the southern Andes. See couplets 45/46 in key to females.] ***P. montezuma*** p. 181
51. Basal half of the forewing glass-clear, the apical half very dark with weak blue-violet reflections. Costa Rica to Colombia; figs 319-330. [Female (only 3 seen) quite large (BL 29-32). Wings orange-amber with approximately basal one-third dark, the junction very diffuse, and a very narrow dark band on the apical margin. Head in dorsal view more rounded than usual, approaching semi-globular. Forewing with SMC3 very long and strongly bulging apico-posteriorly. Structurally very like *P. gracillima* but much larger.] ***P. basalis*** p. 209
- If the forewing is glass-clear, the dark area covers not more than the apical one-third; if more, then the basal part is amber or darker; or else the wings are of quite different colours 52

52. PPT extremely large, tooth-like, projecting strongly in postero-lateral direction; propodeal dorsum quadrate, with wide PTC separating it from the near-vertical posterior face; usually propodeum and much of thorax covered by dense, adpressed, golden hair (not in extreme south of range - see Variation). Wings dark orange-amber, antenna usually deep orange from AS3 onwards, gaster deep metallic blue-green. Found in lower one-third of Amazon mainstream, southwards through central Brazil to Paraguay; figs 331-336. [Female colours as in male. Head in dorsal view strongly swollen behind eyes, also vertex; body very robust, antenna thick; PPT as in male but narrower.] ***P. optimatis*** p. 109
- If the PPT are strong, they are not extremely so; body most often without dense, golden hair; other characters disagree 53
53. SGP elongate, with very long apical hair fringe which is at least as long as minimum SGP width; paramere usually much longer than rest of genitalia 54
- SGP without long hair fringe, usually not elongate 57
54. SGP very strongly expanded to the rounded apex, broadly cupped in centre; tiny species (BL 12-17); most of S.4 hairs form a pair of dense brushes whose apex is very strongly hooked (forming at least a right angle, often more acute); between the brushes are usually some much shorter, quite dense hairs, but these do not form a distinct, graduated series between the laterals and the centre; SGP apical hair almost as long as maximum SGP width; body dark blue-green, occasionally violaceous; wings most often entirely very dark, occasionally with yellow transverse band - see Variation. Ranges from Panamá to Venezuela, Ecuador (including coast), to Amazonian Perú; sparse from the middle Amazon to northern Bolivia; figs 337-345 [Female wing colour variable: see Variation. The best characters for recognition are the tiny size (BL 14-23), and tiny, distant hind tibial teeth.] ***P. sabina*** p. 275
- If the SGP is strongly expanded apicad, it is not cupped, and the body is larger; the lateral and central hairs of S.4 are connected by a distinct, graduated series; body brilliant green or blue-green, wings amber with a dark, apical band 55
55. S.5 with well-defined, slightly pre-apical, band of hair which is strongest in the centre; paramere equal in length to rest of genitalia. Transandean in Colombia and Ecuador; Amazonian Perú; isolated records from Costa Rica, coastal Venezuela and the Guianas, and central Bolivia; figs 346-351. [Female wings entirely dark, AS3 long (AEI 104-130), SMC3 elongate, especially posteriorly; very similar to females of several other species - see text.] ***P. hyalinipennis*** p. 216
- S.5 with only very weak hairs which are denser laterally; paramere longer than rest of genitalia 56
56. SGP narrow, parallel-sided; body small (BL 15-21). Occupies the whole of the Rio Araguaya (in east-central Brazil), and extends across to central Bolivia; figs 352-357. [Female wings with broadly dark apex, basally amber, the latter sometimes reduced to a rather narrow band (*atripennis* mimicry-group); head unusual: in dorsal view with temples only weakly swollen but long, and eyes smaller and wider apart than usual, so that overall the head approaches a semi-globular shape; propodeal dorsum broad, flattened, the DTC rather fine and regular.] ***P. schlinkei*** p. 279
- SGP moderately expanded apicad, body medium-sized (BL 14-26). Most of north-western South America including the whole of the Amazon mainstream and headwaters west to central Perú; transandean in Ecuador (but not recorded from

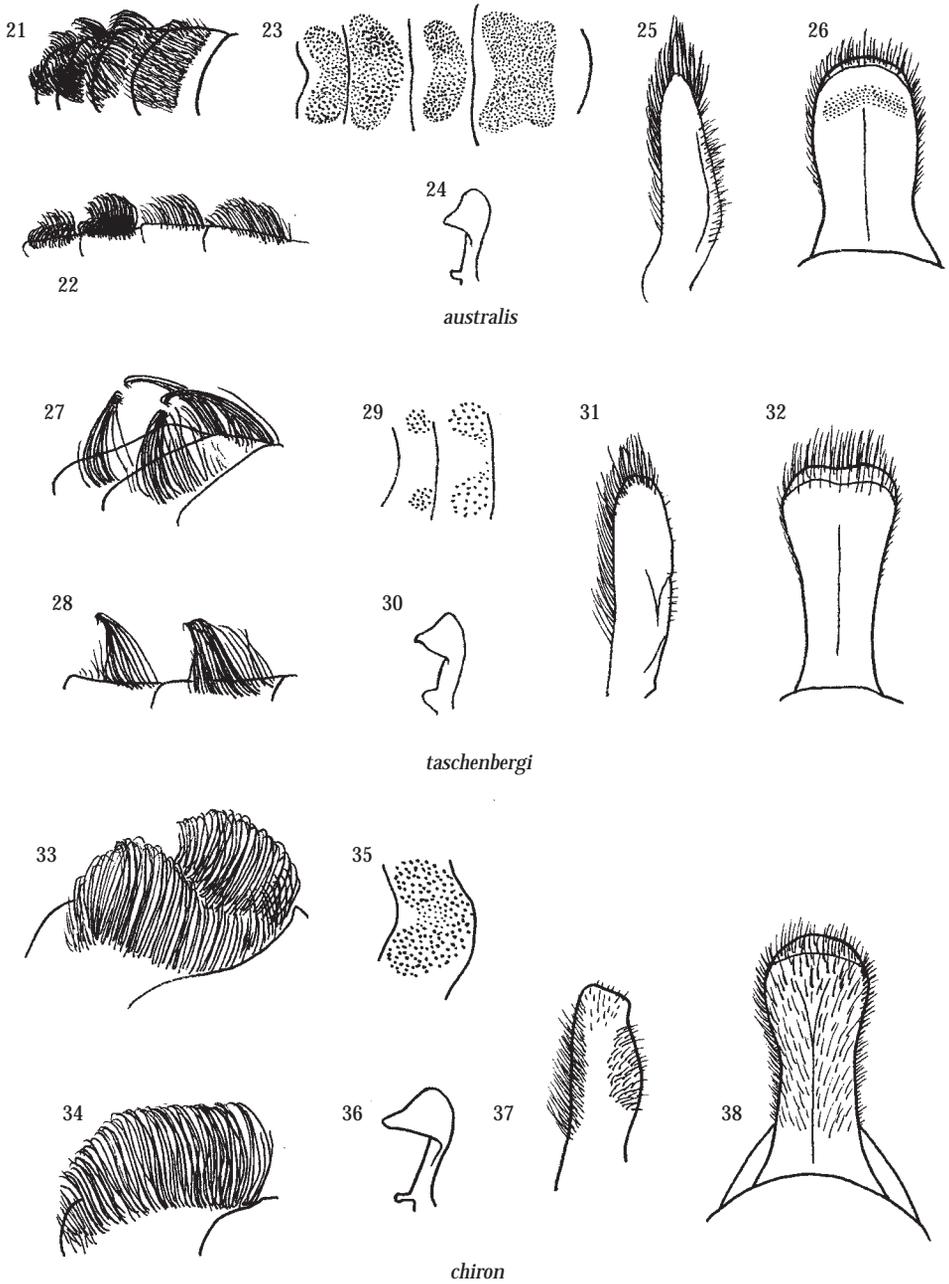
- west-coast Colombia or Panamá); figs 358-363. [Female wings entirely dark, or deep red-brown. AS3 long, AEI 102-126; structurally very variable (in particular, the west-Ecuadorean population has the propodeal sculpture distinct from that of all other populations), resembling females of several other species, especially *P. festiva* - see text.] ***P. gracilis*** p. 223
57. Wings entirely dark 58
 - Wings with at least a small (usually basal) area pale 69
58. S.5 with an apical band of dense, dark hair more than half the height (not length) of those on S.4 59
 - If S.5 has any hairs, they are short, pale, do not form a strong, dense band, and are less than half the height of those on S.4 61
59. Species exclusively of the West Indies; body violet to blue-violet; figs 364-370. [Female wings black with weak blue-violet reflections; MPN with furrow usually more-or-less strongly expanded apicad, and carinae very fine.] ***P. ruficornis*** p. 232
 - Species exclusively of the mainland Americas; body usually without violet colour 60
60. SGP parallel-sided or slightly narrowed apicad, bent down just after mid-point; smaller species (BL 14-22). Costa Rica to Colombia; figs 371-376. [Female wings entirely dark; usually with partly yellow (not orange) antenna; resembles females of several other species.] ***P. lepida*** p. 226
 - SGP weakly expanded apicad, straight; larger species (BL 19-30). Part: this variably dark-winged form is the usual one found from Yucatán to Panamá; figs 377-382. [Female very variable, see text.] ***P. mildei*** p. 229
61. SGP parallel-sided or weakly tapered apicad 62
 - SGP at least weakly expanded apicad 64
62. S.4 with few, small, sparse, central hairs between the lateral brushes 63
 - S.4 with moderately dense central hairs, almost as high (not long) as the lateral brushes; body bright blue-green; SGP parallel-sided; paramere equal in length to rest of genitalia; inner, apical projection of digitus very sharply pointed but not finger-like. Part; this dark-winged form is the usual one found from central Mexico to Panamá; figs 383-385. [Female wings usually entirely dark; AS3 long (AEI 114-133); antenna usually entirely orange from base of AS3 (or near it), but there is much variation and it resembles females of other species sympatric in various parts of its range - see text.] ***P. festiva*** p. 219
63. Distance between PPT equal to or slightly longer than dorsal length of propodeum (back to the PTC). SGP with a pair of weak, longitudinal impressions near the base. Body smaller (BL 19-27), dark green; wings with weak blue-violet reflections. Bolivia and southeast Brazil, southwards to central Argentina; figs 386-391. [Female wings entirely dark; head in dorsal view very strongly swollen behind eyes; SMC3 elongate, this and the radial cell almost symmetrically rounded apically. See text for further characters.] ***P. filiola*** p. 230
 - Distance between PPT much shorter than propodeal dorsal length; SGP narrow, without longitudinal impressions; body larger (BL 25, only one seen), dark violaceous; wings with very strong, golden reflections; Western Colombia; figs 392-397. [Female unknown.] ***P. caliente*** p. 246

64. S.4 hairs decreasing considerably in height and length from the laterals to the mid-centrals 65
- S.4 with at least some mid-central hairs nearly as high as the laterals, (not always as long) 66
65. S.4 with mid-central hairs very small and sparse; antenna with 1-2 apical segments orange; SGP with apical half expanded, rounded, with a fairly strong median keel running right to the apical margin. Eastern and south-eastern Brazil; figs 398-403. [Female wings entirely dark; propodeum with a very strong median ridge containing a sharply-incised MG.] ***P. boharti*** p. 142
- S.4 with central hairs strong, dense; antenna all black; SGP evenly, more-or-less strongly, expanded to the rounded-truncate apex, often with a weak keel in the basal part only. Mainly in southeastern Brazil, Uruguay and the northern half of Argentina; sparse in central Brazil and Argentine central Patagonia. Part; this dark-winged form occurs sporadically; figs 404-409. [Female wings orange-amber with dark apical border; resembles females of several sympatric species - see text.] ***P. flavescens*** p. 176
66. S.4 central hairs very thin and sparse. Found mainly in southern Brazil and northern Argentina, sparsely northwards to Lower Amazon. Part; this dark-winged form occurs sporadically; figs 410-416. [Female with wings usually quite dark; one of the few smaller species (BL 15-29) in the area where it is commonest; it can be confused with small specimens of *P. flavescens*, and also resembles *P. discolor* - see text.] ***P. smaragdina*** p. 188
- S.4 central hairs almost as thick and dense as the laterals 67
67. SGP very variable, but always the middle part has raised margins (in small specimens often little more than a raised line, more strongly polished than the adjacent surface); usually more-or-less expanded apicad; paramere about 1.5 times as long as rest of genitalia; S.4 lateral hairs only a little denser than centrals, but larger and often more strongly hooked apically; antenna often with pale apical segments; smaller species, BL 12-28. Part; these variably dark-winged forms occur frequently in Panamá and north of the Amazon; figs 417-422. [Female wing colour very variable; body usually very robust, with very short MPN; but very variable also in structure; see text.] ***P. dimidiata*** p. 125
- SGP without raised margins; larger species, BL 22-28 68
68. SGP very strongly expanded towards the apex, which is rounded-truncate; a fairly strong, median keel reaches about two-thirds of the distance from base to apex; paramere about twice as long as rest of genitalia; digitus with inner, apical projection very slender, finger-like; propodeal dorsum raised between PPT, with distinct PFC; figs 423-428. [Female unknown.] ***P. catarinensis*** p. 112
- SGP weakly expanded towards the apex, which is strongly rounded; without a keel; paramere about 1.5 times as long as rest of genitalia; digitus with the inner, apical projection very sharp but not finger-like; propodeal dorsum flattened between PPT and virtually without PFC; figs 429-434. [Female wings entirely dark; propodeum evenly rounded in profile, without PFC; inner spur of hind tibia scarcely longer than outer.] ***P. convexa*** Lucas p. 110
69. S.4 lateral hair-brushes evenly, gradually curved, with tips meeting or almost so, forming a perfect arc 70

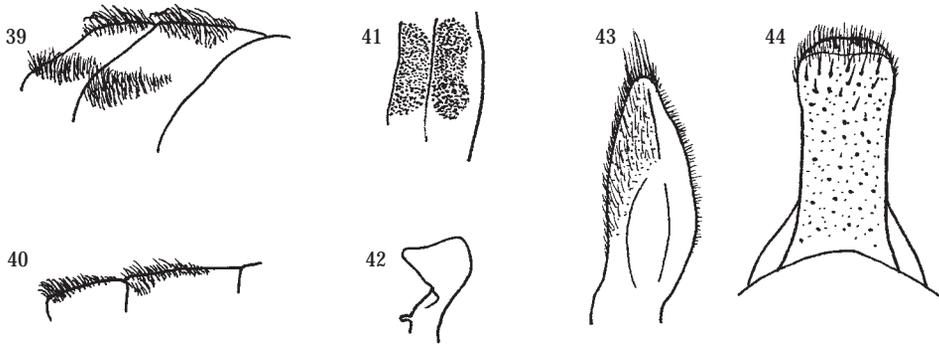
- S.4 lateral hair-brushes with at least a short, distal part much more strongly curved than the rest, sometimes very strongly hooked; thus not forming an arc 76
- 70. S.5 with distinct, transverse band of dark hair about half the height (not length) of those on S.4 (N.B. if on anterior part of S.5, may be partly hidden between S.4 hairs); wings orange-amber with dark, apical band 71
- S.5 without a distinct hair band, sometimes with a few, weak, pale hairs 72
- 71. S.4 hairs changing from laterals to centrals in an evenly graduated series. Restricted to a zone between 500-3,200 m in the eastern Andes of Argentina, from Jujuy to Mendoza; figs 435-440. [Female wings orange-amber with dark apical border; propodeum usually rather evenly curved in profile, with MG often distinct and running right through on to posterior face; otherwise very similar to that of the sympatric *P. montezuma* - see text for further differences.] ***P. nigricans*** p. 180
- S.4 lateral hairs abruptly replaced towards the centre by many shorter hairs, all about equally long, their apexes thus forming a straight line between the lateral brushes. Widespread from northern Argentina to central Patagonia, although sparser in the east; almost as widely distributed in Chile; figs 441-446. [Female wings orange-amber with dark apical border; MPN usually has the furrow strongly expanded apicad; but it is very similar to those of several, partly-sympatric species, see text for differences.] ***P. thoreyi*** p. 174
- 72. Long, quite dense (but not otherwise modified) hairs on S.1, 2 and 3. Wings mainly deep orange-amber. Most of Argentina southwards to central Patagonia, also in central Chile; figs 447-452. [Female wings orange-amber with dark apical border; resembles females of several sympatric species - see text.] ***P. limbata*** p. 199
- Only S.4 with strong hairs; wings usually mainly pale amber, never deep orange-amber 73
- 73. S.4 hairs arranged in a semicircle, all curved strongly inwards, the laterals to the centrals forming an evenly graduated series, decreasing to about half the height; although the central hairs are thinner than the laterals, they are almost as dense. Sides of thorax usually without metallic hair. Mainly in southeast Brazil, Uruguay and the northern half of Argentina; sparse in central Brazil and Argentine central Patagonia. Part; this light-winged form is the usual one; figs 404-409. [Female wings orange-amber with dark apical border; resembles females of several sympatric species - see text.] ***P. flavescens*** p. 176
- S.4 central hairs not much shorter, but distinctly sparser than laterals; sides of thorax often with silver to golden adpressed hair 74
- 74. S.4 lateral hair brushes very dense (not possible to see gaps between hair bases); central hairs even, regular; SGP parallel-sided; paramere equal in length to rest of genitalia; inner, apical projection of digitus very sharply pointed but not finger-like. Part; this light-winged form is the usual one found almost everywhere in South America, south to northern Argentina; figs 383-385 [Female wings usually entirely dark; AS3 long (AEI 114-133); antenna entirely orange from base of AS3 (or near it), but there is much variation and it resembles those of other species sympatric in various parts of its range - see text.] ***P. festiva*** p. 219
- S.4 lateral brushes only moderately dense (possible to see between hairbases); central hairs very sparse, often irregular; SGP expanded apicad (weakly in small

- specimens); paramere longer than rest of genitalia; inner, apical projection of digitus very slender, finger-like 75
75. Usually at least the last antennal segment yellow or orange (occasionally brown); SGP strongly expanded apicad, apex often emarginate centrally. Found mainly in southern Brazil and northern Argentina, sparsely northwards to Lower Amazon. Part; this light-winged form is the usual one; figs 410-416. [Female with wings usually quite dark; one of the few smaller species (BL 15-29) in the area where it is commonest; it can be confused with small specimens of *P. flavescens*, and also resembles *P. discolor*; see text.] ***P. smaragdina*** p. 188
- Up to 2.5 apical antennal segments ivory white; SGP weakly expanded apicad, not emarginate. Suriname, and sparsely southwards to the Lower Amazon; figs 453-458. [Female wings usually bright orange-amber with an extremely narrow, dark, apical border, much narrower than in the similar colour form of *P. smaragdina* in northeast Brazil.] ***P. achterbergi*** p. 191
76. Wings bright orange-amber with a dark, apical border. USA to Panamá 77
- If the wings are orange-amber, it is usually paler and often more restricted in extent; species occurring elsewhere 78
77. S.5 with very dense hair band (not possible to see between hair bases); paramere very little longer than rest of genitalia; inner, apical projection of digitus only sharply pointed; larger species, BL 19-30. Part; this variably light-winged form is the usual one found from the USA to Mexico north of Yucatán; figs 377-382. [Female very variable, see text.] ***P. mildei*** p. 229
- S.5 hairs sparse (possible to see between bases); paramere about 1.5 times as long as rest of genitalia; inner, apical projection of digitus long and slender, finger-like; smaller species, BL 11-22; figs 459-467. [Female wings orange-amber with dark apical border; very similar to that of the sympatric *P. montezuma* - see table in text.] ***P. basifusca*** p. 141
78. Species found only in Jamaica; figs 468-474. [Female wings moderately dark with yellowish reflections.] ***P. jamaicensis*** p. 234
- Species found elsewhere 79
79. Tiny species (BL 11-18), body brilliant blue-green; S.4 hairs forming a pair of well-defined lateral brushes, the area between them polished, without hairs; the hairs are apically hooked and inclined very strongly backwards; S.5 hairs extremely weak or absent; SGP a virtually unmodified rectangle; paramere equal in length to rest of genitalia. Wings clear with apical one-third to half dark, the junction sometimes very diffuse. Panamá to Amazon mainstream, but apparently absent from large areas north of the latter; figs 475-480. [Female wings usually entirely rather dark; body brilliant green, otherwise not well characterized, see text.] ***P. purpurea*** p. 238
- Species larger, body not always brilliant blue-green; wing colour often different; either S.4 hairs are different (usually with hairs in centre) or S.5 has distinct, modified hairs 80
80. S.4 hairs of two very different kinds: the laterals form a pair of narrow brushes whose apices are very strongly curled back on themselves (not angulately hooked), while the central hairs are much shorter, almost straight, and all about equally long; the S.5 hairs form an apical band closely resembling the central hairs of S.4; SGP bent down about the middle, the apex narrowly rounded. Wings clear with apical

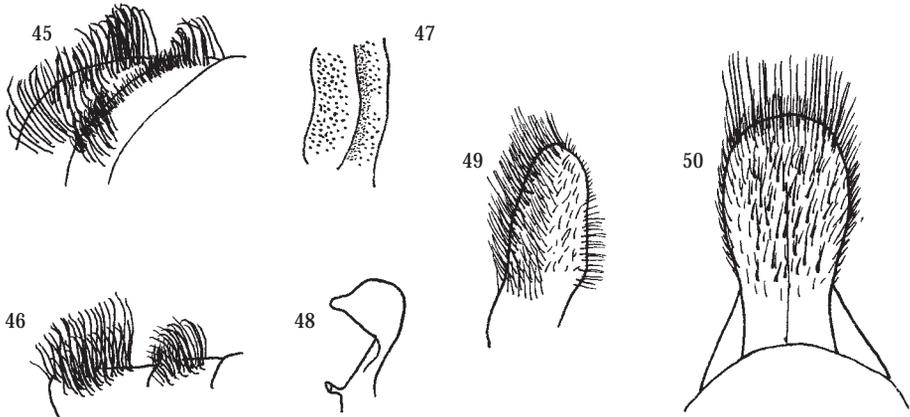
- one-third rather dark. Known only from Pebas on the Peruvian Upper Amazon; figs 481-486. [Female unknown.] ***P. krombeini*** p. 212
- S.4 hairs either form an evenly graduated series from the laterals to the centrals, or are not much differentiated 81
 - 81. SGP bent down at about the middle 82
 - SGP straight 83
 - 82. SGP very small, strongly tapered apicad; slender species with temples not swollen in dorsal view (head more-or-less triangular); dark apex of forewing usually merging with basal part very diffusely; SMC3 with distal vein strongly bulging posteriorly. Transandean in Colombia; west of Andes in Ecuador; Venezuela; figs 487-492. [Female wing colour very variable; AS3 very long, AEI 124-138; head more-or-less globular in dorsal view; but see text.] ***P. gracillima*** p. 205
 - SGP slightly widened and transversely concave pre-apically; robust species; temples slightly swollen in dorsal view; forewing with dark apex usually sharply delimited from pale base; SMC3 not strongly bulging distally; Paraguay, north-east Argentina, south-east Brazil northwards to Pernambuco; figs 493-498. [Female wings entirely dark; very similar to that of *P. viridis*; see text.] ***P. brunneicornis*** p. 236
 - 83. S.4 lateral hairs with only tiny hooks at apex, and usually with more-or-less dense central hairs; S.5 without distinctly modified hairs; SGP variable but always with narrowly raised margins about the middle. Wings usually clear with dark apical quarter but sometimes with a sub-basal, transverse, yellow band (*atripennis* mimicry-group). Part; this variably light-winged form occurs mainly south of the Amazon; figs 417-422. [Female wing colour very variable; body usually very robust, with very short MPN; but very variable also in structure; see text.] ***P. dimidiata*** p. 125
 - If S.4 lateral hairs have only tiny hooks, then S.5 has a distinct, apical band of modified hair 84
 - 84. S.4 lateral hairs only moderately hooked apically (at most 180°), and with abundant central hairs between them; S.5 hairs in thin band. Guianas; Amazon mainstream and its western headwaters from central Colombia to central Perú; figs 499-506. [Female wings entirely dark; AS3 long, AEI 115-121; similar to females of *P. gracillima* and *P. hyalinipennis*; see text.] ***P. willinki*** p. 208
 - S.4 lateral brushes extremely strongly hooked apically (about three-quarters of a circle), with scarcely any central hairs between them; S.5 hairs forming a thick band 85
 - 85. S.5 hair band with anterior hairs longer and curved back over the tops of the posterior ones. Guianas, and broadly along Amazon mainstream; figs 507-514. [Female wings dark; AS3 long, AEI 105-118; very similar to the female of *P. infuscata* - see table in text.] ***P. viridisetosa*** p. 241
 - S.5 band with hairs of about equal height and almost straight. Central Bolivia, central Brazil and Paraguay; figs 515-521. [Female wings deep red-brown or dark; hind tibial teeth vestigial.] ***P. adonta*** p. 245



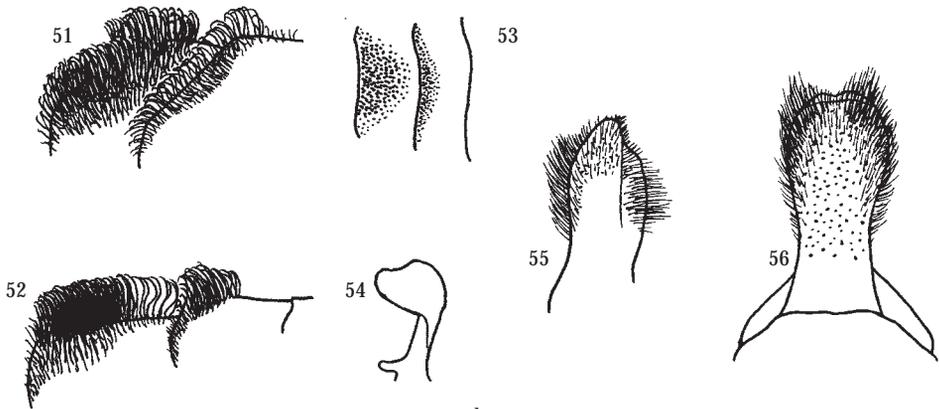
Figs 21-521. Male *Pepsis* parts. Figs 21-26, *australis*; 27-32, *taschenbergi*; 33-38, *chiron*. 21-23, 27-29, 33-35, sternal hairs in antero-lateral and ventral view, and insertion points, respectively; 24, 30, 36, digitus apex dorsal; 25, 31, 37, paramere ventral; 26, 32, 38, SGP ventral.



laetabilis

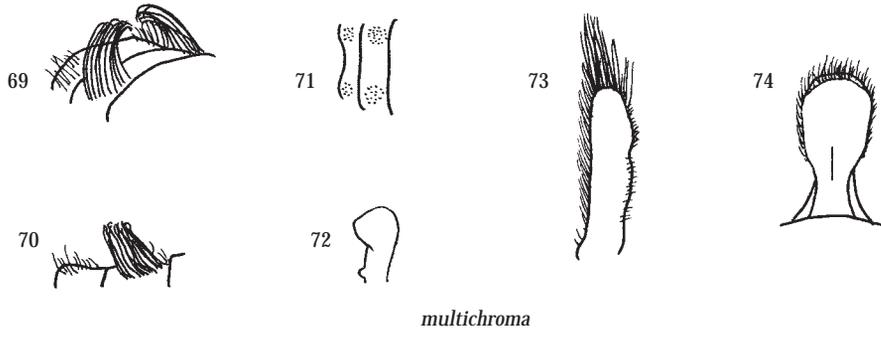
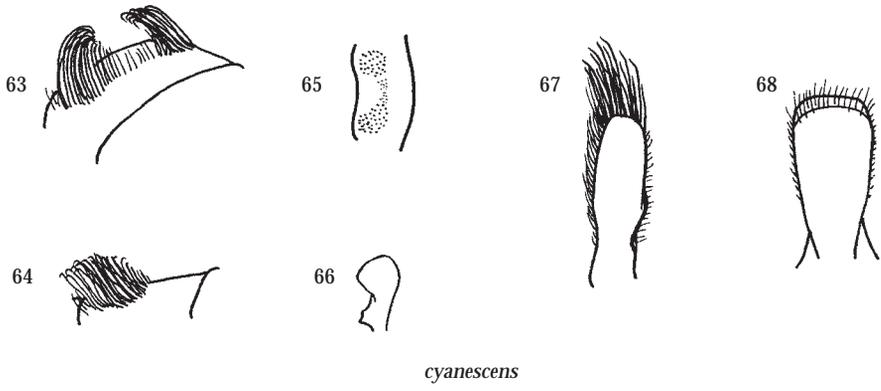
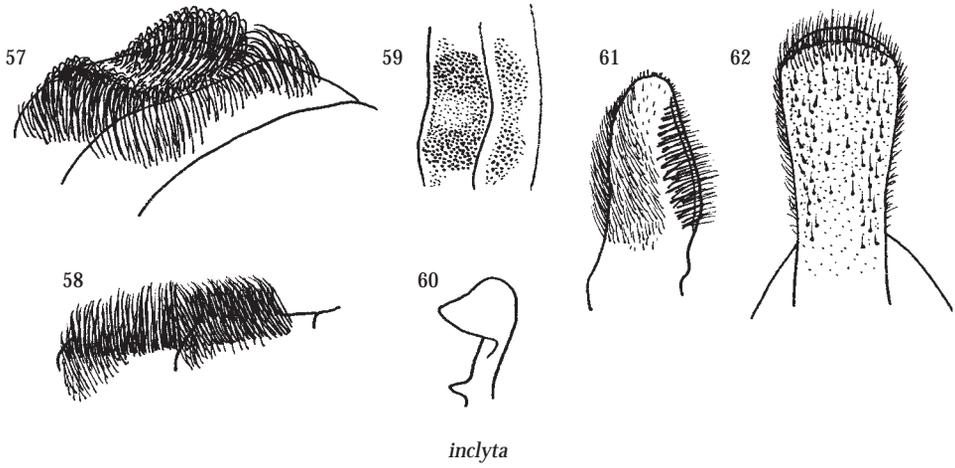


crassicornis

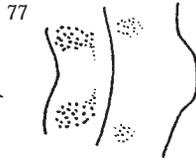


atalanta

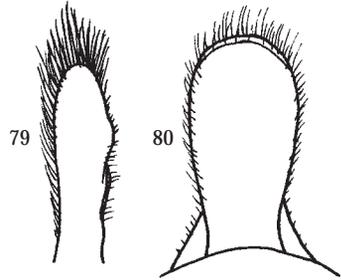
Pepsis species: figs 39-44, *laetabilis*; 45-50, *crassicornis*; 51-56, *atalanta*. 39-41, 45-47, 51-53 sternal hairs; 42, 48, 54, digitus apex; 43, 49, 55, paramere; 44, 50, 56, SGP.



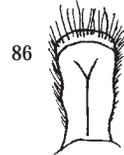
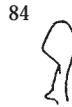
Pepsis species: figs 57-62, *inclyta*; 63-68, *cyanescens*; 69-74, *multichroma*. 57-59, 63-65, 69-71, sternal hairs; 60, 66, 72, digitus apex; 61, 67, 73, paramere; 62, 68, 74, SGP.



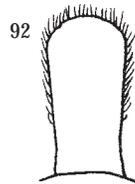
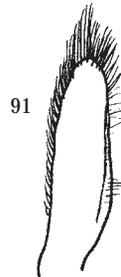
varipennis



lampas

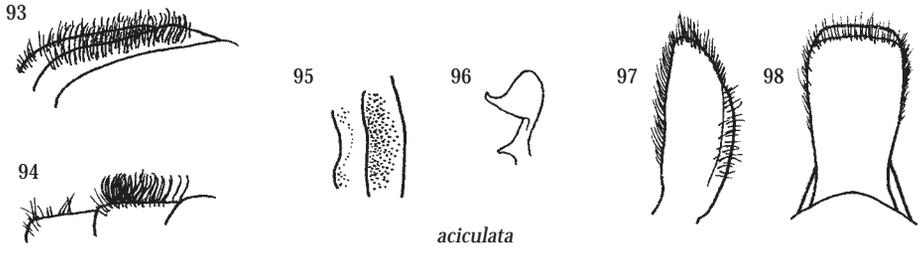


elongata

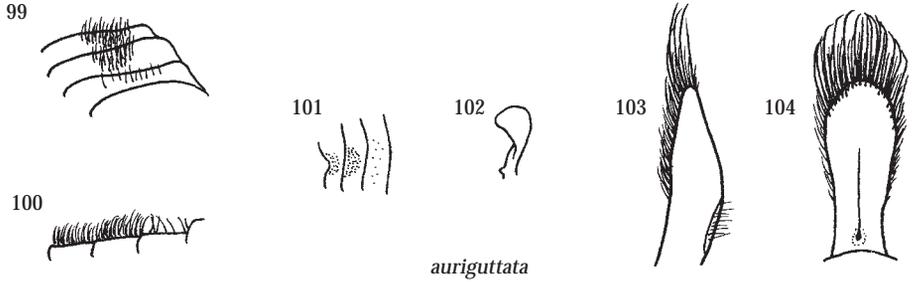


nitida

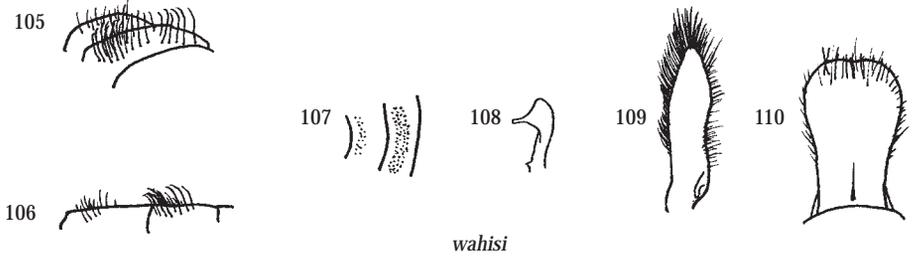
Pepsis species: figs 75-77, *varipennis*; 78-80, *lampas*; 81-86, *elongata*; 87-92, *nitida*. 75-77, 81-83, 87-89, sternal hairs; 78, 84, 90, digitus apex; 79, 85, 91, paramere; 80, 86, 92, SGP.



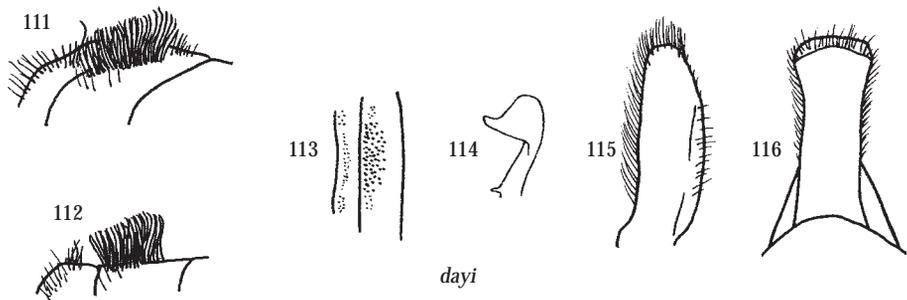
aciculata



auriguttata

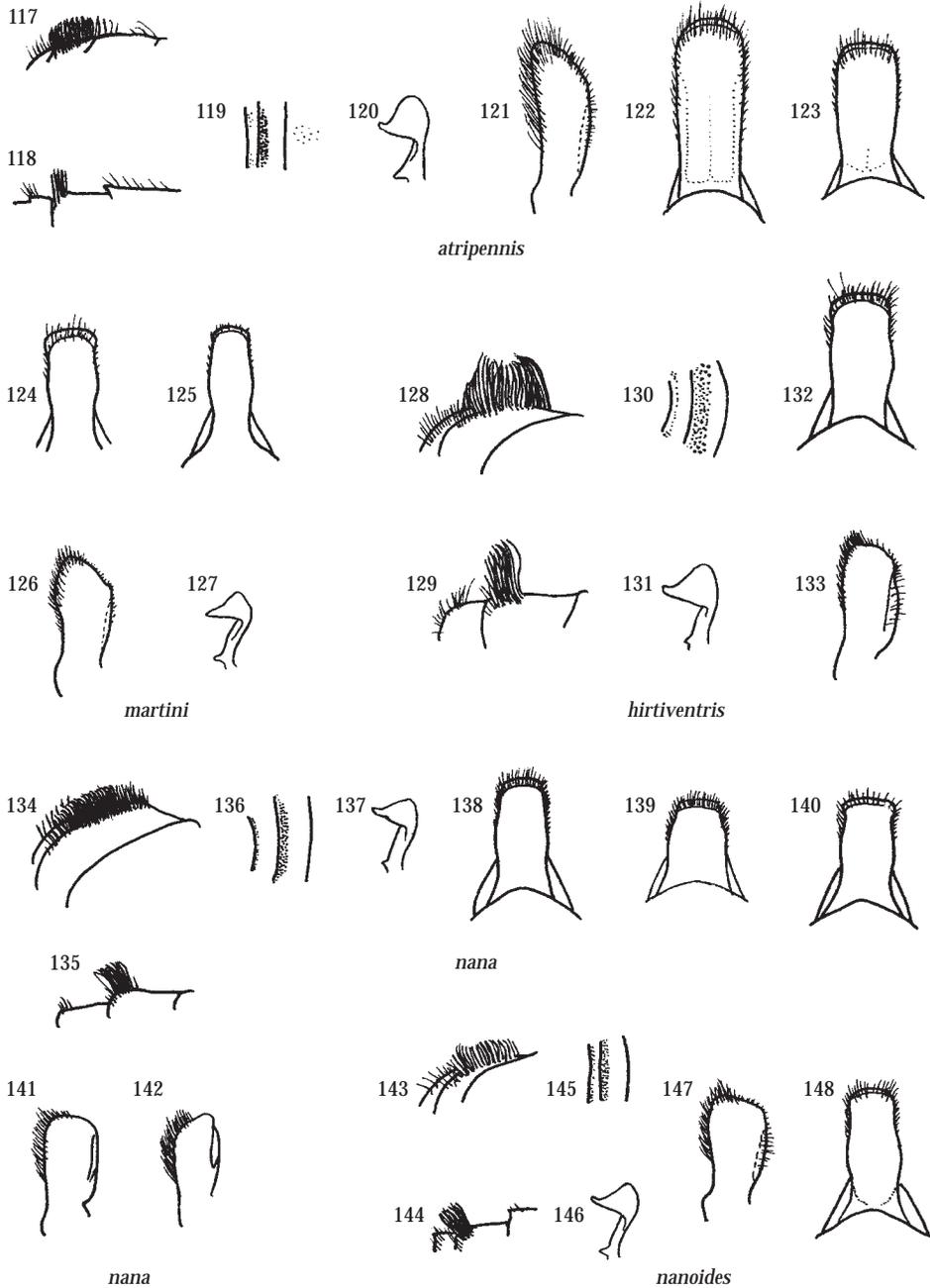


wahisi

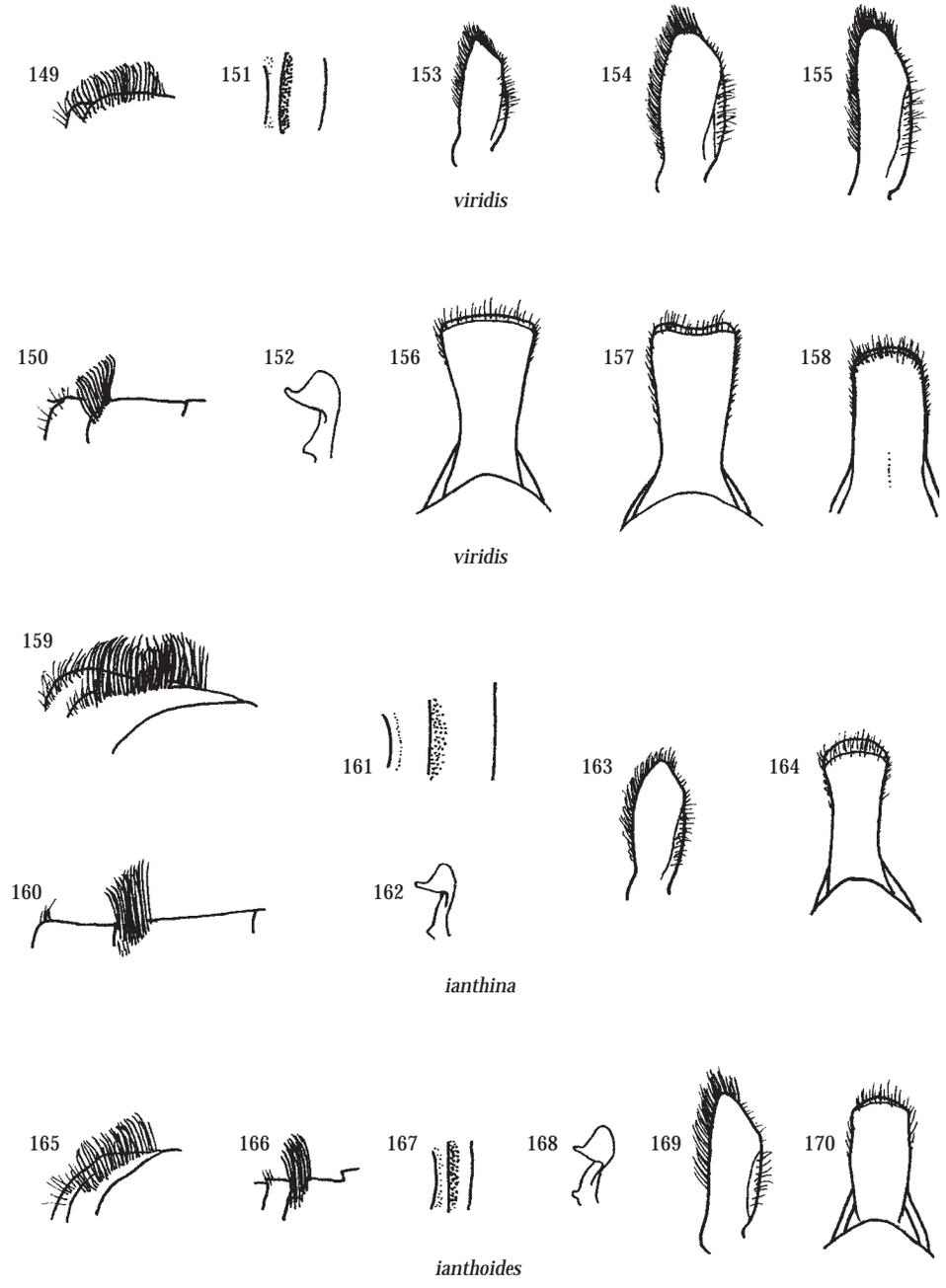


dayi

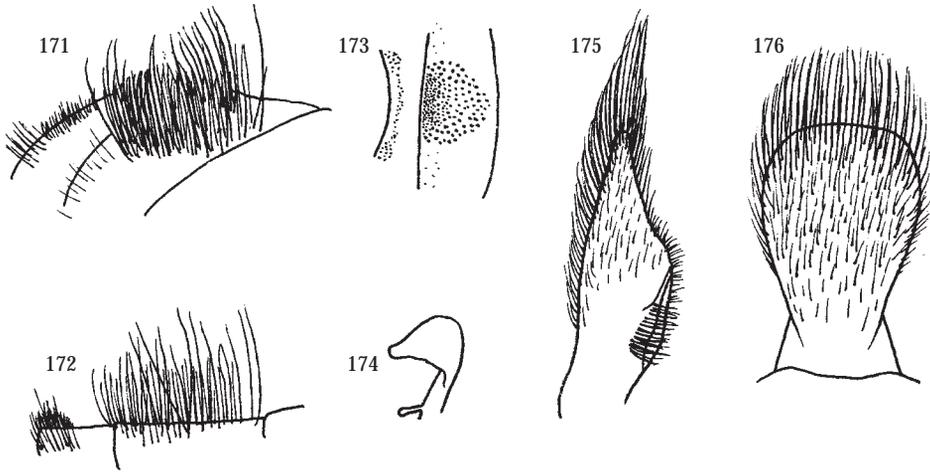
Pepsis species: figs 93-98, *aciculata*; 99-104, *auriguttata*; 105-110, *wahisi*; 111-116, *dayi*. 93-95, 99-101, 105-107, 111-113, sternal hairs; 96, 102, 108, 114, digitus apex; 97, 103, 109, 115, paramere; 98, 104, 110, 116, SGP.



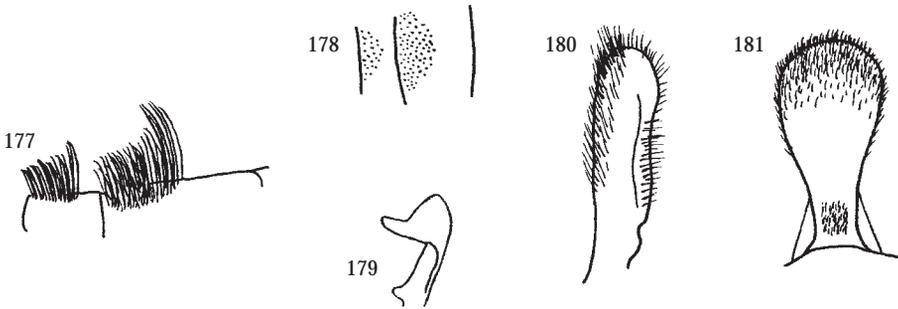
Pepsis species: figs 117-123, *atripennis* (122, Brazil, Pará; 123, Suriname); 124-127, *martini* (124, Brazil, Campinas; 125, Paraguay); 128-133, *hirtiventris*; 134-142, *nana* (134-138, 141, Perú; 139, Bolivia, Aiquile; 140, Bolivia, Chaparé; 142, Bolivia, Pando); 143-148, *nanoides*. 117-119, 128-130, 134-136, 143-145, sternal hairs; 120, 127, 131, 137, 146, digitus apex; 121, 126, 133, 141, 142, 147, paramere; 122-125, 132, 138-140, 148, SGP.



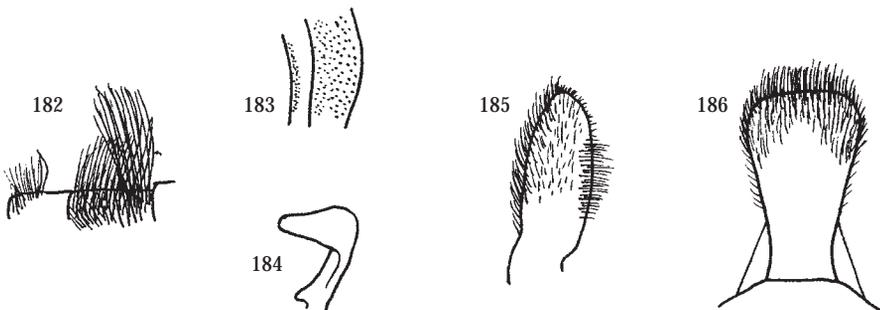
Pepsis species: figs 149-158, *viridis* (153, Argentina, Tucumán; 154 & 157, Argentina, Río Negro; 155, Argentina, Catamarca; 156, Argentina, Buenos Aires); 159-164, *ianthina*; 165-170, *ianthoides*. 149-151, 159-161, 165-167, sternal hairs; 152, 162, 168, digitus apex; 153-155, 163, 169, paramere; 156-158, 164, 170, SGP.



fumipennis

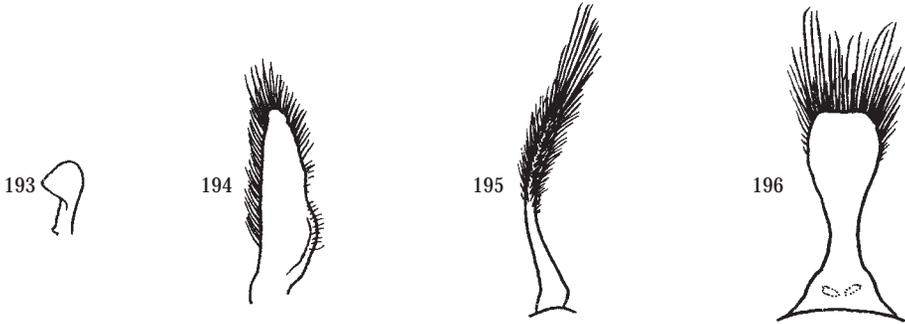
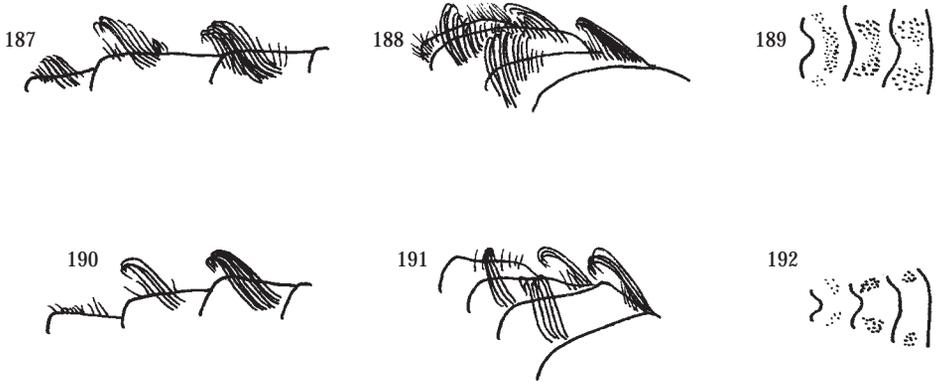


sommeri

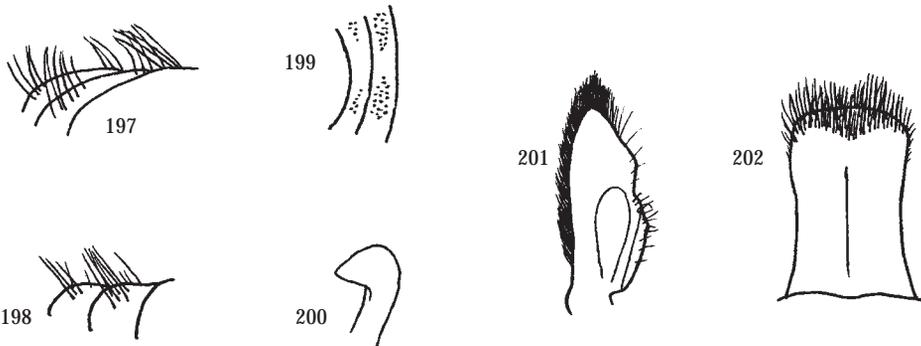


xanthocera

Pepsis species: figs 171-176, *fumipennis*; 177-181, *sommeri*; 182-186, *xanthocera*. 171-173, 177, 178, 182, 183 sternal hairs; 174, 179, 184 digitus apex; 175, 180, 185 paramere; 176, 181, 186 SGP.

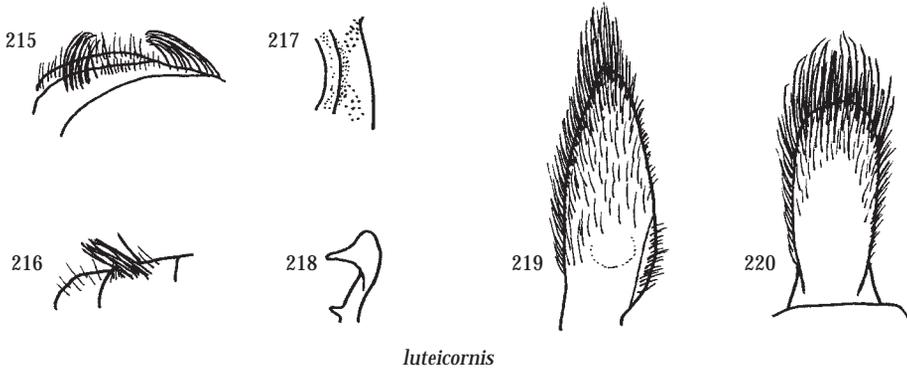
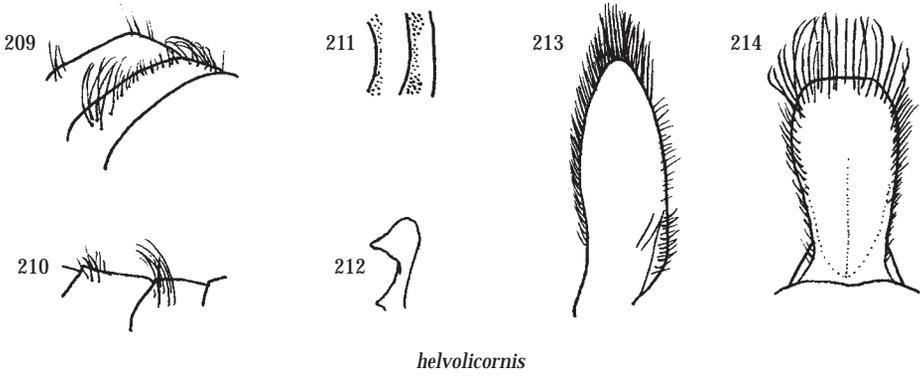
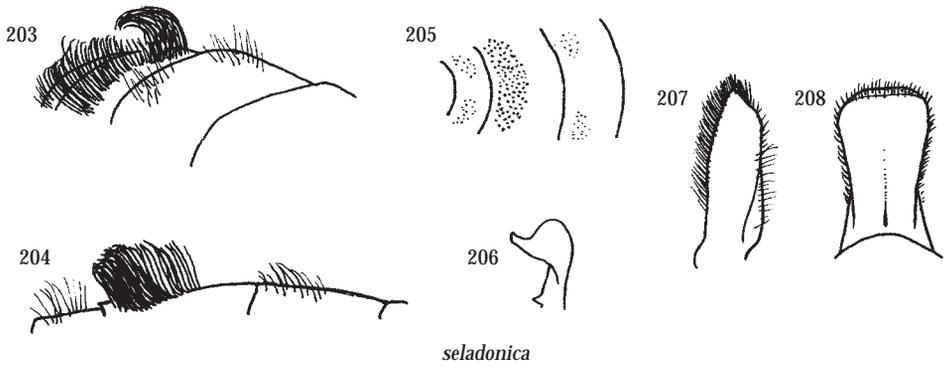


purpureipes

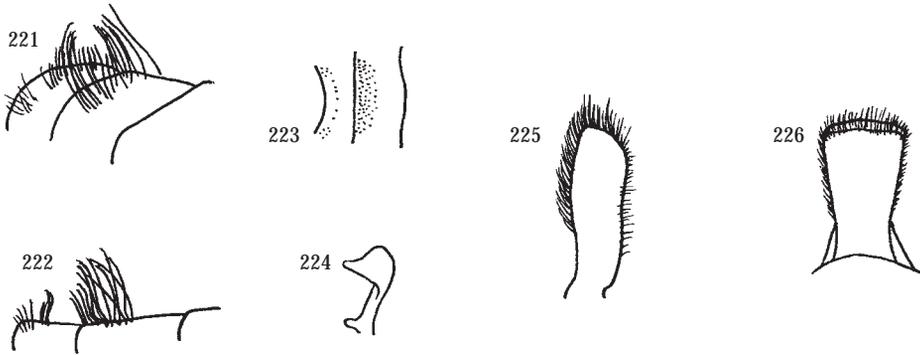


decipiens

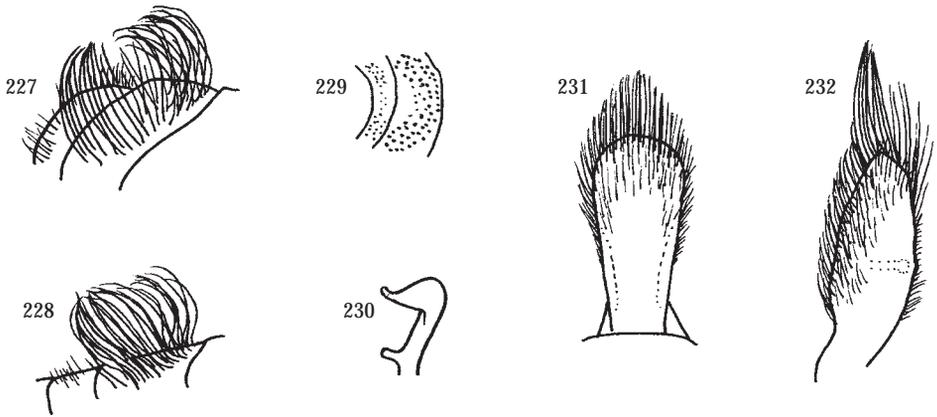
Pepsis species: figs 187-196, *purpureipes* (187-189, Colombia; 190-196, Ecuador); 197-202, *decipiens*. 187-192, 197-199, sternal hairs; 193, 200, digitus apex; 194, 201 paramere; 195, 196, 202, SGP.



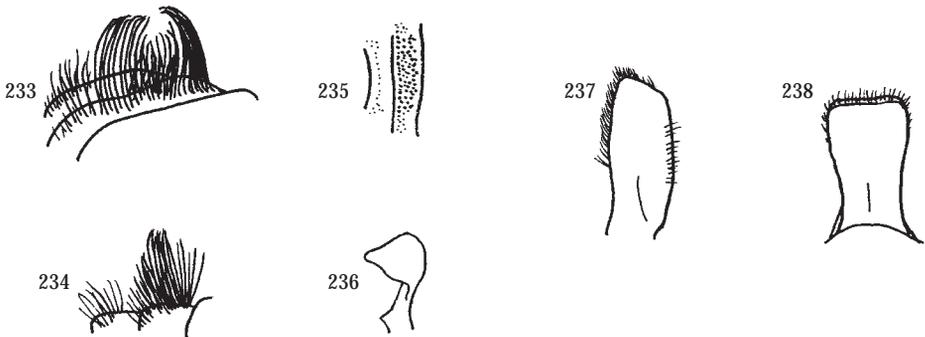
Pepsis species: figs 203-208, *seladonica*; 209-214, *helvolicornis*; 215-220, *luteicornis*. 203-205, 209-211, 215-217, sternal hairs; 206, 212, 218, digitus apex; 207, 213, 219, paramere; 208, 214, 220, SGP.



cybele

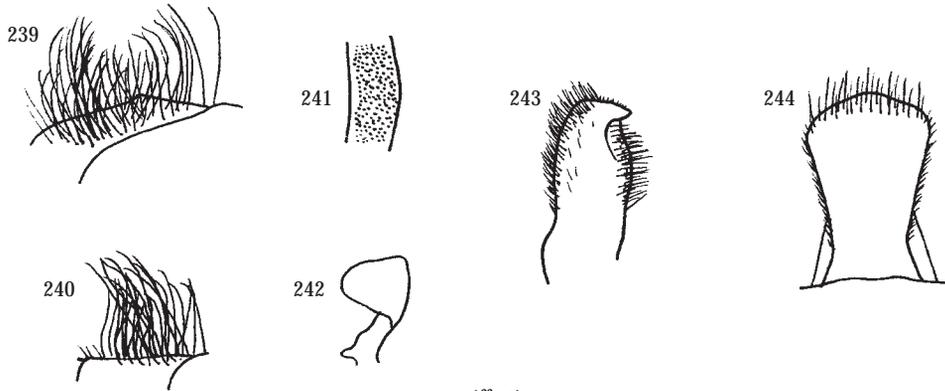


vitripennis

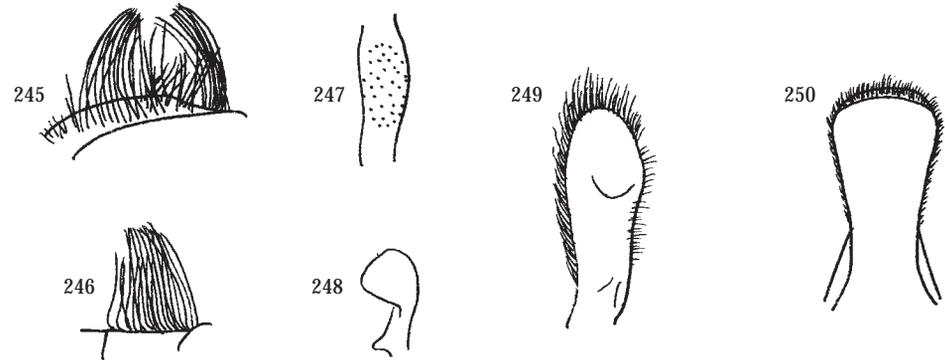


pilosa

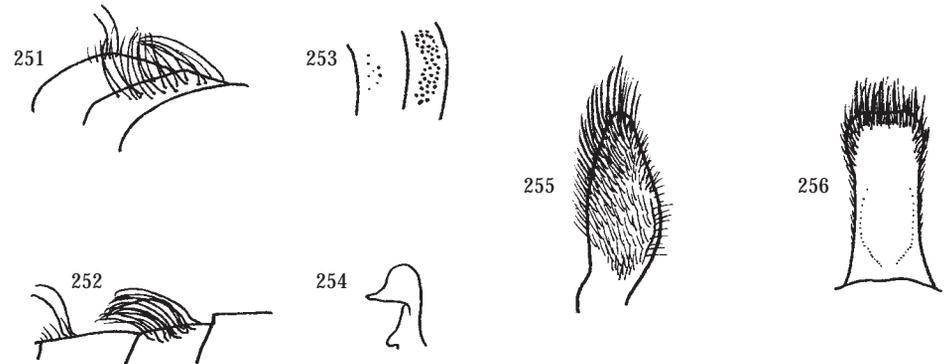
Pepsis species: figs 221-226, *cybele*; 227-232, *vitripennis*; 233-238, *pilosa*. 221-223, 227-229, 233-235, sternal hairs; 224, 230, 236, digitus apex; 225, 232, 237, paramere; 226, 231, 238, SGP.



seifferti

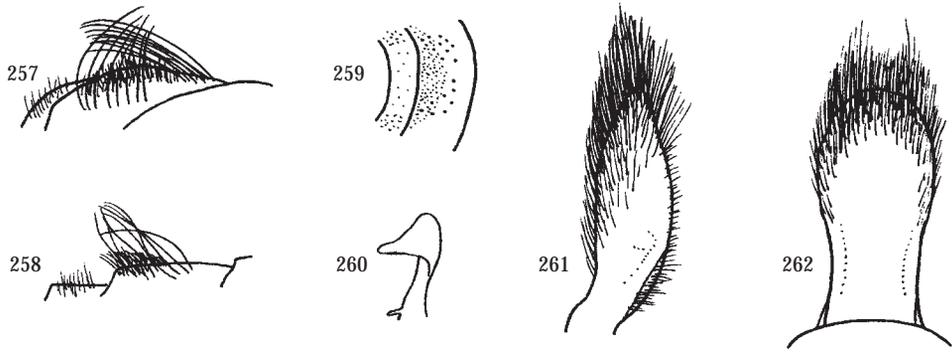


discolor

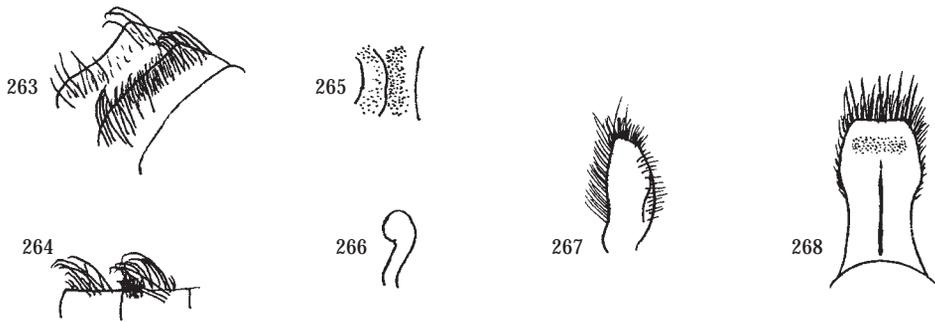


minarum

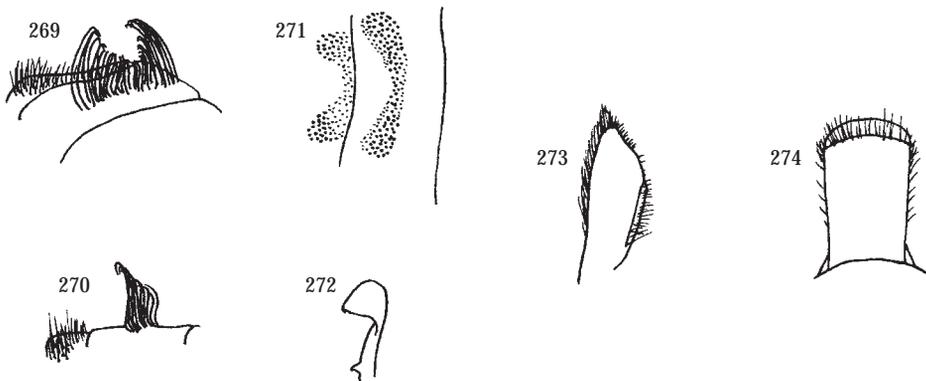
Pepsis species: figs 239-244, *seifferti*; 245-250, *discolor*; 251-256, *minarum*. 239-241, 245-247, 251-253, sternal hairs; 242, 248, 254, digitus apex; 243, 249, 255, paramere; 244, 250, 256, SGP.



asteria

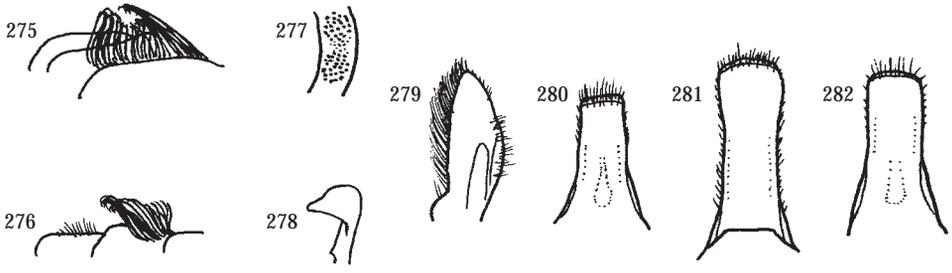


esmeralda

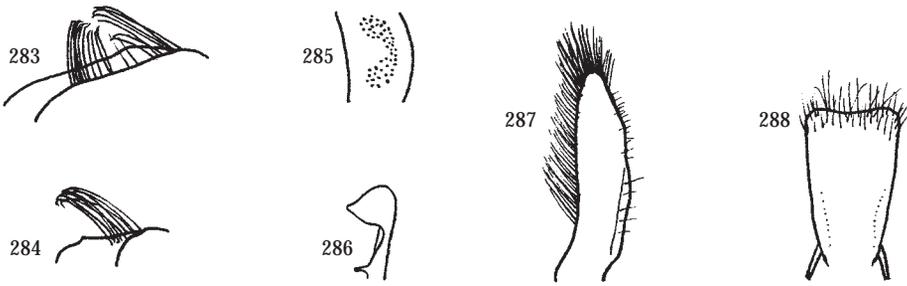


maeandrina

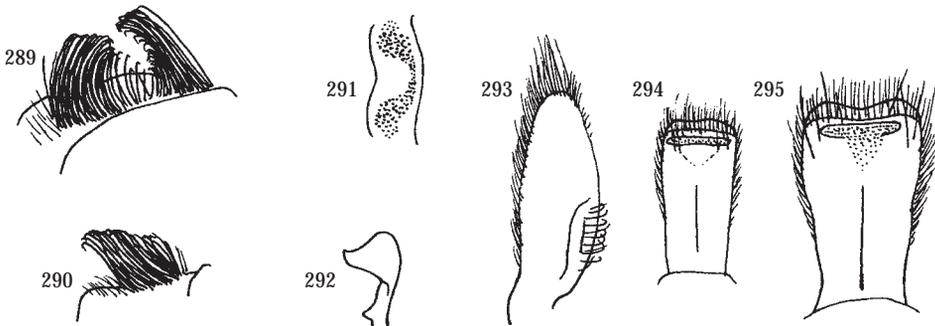
Pepsis species: figs 257-262, *asteria*; 263-268, *esmeralda*; 269-274, *maeandrina*. 257-259, 263-265, 269-271, sternal hairs; 260, 266, 272, digitus apex; 261, 267, 273, paramere; 262, 268, 274, SGP.



infuscata

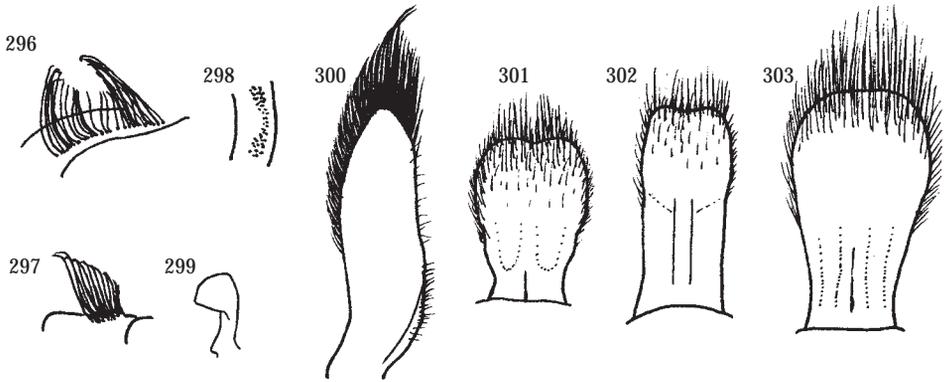


amyntas

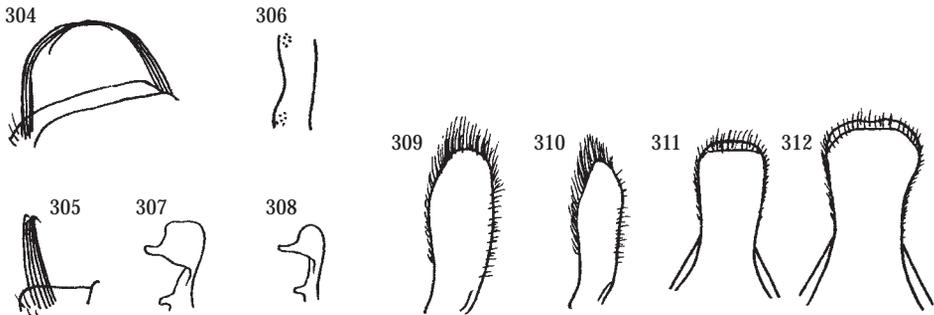


chrysoptera

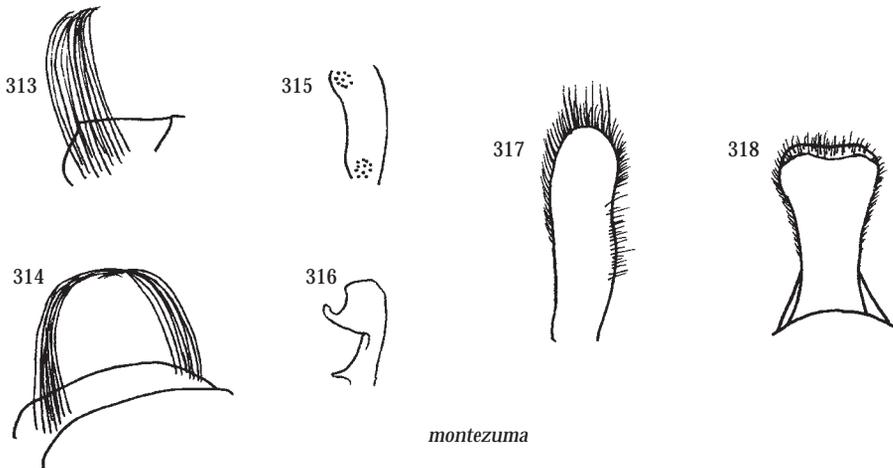
Pepsis species: figs 275-282, *infuscata* (280, Ecuador, Taisha; 281, Ecuador, Napo; 282, Perú); 283-288, *amyntas*; 289-295, *chrysoptera*. 275-277, 283-285, 289-291, sternal hairs; 278, 286, 292, digitus apex; 279, 287, 293, paramere; 280-282, 288, 294, 295, SGP.



menechma

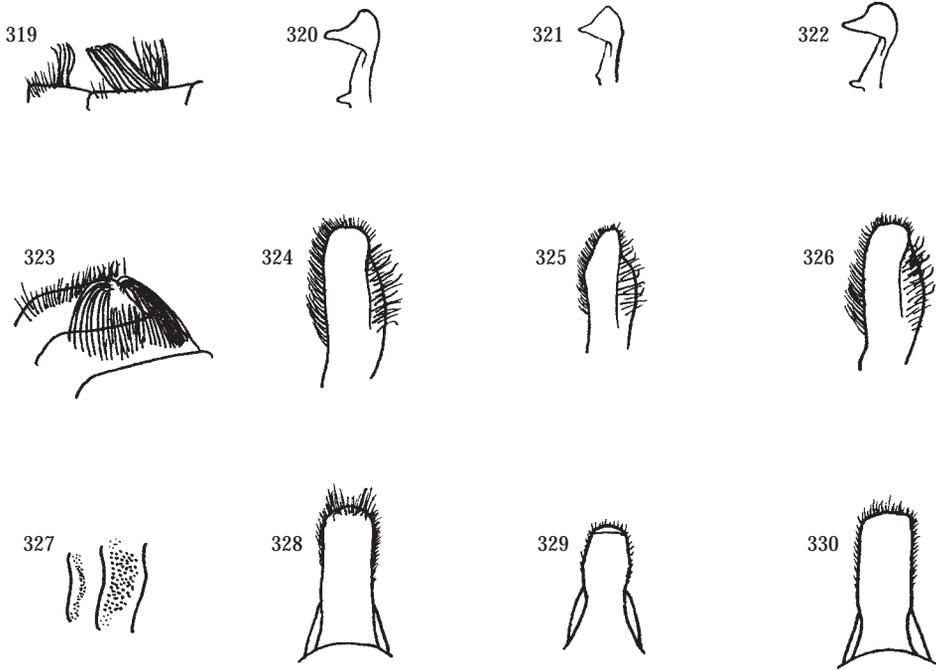


completa

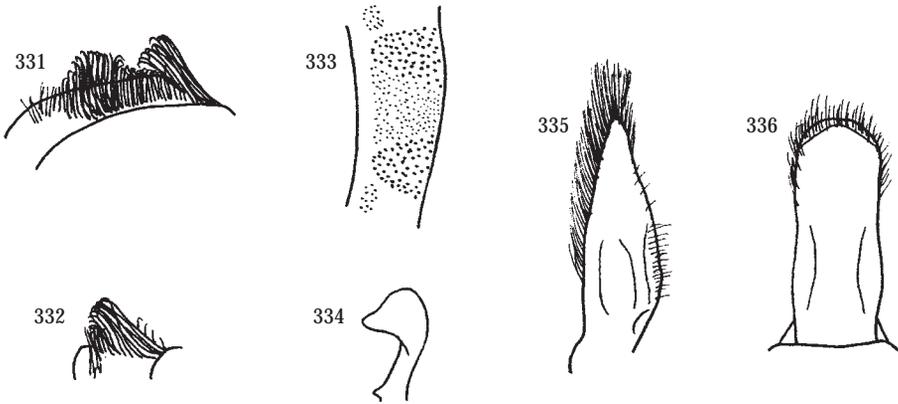


montezuma

Pepsis species: figs 296-303, *menechma* (301, USA, Arizona; 302, USA, North Carolina; 303, Argentina, Chaco); 304-312, *completa* (307, 309, 312, Argentina, Corrientes; 308, 310, no locality; 311, Argentina, Salta); 313-318, *montezuma*. 296-298, 304-306, 313-315, sternal hairs; 299, 307, 308, 316, digitus apex; 300, 309, 310, 317, paramere; 301-303, 311, 312, 318, SGP.

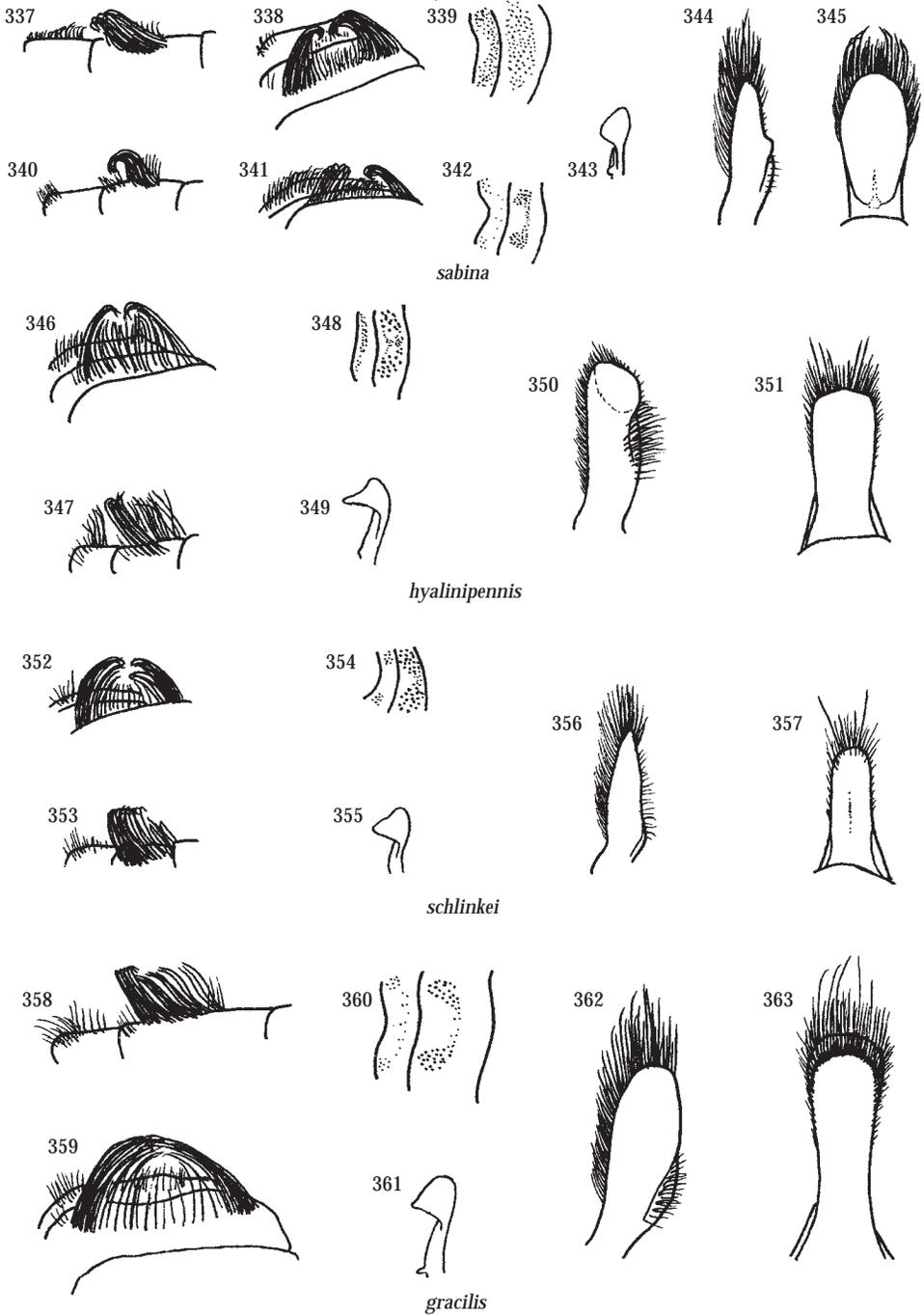


basalis

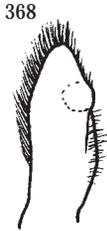


optimatis

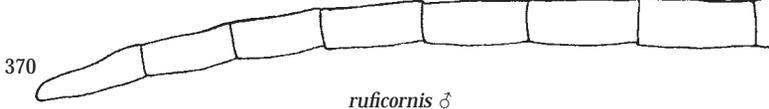
Pepsis species: figs 319-330, *basalis* (320, 324, 328, Costa Rica; 321, 325, 329, Colombia, Sierra Nevada; 322, 326, 330, Colombia, Putumayo); 331-336, *optimatis*. 319, 323, 327, 331, 332, 333, sternal hairs; 320-322, 334, digitus apex; 324-326, 335, paramere; 328-330, 336, SGP.



Pepsis species: figs 337-345, *sabina*; 346-351, *hyalinipennis*; 352-357, *schlinkei*; 358-363, *gracilis*. 337-342, 346-348, 352-354, 358-360, sternal hairs; 343, 349, 355, 361, digitus apex; 344, 350, 356, 362, paramere; 345, 351, 357, 363, SGP.



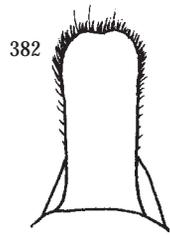
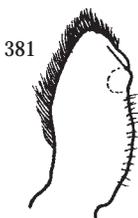
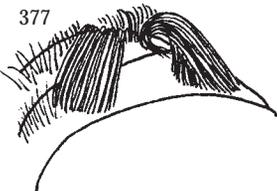
ruficornis



ruficornis ♂

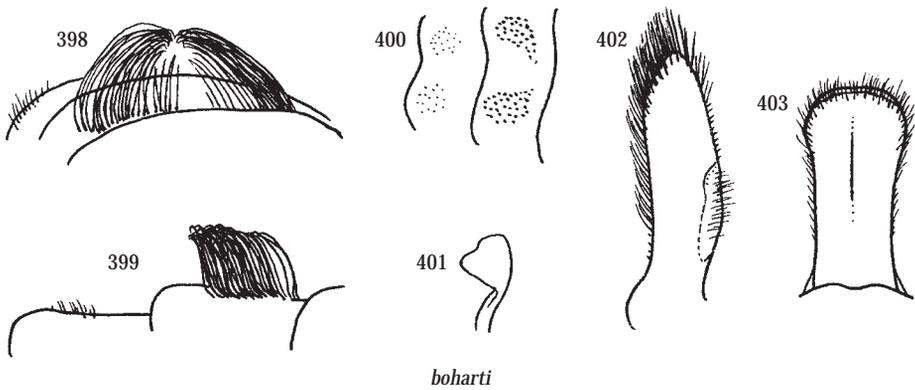
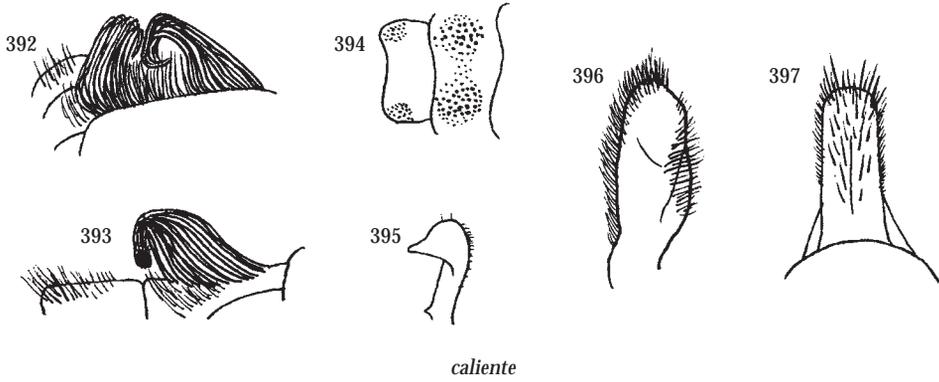
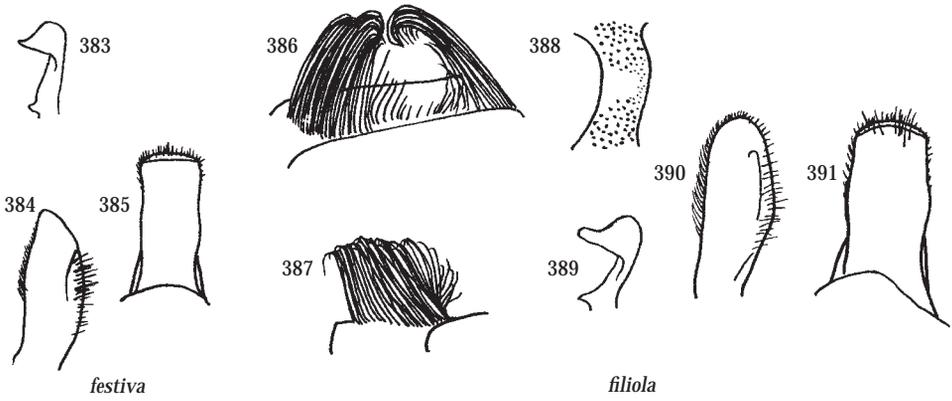


lepida

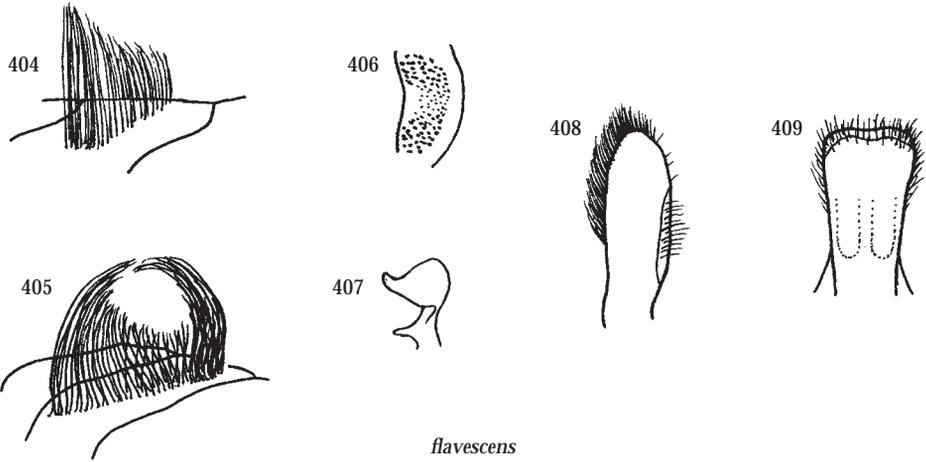


mildei

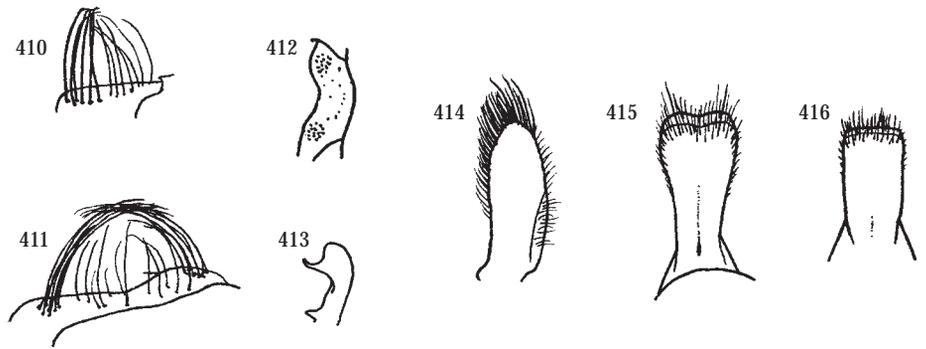
Pepsis species: figs 364-370, *ruficornis*; 371-376, *lepida*; 377-382, *mildei*. 364-366, 371-373, 377-379, sternal hairs; 367, 374, 380, digitus apex; 368, 375, 381, paramere; 369, 376, 382, SGP; 370, right antenna.



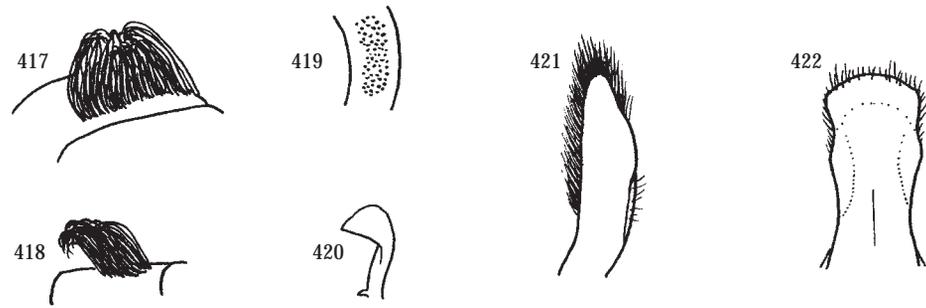
Pepsis species: figs 383-385, *festiva*; 386-391, *filiola*; 392-397, *caliente*; 398-403, *boharti*. 386-388, 392-394, 398-400, sternal hairs; 383, 389, 395, 401, digitus apex; 384, 390, 396, 402, paramere; 385, 391, 397, 403, SGP.



flavescens

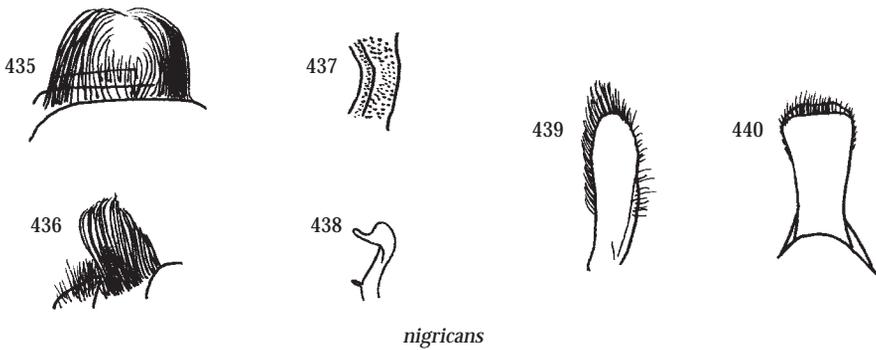
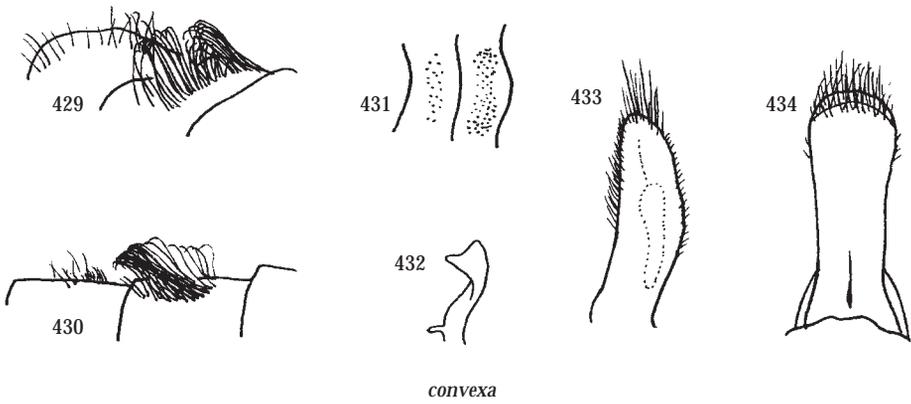
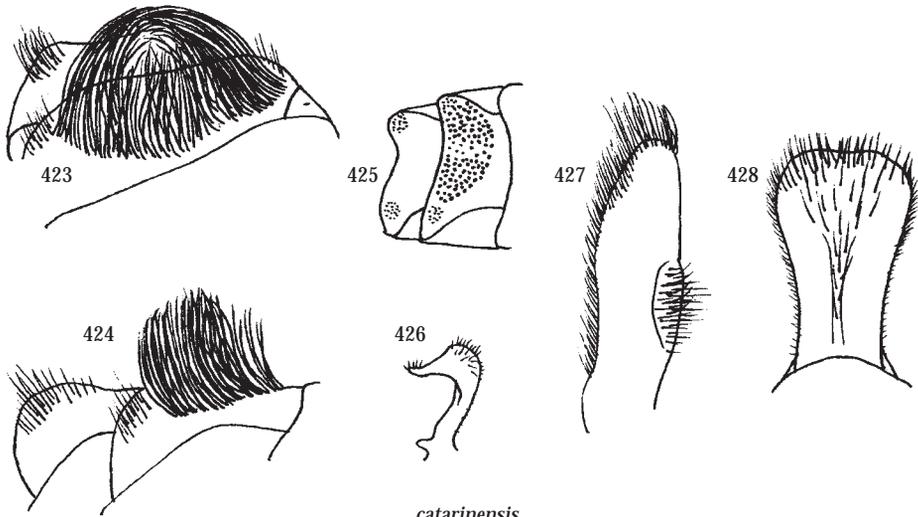


smaragdina

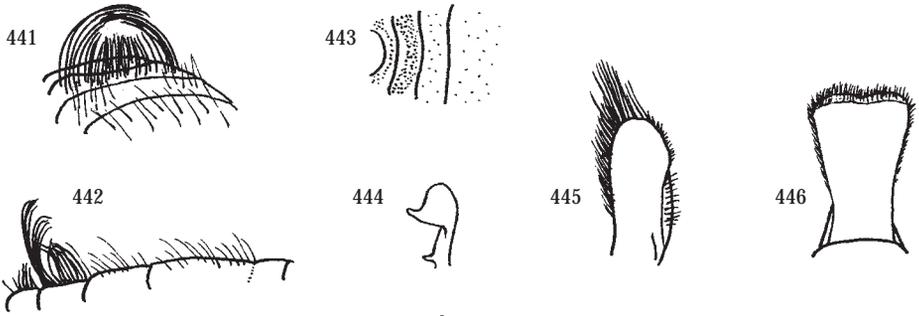


dimidiata

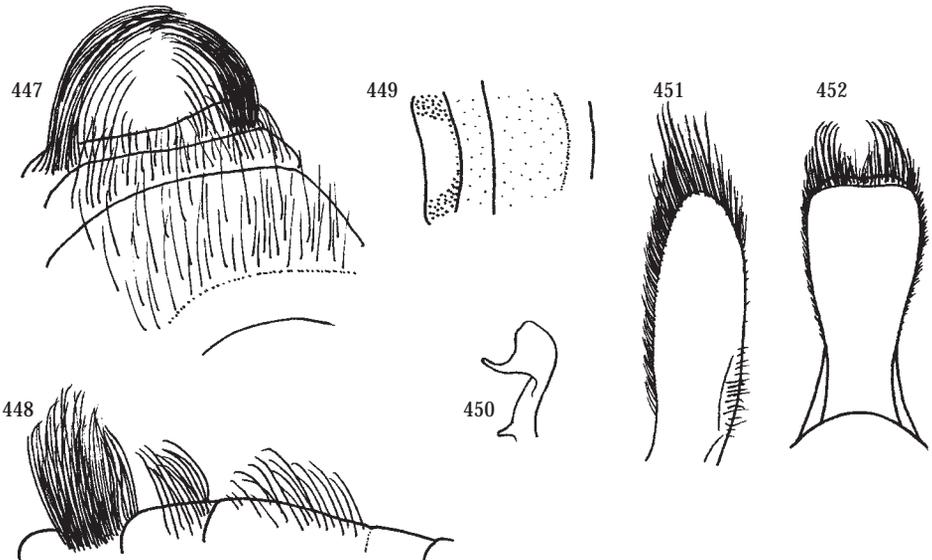
Pepsis species: figs 404-409, *flavescens*; 410-416, *smaragdina*; 417-422, *dimidiata*. 404-406, 410-412, 417-419, sternal hairs; 407, 413, 420, digitus apex; 408, 414, 421, paramere; 409, 415, 416, 422, SGP.



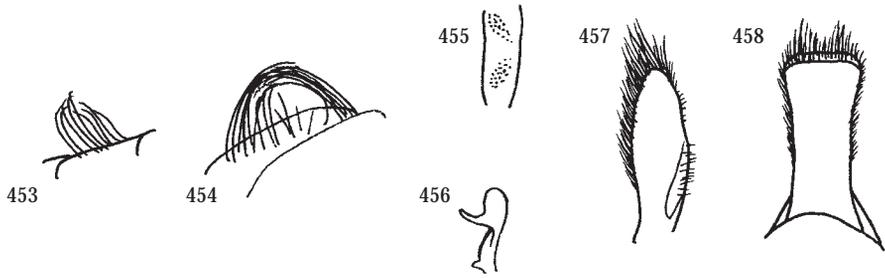
Pepsis species: figs 423-428, *catarinensis*; 429-434, *convexa*; 435-440, *nigricans*. 423-425, 429-431, 435-437, sternal hairs; 426, 432, 438, digitus apex; 427, 433, 439, paramere; 428, 434, 440, SGP.



thoreyi

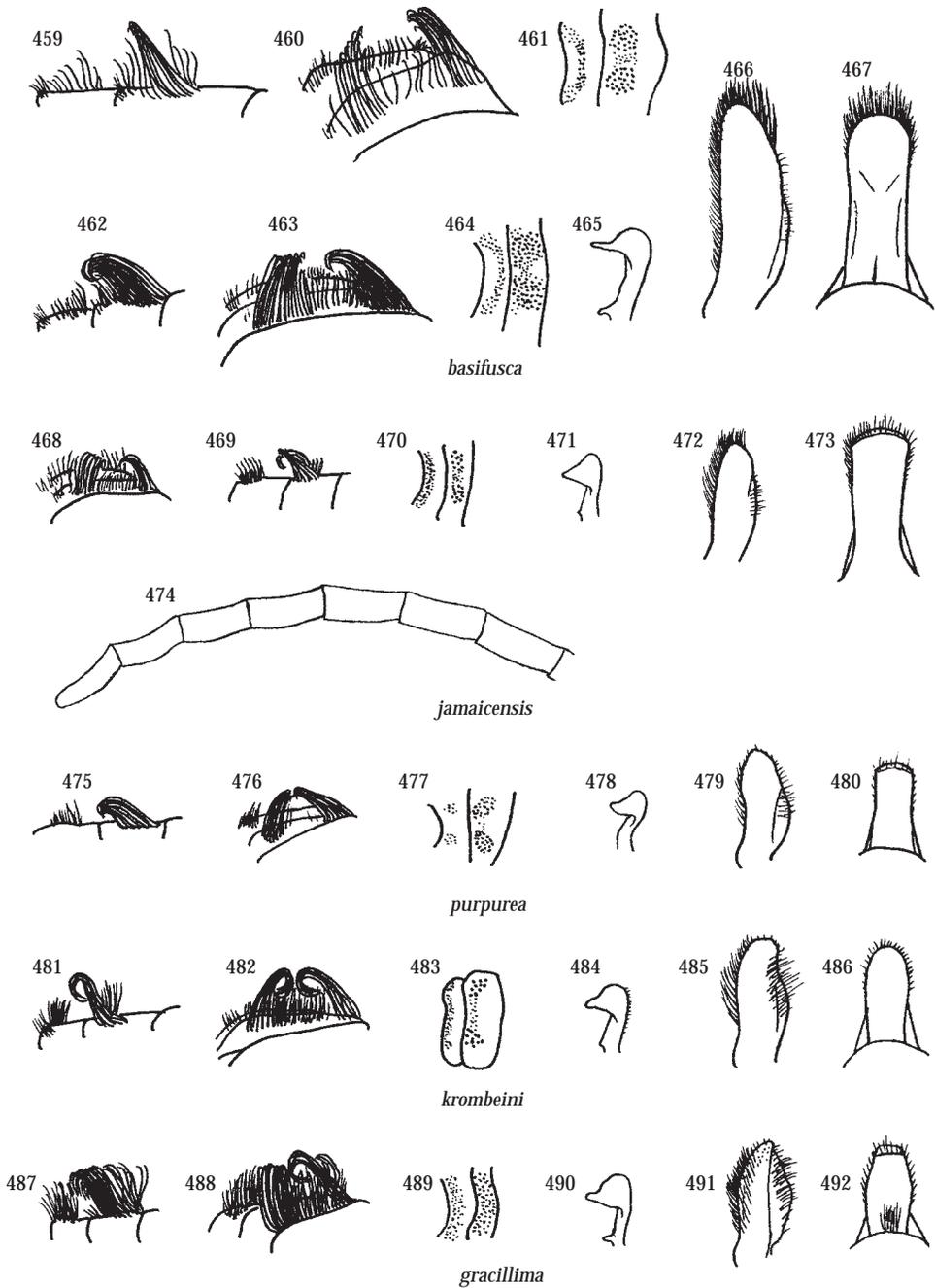


limbata

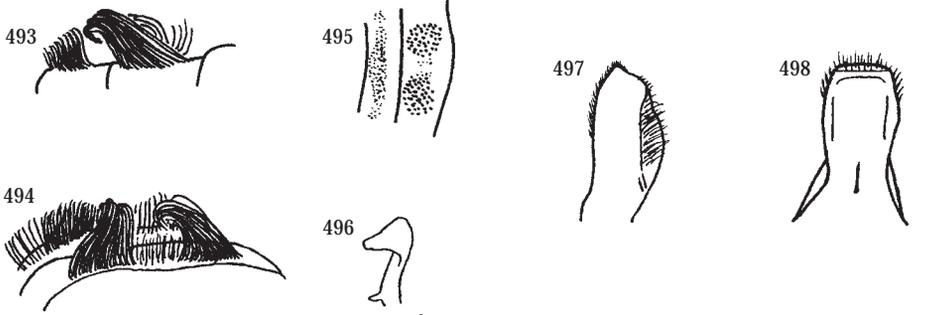


achterbergi

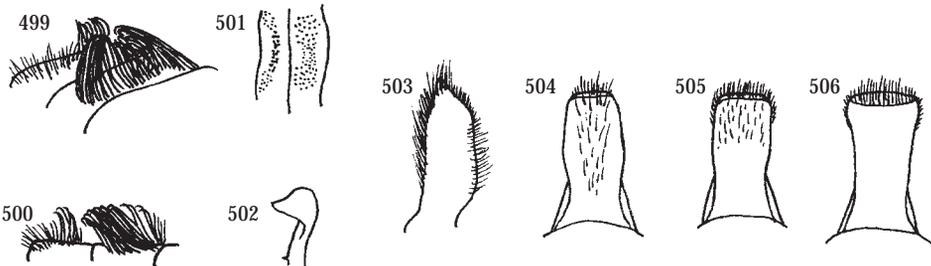
Pepsis species: figs 441-446, *thoreyi*; 447-452, *limbata*; 453-458, *achterbergi*. 441-443, 447-449, 453-455, sternal hairs; 444, 450, 456, digitus apex; 445, 451, 457, paramere; 446, 452, 458, SGP.



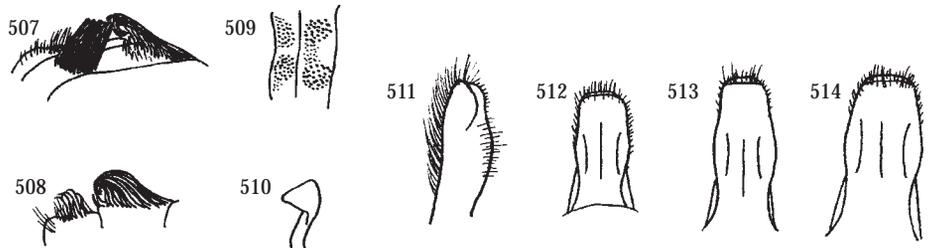
Pepsis species: figs 459-467, *basifusca* (459-461, Costa Rica; 462-464, USA, Texas); 468-474, *jamaicensis*; 475-480, *purpurea*; 481-486, *krombeini*; 487-492, *gracillima*. 459-464, 468-470, 475-477, 481-483, 487-489, sternal hairs; 465, 471, 478, 484, 490, digitus apex; 466, 472, 479, 485, 491, paramere; 467, 473, 480, 486, 492, SGP.



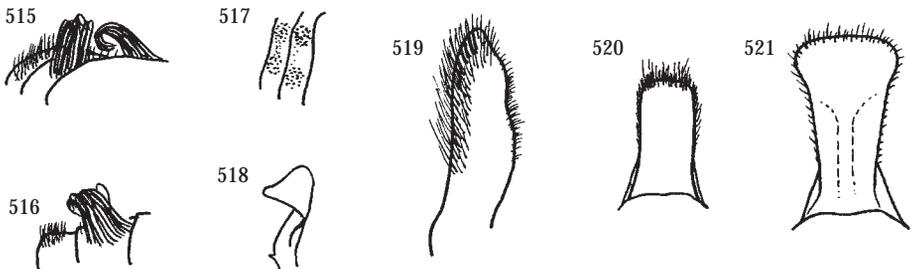
brunneicornis



willinki

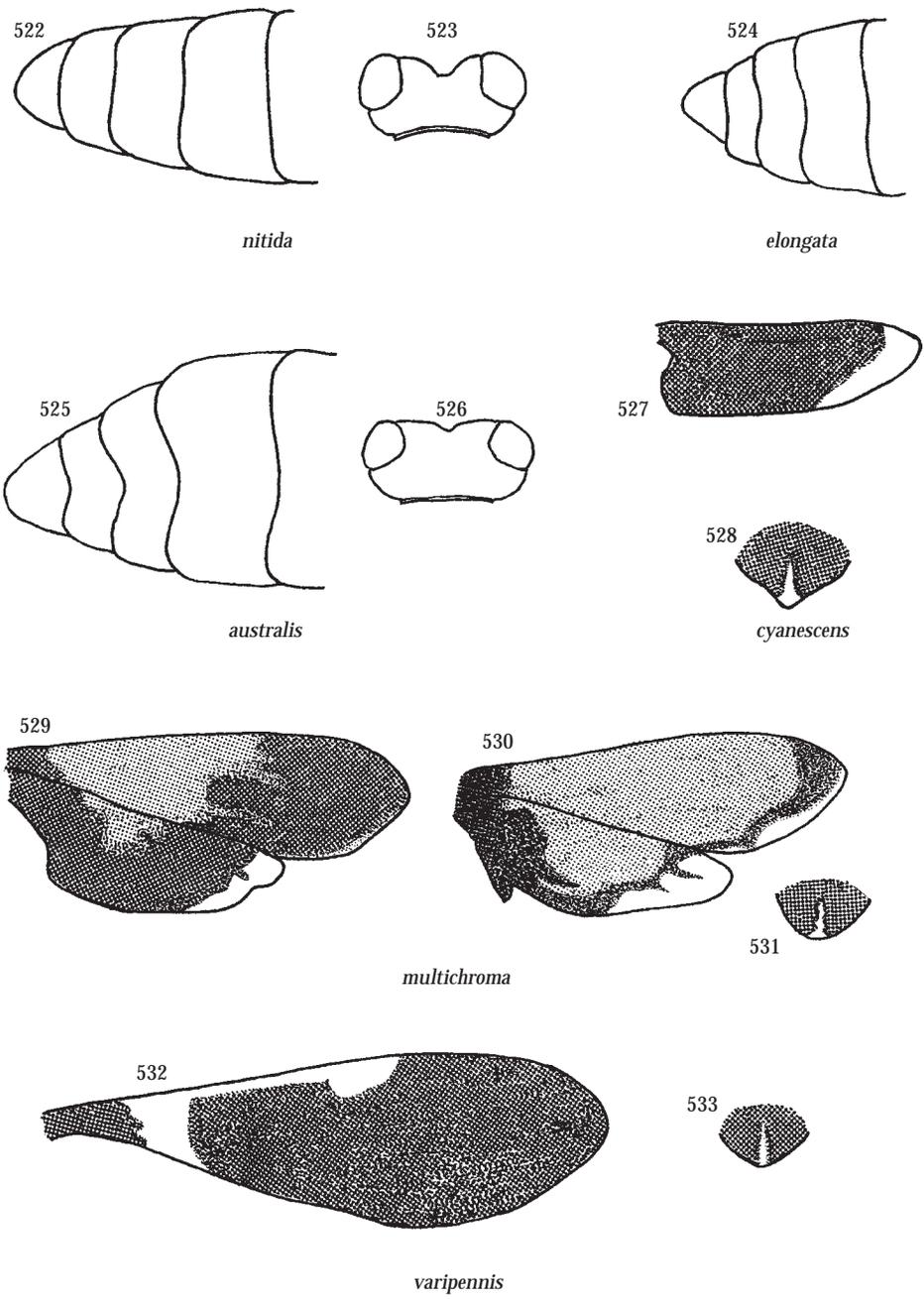


viridisetosa

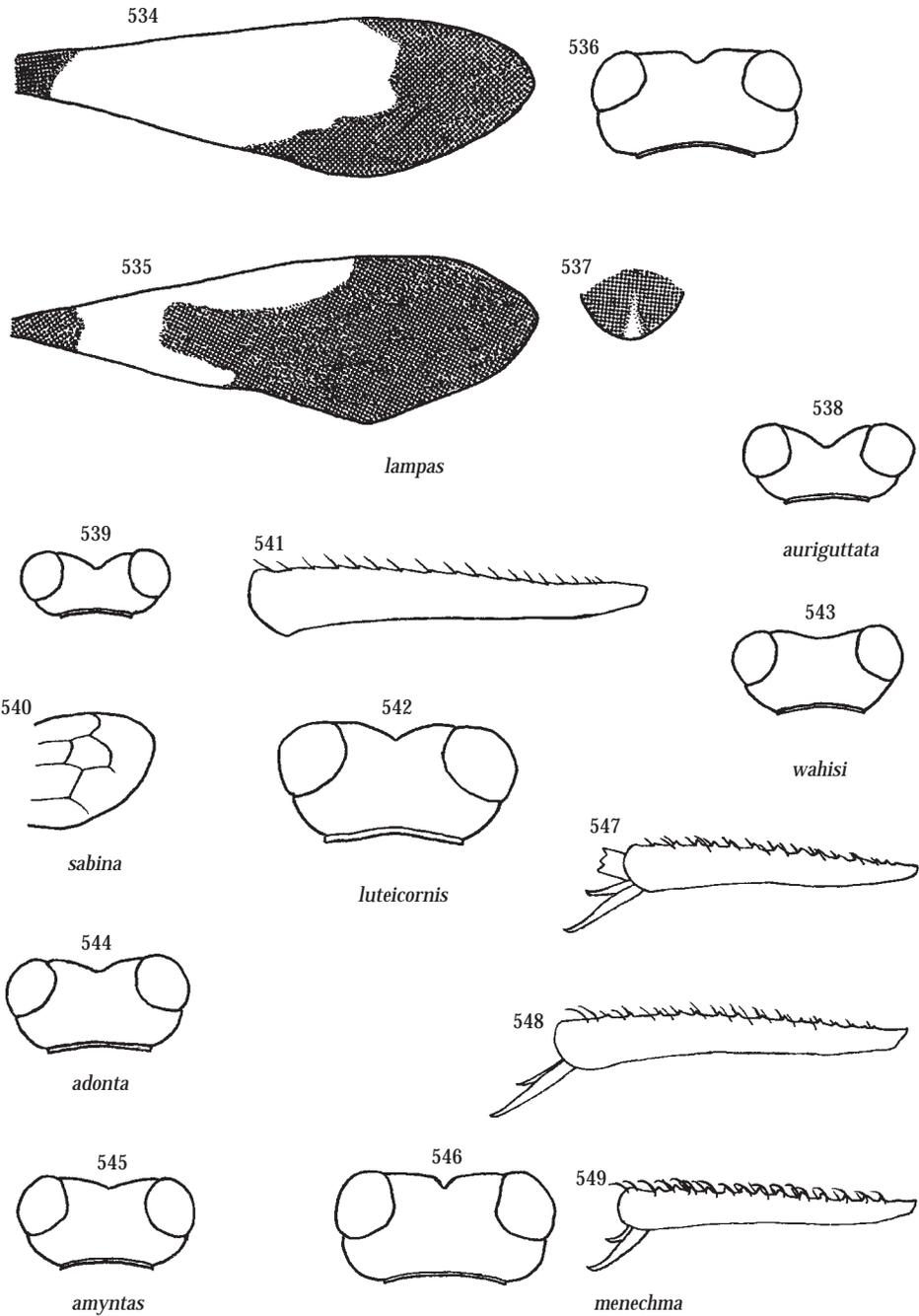


adonta

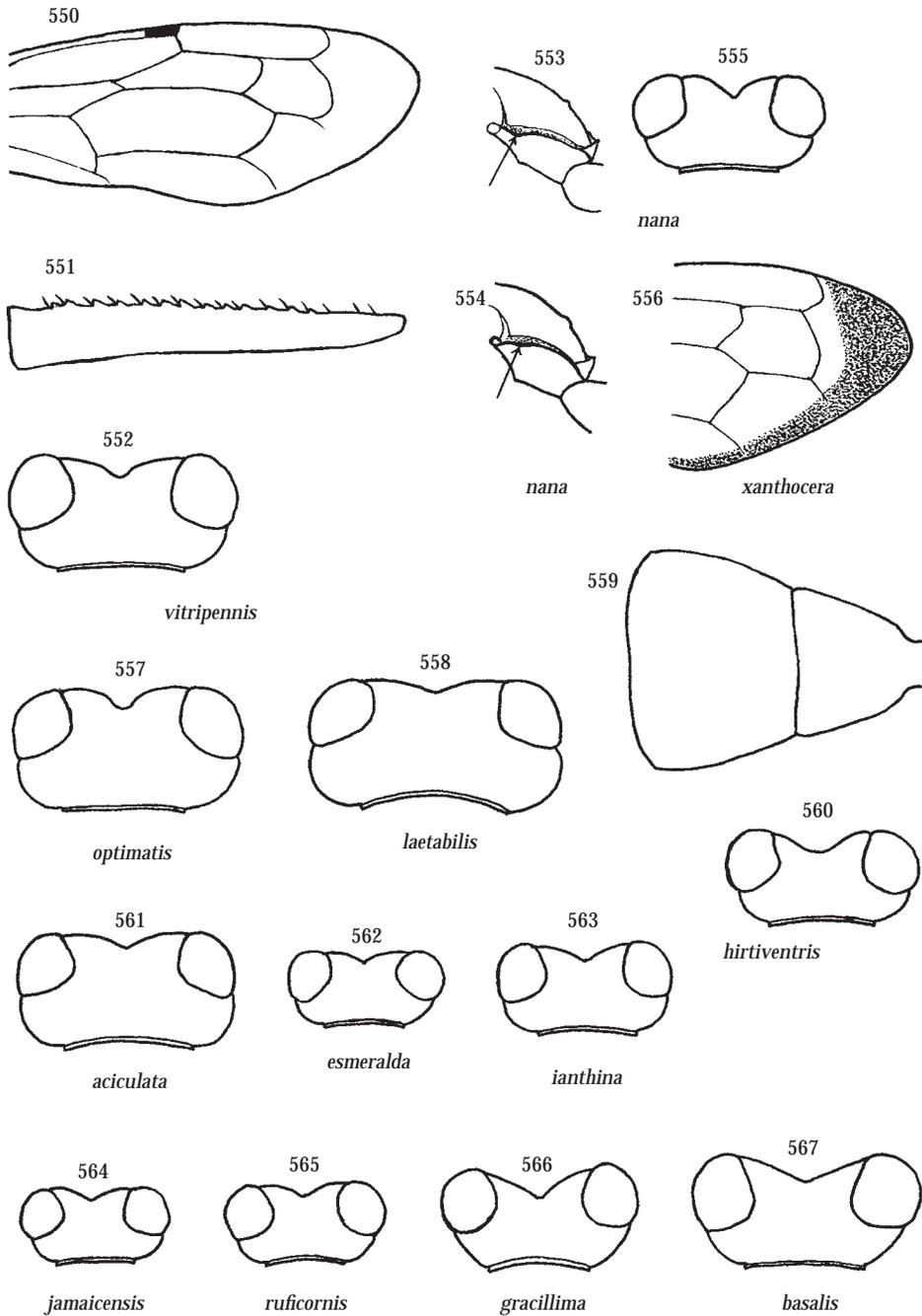
Pepsis species: figs 493-498, *brunneicornis*; 499-506, *willinki*; 507-514, *viridisetosa*; 515-521, *adonta* (520, Paraguay; 521, Brazil, Canoas). 493-495, 499-501, 507-509, 515-517, sternal hairs; 496, 502, 510, 518, digitus apex; 497, 503, 511, 519, paramere; 498, 504-506, 512-514, 520, 521, SGP.



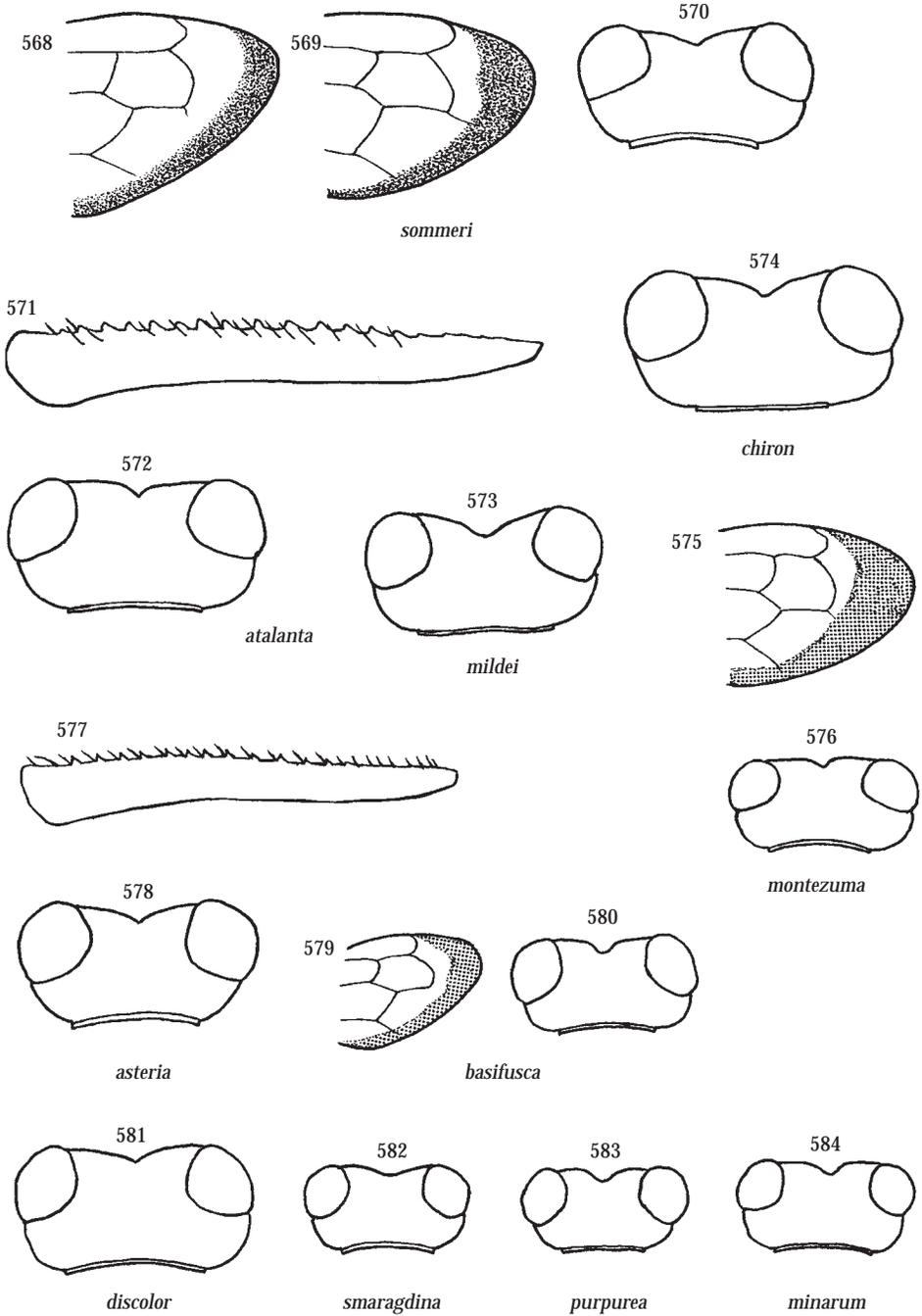
Figs 522-645 are of female *Pepsis* parts. 522, 523, *nitida*; 524, *elongata*; 525, 526, *australis*; 527, 528, *cyanescens*; 529-531, *multichroma*; 532, 533, *varipennis*. 522, 524, 525, gaster, dorsal; 523, 526, head, dorsal; 527, hindwing; 528, 531, 533, pygidium; 529, 530 highland & lowland wings respectively; 532, forewing.



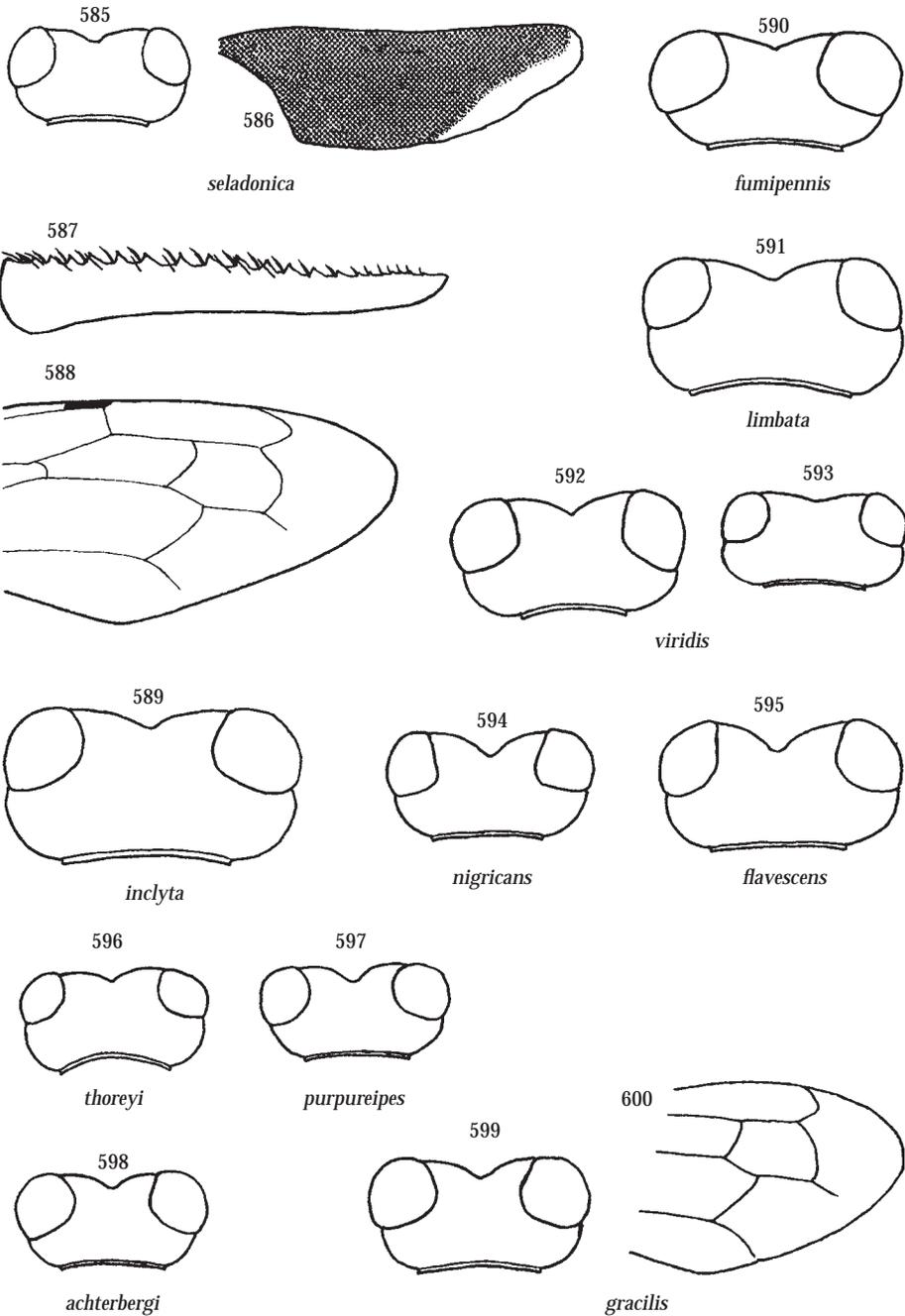
Pepsis species: figs 534-537, *lampas* (535, Brazil, Mato Grosso); 538, *auriguttata*; 539, 540, *sabina*; 541, 542, *luteicornis*; 543, *wahisi*; 544, *adonta*; 545, *amyntas*; 546-549, *menechma* (547, USA; 548, Costa Rica; 549, Mexico). 534, 535, 540, wings; 536, 538, 539, 542, 543, 544, 545, 546, heads, dorsal; 537, pygidium; 541, 547-549, hind tibia.



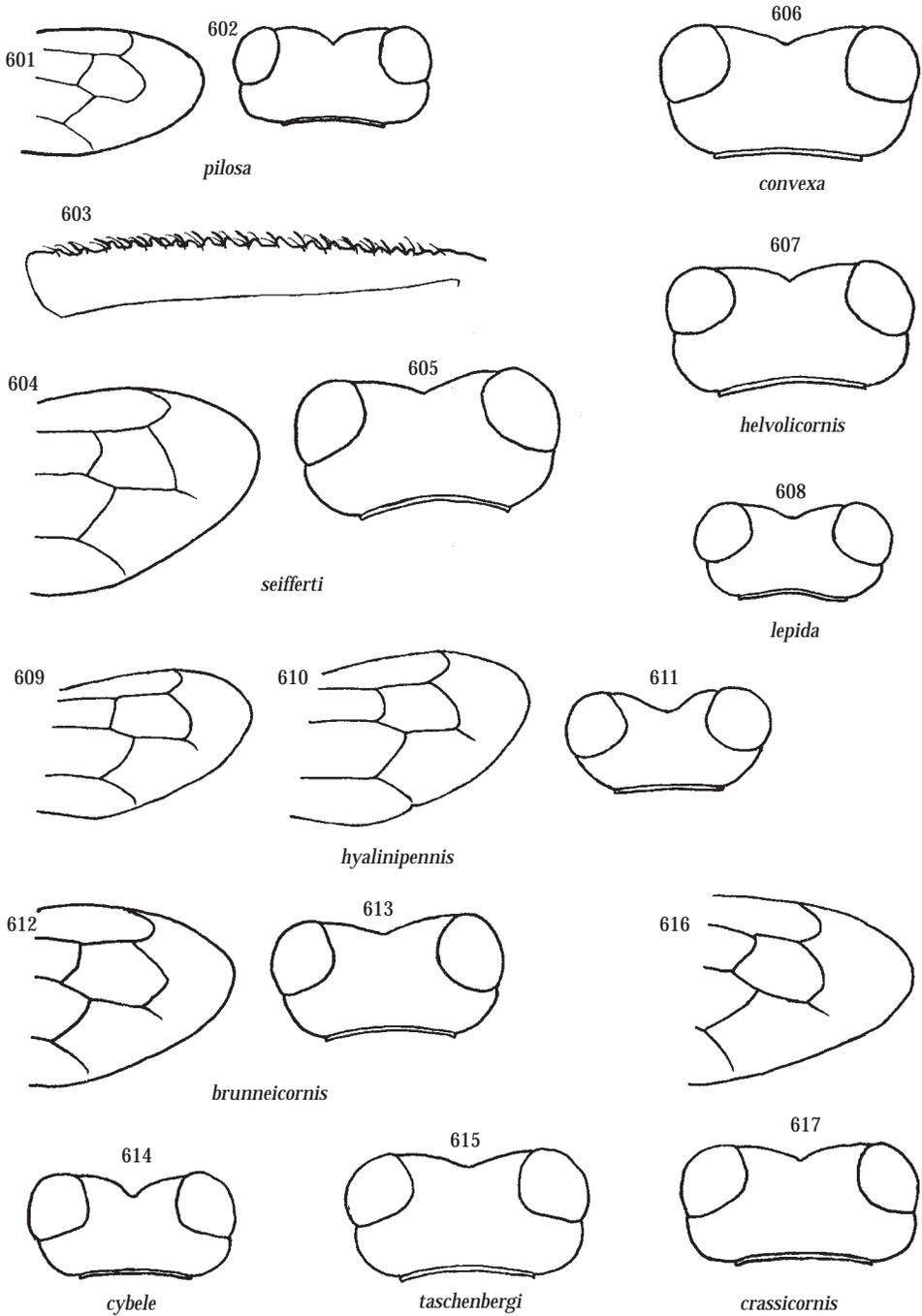
Pepsis species: figs. 550-552, *vitripennis*; 553-555, *nana* (553, 1961; 554, 1962); 556, *xanthocera*; 557, *optimatis*; 558, *laetabilis*; 559, 560, *hirtiventris*; 561, *aciculata*; 562, *esmeralda*; 563, *ianthina*; 564, *jamaicensis*; 565, *ruficornis*; 566, *gracillima*; 567, *basalis*. 550, 556, wing; 551, hind tibia; 553, 554, propodeum, left side; 559, gaster, dorsal; 552, 555, 557, 558, 560-567, head, dorsal.



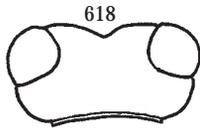
Pepsis species: figs 568-570, *sommeri*; 571-572, *atalanta*; 573, *mildei*; 574, *chiron*; 575, 576, *montezuma*; 577, 578, *asteria*; 579, 580, *basifusca*; 581, *discolor*; 582, *smaragdina*; 583, *purpurea*; 584, *minarum*; 568, 569, 575, 579, wings; 571, 577, hind tibiae; 570, 572-574, 576, 578, 580-584, heads.



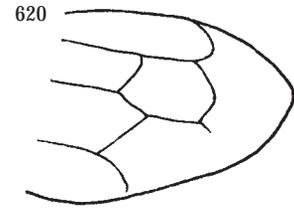
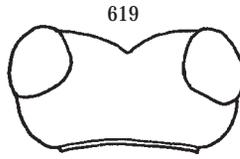
Pepsis species: figs 585, 586, *seladonica*; 587-589, *inclyta*; 590, *fumipennis*; 591, *limbata*; 592, 593; *viridis* (593, Argentina, Tandil); 594, *nigricans*; 595, *flavescens*; 596, *thoreyi*; 597, *purpureipes*; 598, *achterbergi*; 599, 600, *gracilis*. 585, 589-599, heads, dorsal; 586, hindwing; 587, hind tibia; 588, 600, wing.



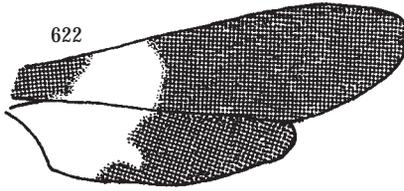
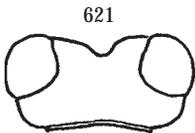
Pepsis species: figs 601, 602, *pilosa*; 603-605, *seifferti*; 606, *convexa*; 607, *helvolicornis*; 608, *lepida*; 609-611, *hyalinipennis*; 612, 613, *brunneicornis*; 614, *cybele*; 615, *taschenbergi*; 616, 617, *crassicornis*. 601, 604, 609, 610, 612, 616, wing; 602, 605-608, 611, 613-615, 617, head, dorsal; 603, hind tibia.



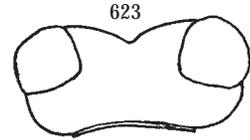
chrysoptera



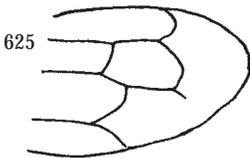
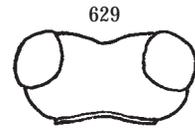
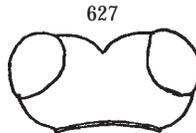
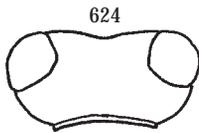
filiola



atripennis



boharti



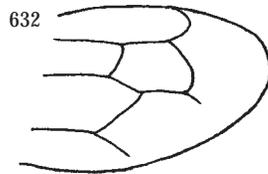
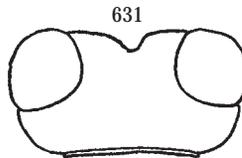
viridisetosa



infusata

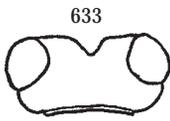
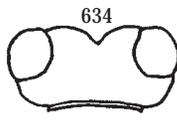
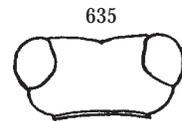
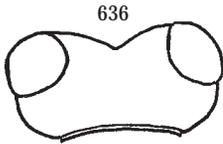
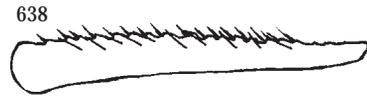
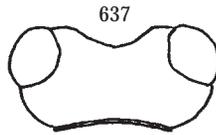
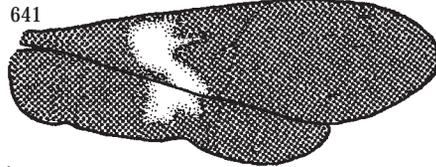
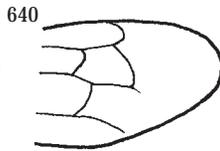
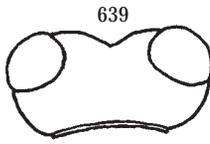
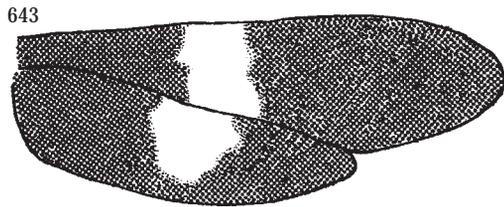
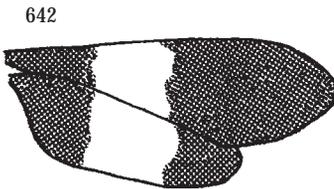
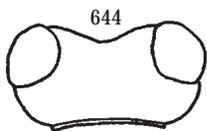
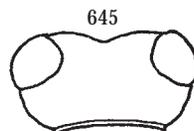


willinki



festiva

Pepsis species: fig 618, *chrysoptera*; 619, 620, *filiola*; 621, 622, *atripennis*; 623, *boharti*; 624-626, *willinki*; 627, 628, *viridisetosa*; 629, 630, *infusata*; 631, 632, *festiva*. 618, 619, 621, 623, 624, 627, 629, 631, heads, dorsal; 620, 622, 625, 626, 628, 630, 632, wings.

*martini**nanooides**maeandrina**dimidiata**decipiens**dayi**completa**completa**schlinkei*

Pepsis species: fig 633. *martini*. 634. *nanooides*. 635. *maeandrina*. 636. *dimidiata*. 637, 638. *decipiens*. 639-641. *dayi*. 642-644. *completa* (642 & 643 male and female respectively). 645. *schlinkei*. 633-637, 639, 644, 645, heads, dorsal; 638, hind tibia; 641-643, wings.

General key to females

Notes.— (1) At couplet 15, the user is referred to the separate keys for mimicry-groups; the following key caters for those specimens which, despite belonging to the same species, do not pertain clearly to those mimicry-groups. (2) The ‘Southern Cone’ of South America (couplet 45) is here defined as the area south of a line between northernmost Chile and Curitiba in southern Brazil.

1. Gastral tergites strongly polished, and often more-or-less strongly dorsoventrally compressed 2
 - Gastral tergites at most weakly shining; not or little compressed 8
2. Last tergite basally swollen, so that the segment is directed strongly downwards; hind coxa with an extremely sharp, sinuate carina at the junction of upper and outer faces; legs with abundant strong hairs. Wing colour extremely variable. Amazon mainstream to Buenos Aires; figs 522, 523 ***P. nitida*** p. 161
 - Last tergite normal, its main axis aligned with rest of gaster; hind coxa with only a rounded angle at the junction of the upper and outer faces; MT extremely sharp . 3
3. Gastral tergites 3-5 strongly arcuately emarginate behind; gaster strongly dorsoventrally compressed; last tergite with at most a poorly-defined basal, polished area 4
 - Gastral tergites 3-5 at most weakly emarginate behind; gaster only moderately compressed; last tergite with a narrow, polished, median strip, well-defined especially apically 5
4. Propodeum with at most a weak PTC, the dorsum smoothly rounded into the posterior face; hindwing unicolorous; forewing sometimes with a white extreme apex, but not in dark-winged specimens, thus only weakly contrasting with the rest of the wing; wing colour otherwise very variable. Panamá to Amazon mainstream, with isolated records further south; fig. 524 ***P. elongata*** p. 150
 - Propodeum with a fairly strong PTC, junction of dorsal and posterior faces in profile forming an obtuse angle; hindwing with a pale patch covering at least the vannal lobe (sometimes much more); forewing with the extreme apex white, strongly contrasting with rest of wing; wing colour otherwise very variable but often belonging to the *discolor* mimicry-group (which see). For other differences from *P. elongata*, see Distinctions in the text. Eastern and central Brazil; figs 525, 526 ***P. australis*** p. 152
5. Hindwing with white apical band 6
 - Hindwing with margin entirely dark 7
6. Wings entirely black apart from a white hindwing margin. Central America and West Indies to central Brazil; figs 527, 528 ***P. cyanescens*** p. 154
 - Wings with central orange, amber or golden patch. Southern Ecuador and northern Perú, coast and up to 900 m; figs 529, 531 ***P. multichroma*** p. 156
7. Forewing with silvery, white or yellowish markings, not very extensive but including a sub-basal transverse band. East Brazil, Paraguay, and extreme north-east Argentina (Misiones); figs 532, 533 ***P. varipennis*** p. 158
 - Forewing with usually extensive orange markings (when these are reduced, confusion with *P. varipennis* is possible - see Distinctions in main text). Southern Perú and southern Brazil to Argentine Patagonia; figs 534-537 ***P. lampas*** p. 159

8. Hind tibia with tiny, vestigial, or no teeth (species with variable teeth are run in both this and the following options) 9
- Hind tibia with normally developed teeth 15
9. Very small species (BL 14-28), head strongly transverse; most of the following also usually apply: MT very sharply pointed; SMC3 with the anterior vein much shorter than the proximal (at most equal), PPV very short (much shorter than the first abscissa of the radial vein) and more transverse than usual (at about 45° to the wing axis); MPN furrow broad, especially posterad; DTC coarse 10
- Size various; if very small, SMC3 always has the anterior vein longer than the proximal, and head is usually less strongly transverse 11
10. Femora with abundant coarse hair, AS3 usually very long (AEI 85-133) and with bristles on the inner side (sometimes abraded); body blue-green, wings all black, or with orange-amber markings in southeastern Brazil and Argentina. Most of South America, more common southwards; a few records from Central America; fig. 538 *P. auriguttata* p. 272
- Femora with a few weak hairs or none. AS3 usually shorter (AEI 83-113), without bristles; body blue-violet (gaster sometimes blue-green). Wings all black or with variable orange markings (sometimes entirely orange with black apical border). Found from Panamá to north coastal Perú; and the Amazon basin, mainly north-western, from central Perú to Venezuela; figs 539, 540 *P. sabina* p. 275
11. Head semi-triangular (i.e. in dorsal view, centrally long, and not swollen behind eyes); MPN matt, its furrow broad posteriorly but not reaching anterior margin; propodeal dorsum almost entirely without hairs, so that DTC are very clear, moderately strong, mostly complete and very regular; dorsum with flat-topped median ridge, its margins continued and enlarged as the VR; PPT rather narrow but strongly projecting, crossed by 1-3 carinae 12
- Head in dorsal view quite strongly swollen behind eyes, sometimes transverse, or scarcely swollen and strongly transverse 13
12. Larger species (BL 21-35); inner spur of hind tibia often short and thick, only up to 1.2 times as long as outer spur and up to 0.3 basitarsus length. Found in the Guianas, where the wings are dark brown on the basal two-thirds, the rest yellow-amber; and the Amazon mainstream, in the west extending southwards to Bolivia, where the wings are amber with a dark apical border (a specimen from Manaus has the Guianan colour but with paler apex); figs 541, 542 *P. luteicornis* p. 104
- Smaller species (BL 24); wings dirty-amber with a darker apical border; inner spur of hind tibia 1.5 times as long as outer spur and 0.3 basitarsus length. Eastern Brazil, Bahia; fig. 543 *P. wahisi* p. 283
- N.B. The only specimen known is just possibly a dwarf female of *P. luteicornis* on the edge of its range; its association with the male is tentative in any case.
13. Head quite strongly transverse, although also strongly swollen behind the eyes in dorsal view; spurs of mid tibia (often also hind tibia) slightly curved apically; DTC very coarse, more-or-less regular; hind tibial teeth small, distant, upright, with some very weak, backwardly-inclined hairs. Wings orange-amber with base broadly and apex narrowly dark in most of Central America and parts of the north coast of South America, all black in the rest of South America. (The range of variation also includes specimens with normally large hind tibial teeth; these are keyed out elsewhere); figs 546-549 *P. menechma* p. 131

- If the head is strongly transverse, it is not strongly swollen behind the eyes; also some other characters usually disagree 14
- 14. MPN scarcely depressed, almost level with propodeum, narrowed central (thus forming an angulate junction with the propodeum), its furrow extremely narrow, suture-like; DTC rather fine, becoming markedly finer and denser towards the MPN. Wings all black. Bolivia, east-central Brazil, Paraguay); fig. 544 ***P. adonta*** p. 245
- MPN deeply depressed, well below level of propodeal dorsum, weakly arcuately narrowed centrally, its furrow broad and deep, especially posteriorly, DTC coarse, not finer or denser anteriorly; wing colour very variable. Northern and southern South America (including a single record from Cali, west of the Colombian Andes), but rare in the Amazon basin itself); fig. 545 ***P. amyntas*** p. 123
- 15. Forewing with a more-or-less broad, transverse band which is yellow or sometimes whitish; its most distal extent is at or slightly beyond the midpoint of the forewing, its most proximal is close to the wing-base; it is most often sharply delimited from the remaining dark area but not always with regular margins, and rarely is broken into spots. Some specimens of *P. auriguttata* and *P. dimidiata* have a separate yellow mark towards the wing apex, very variable in extent (several species occur in multiple colour forms and are therefore keyed out also elsewhere) see separate keys to *atripennis* and *completa* mimicry-groups after the Introduction.
- Wing colour not clearly pertaining to the above-described mimicry-groups 16
- 16. Wings black with extremely strong blue-violet metallic reflections, and the lateral, posterad extension of the S.2 transverse groove is absent or vestigial 17
- If the wings have such strong reflections, the lateral extension of the S.2 groove is well developed 18
- 17. Antenna all black, AS3 shorter, AEI 93-111; inner spur of hind tibia of normal length, about 0.3 basitarsus length, and distinctly longer than outer spur. Central America; in South America, found in most areas south to the Amazon mainstream, and transandean southwards to Bolivia); figs 550-552 ***P. vitripennis*** p. 115
- Antenna usually orange from near base of AS3, which is long, AEI 110-139; inner spur of hind tibia very short, about 0.2-0.25 basitarsus length, more-or-less equal to outer spur. (Note that pale-winged forms occur; these are very difficult to distinguish from *P. sommeri*, see table under *P. xanthocera*). A few records from Central America; South America to northern Argentina); fig. 556 ***P. xanthocera*** p. 98
- 18. All of the gaster after the S.2 groove with long, dense hair below; the rest of the body without obvious long hair; in dorsal view, between T.1 and 2 is a constriction, not an even curve; subfemoral hair abundant (in fresh specimens). Small, slender species (BL 21-32). Eastern Andes from Colombia to Bolivia); figs 559, 560 ***P. hirtiventris*** p. 269
- If the gaster has dense, long hair below, so also does the rest of the body; junction of T.1 and 2 usually forming a single curve 19
- 19. Lateral, horizontal groove of propodeum more-or-less strongly sinuate anteriorly; subfemoral hair rather sparse and thin, but longer than maximum femoral width. Small species (BL 16-28). Eastern Andes from Venezuela to extreme northern Argentina, and Upper Amazon); figs 553-555 ***P. nana*** p. 265
- Propodeal groove straight or evenly curved anteriorly; any subfemoral hair usually coarser and shorter 20

20. Propodeum very smooth, evenly curved in profile; the MG continues almost unchanged down the posterior face almost to the petiole socket; PTC totally absent; MPN furrow suture-like, not reaching the anterior margin. Small, very slender, dark-winged species, BL 18-27. Guianas and lower half of Amazon mainstream); fig. 562 ***P. esmeralda*** p. 281
- Propodeal MG not running on to posterior face unchanged, PTC usually present . 21
21. Body very robust; propodeum transverse, dorsal face shorter than distance between tips of PPT (but see couplet 77, *P. crassicornis*); PPT extremely strong, tooth-like; head behind eyes strongly swollen dorsally and laterally; antenna orange from AS3; parts of body, including entire propodeum, with dense, golden hair (except at southern limit of range in Paraguay). Found in lower one-third of Amazon mainstream, southwards through central Brazil to Paraguay); fig. 557 ***P. optimatis*** p. 109
- Propodeum quadrate or more elongate; PPT not so strong; without much dense, golden hair on propodeal dorsum (except a few *P. asteria*, which are very different structurally, and allopatric); body usually more slender 22
22. AS3 thick and very short, AEI 82-97; antenna almost always bright orange from AS3 onwards; MPN furrow more-or-less strongly expanded apicad; wings always very dark. Panamá, northern South America south to Amazon mainstream, west coast); fig. 563 ***P. ianthina*** p. 261
- If the AS3 is thick and short, it is usually not so extensively bright orange, and/or the species is allopatric 23
23. Species of the West Indies 24
- Species found elsewhere 25
24. Species found in Jamaica only; fig. 564 ***P. jamaicensis*** p. 234
- Species found in all the West Indian islands except Jamaica and to the south of Guadeloupe; fig. 565 ***P. ruficornis*** p. 232
25. Head in dorsal view very strongly swollen behind eyes; wings orange-amber with more-or-less dark apical band; species found in the Southern Cone of South America 26
- All three characters not coinciding 27
26. Spurs of hind tibia of about equal length; forewing with 1r-m strongly sloping antero-distally, and 2r-m sharply bent about the middle; rather large species, BL 30-37. Southeastern Brazil to northeastern Argentina; fig. 558 ***P. laetabilis*** p. 108
- Inner spur of hind tibia at least a little longer than outer; 1r-m less strongly sloping; if 2r-m is bent, the bend is usually less angulate and behind the middle; BL often shorter, 21-32. Paraguay, Uruguay, northern and eastern Argentina; fig. 561 ***P. aciculata*** p. 254
- Note.— Very similar to the amber-winged form of *P. viridis*, see the text table under that species.
27. Head in dorsal view strongly transverse/semiglobular (fig. 566); AS3 very long, AEI 124-138; forewing SMC3 more-or-less strongly bulging posterodistally; propodeum tapering posterad, with abundant, but not very dense, long hair, PPT weak; hind tibial teeth much broader than high; rather small, slender species, BL 19-32. Transandean in Colombia; west of Andes in Ecuador; Venezuela; often at higher altitudes [similar to unicolorous-winged specimens of *P. purpureipes*, whose description see for differences] ***P. gracillima*** p. 205

- If the head is of the above shape, the species is found elsewhere and other characters disagree 28
- 28. Base of forewing strongly and broadly infusate, to a breadth at least equal to thorax width between tegulae, and extending to just under half of wing length at most; also with a more-or-less dark, apical border; rest of wing orange-amber. Species of Central America, Colombia and Venezuela 29
 - If the base of the forewing is infusate, it is less broadly so, or the wings are of a totally different colour; species often found elsewhere 33
- 29. Small but very robust species, BL 16-28; spurs of middle tibia apically curved; inner spur of hind tibia distinctly longer than outer; hind tibial teeth tiny (about the same size as the claw-tooth of the hind tarsus), upright, distant; DTC very coarse; MPN furrow more-or-less strongly expanded apicad; MT strong; subfemoral hair absent. Central America, especially Costa Rica; specimens from other areas differ in the tibial characters, often also in colour (see couplet 33); figs 546-549
 - ***P. menechma*** p. 131
 - Larger species; hind tibial teeth may be small but not tiny, always much larger than claw-tooth; other characters disagree 30
- 30. Propodeal hair clearly much longer than MPN length; AS3 very long, AEI 110-145 31
 - Propodeal hair equal to or slightly shorter than MPN length; AS3 shorter, AEI 100-122 32
- 31. Lateral extension of S.2 groove well developed; hind tibial teeth much broader than high, without gaps between. Costa Rica to Colombia; fig. 567 ***P. basalis*** p. 209
 - Lateral extension of S.2 groove very reduced or absent; hind tibial teeth at least as high as broad. Northern Mexico to Colombia and Venezuela; figs 568-570
 - ***P. sommeri*** p. 96
- Note.— This species is very similar to *P. xanthocera* where the two are sympatric; see the text-table under *P. xanthocera*.
- 32. Propodeum with most DTC extremely fine (sometimes less so anteriorly and posteriorly); antenna orange from mid-AS3 onwards; VR strong, at least where they join the PTC. Central America; fig. 574 ***P. chiron*** p. 92
 - Propodeum with DTC strong or very strong over most of dorsum; antennal orange begins at least a little before mid-AS3; VR very weak or absent. Mexico and Central America, a few records from Colombia and Venezuela; figs 571-572
 - ***P. atalanta*** p. 87
- 33. All spurs of mid and hind tibia strongly curved apically; hind tibia usually with many, strong, backwardly-curved bristles (at least a few near apex); head usually very strongly swollen behind the eyes and on top; AS3 very short, AEI 63-86; MPN often very short with very broad furrow; DTC very coarse; MT often strong; body rather small but very robust, BL 16-28; wings often entirely black, sometimes with variable amber to orange patches. Everywhere from the USA to Argentine Patagonia; absent only from the West Indies and west coast south of Ecuador. (The strong tibial characters are often much reduced in parts of Central America, see couplet 13.); figs 546-549 ***P. menechma*** p. 131
 - Spurs not strongly curved apically (except rarely outer spur of hind tibia; see couplet 79); other characters disagree 34

34. Species found from USA to Panamá; wings partly orange-amber 35
 - Species found in South America; wings variously coloured 37
35. Larger species, BL 23-43; body without very long, dense hair; AEI 94-118. USA to Mexico excluding Yucatán (See also couplet 71); fig. 573 ***P. mildei*** p. 229
 - Smaller species, BL 16-33; AEI 70-107, but when it is over 91, the body has long, dense, black hair 36
36. Body with much long, dense, black hair; BL 18-33; AEI 81-107); figs 575, 576
 ***P. montezuma*** p. 181
 - Body hair not long and dense; BL 16-27; AEI 70-91); figs 579, 580.. ***P. basifusca*** p. 141
 Note.— These two species are difficult to separate, see the table under *P. basifusca*.
37. Forewing smoky-amber with extreme apex paler (but not sharply delimited), and without a dark border before the pale apex 38
 - If the forewing is smoky-amber, the apex is not pale 39
38. Larger, slender species, BL 25-42; body black, often with some golden or violet pubescence; antenna with some apical segments orange; AS3 long (AEI 116-128), without bristles; MPN furrow narrow, often suture-like; inner spur of hind tibia much longer than outer (0.2-0.4 length of basitarsus). Middle Amazon westwards, and south to Perú; transandean in Colombia and Ecuador (but not recorded from Panamá); figs 577, 578 ***P. asteria*** p. 106
 - Smaller, robust species, BL 20-25; body dark blue-green, never with golden pubescence; antenna all black; AS3 short (AEI 73-86), with bristles on inner side near base; MPN furrow usually broad, especially posteriorly; inner spur of hind tibia very short (0.2-0.25 basitarsus length) and equal to outer. South-eastern Brazil and Paraguay); fig. 584 ***P. minarum*** p. 140
39. Wings moderately infuscate (possible to see through at least hindwing easily); usually both wings evenly infuscate, but sometimes hind or both wings very slightly paler basad, or hindwing slightly paler than forewing (if distinctly paler, then with amber tint); body deep green or blue-green 40
 - Either wings are strongly infuscate (practically black) or of entirely different colour 42
40. Antenna black; hindwing noticeably paler than forewing, contrasting; forewing with distinct, pale spot in the base of the first discoidal cell; rather large species, BL 22-37. Argentine Patagonia north to Bolivia and southeastern Brazil, with isolated records to the Amazon mainstream; fig. 581 ***P. discolor*** p. 193
 Note.— This species has also a form with orange-amber wings; see couplet 55.
 - Antenna with some apical segments orange; hindwing at most very slightly paler than forewing; if there is a clear spot in the base of the first discoidal cell, the species is usually smaller and allopatric 41
41. Medium-sized species, BL 18-29; AS3 of moderate length, AEI 75-107; head in dorsal view more-or-less strongly swollen behind eyes; MPN often a little shorter than PST, its furrow usually abruptly expanded apicad; all propodeal tubercles and PTC weak. Commonest in southern Brazil and northern Argentina, sparsely northwards to the Lower Amazon; fig. 582 ***P. smaragdina*** p. 188
 - Very small, slender species, BL 14-26; AS3 long, AEI 102-128; head in dorsal view scarcely swollen behind eyes; MPN about as long as PST, its furrow moderately strongly expanded apicad; PPT and PTC moderately strong. Panamá to the Amazon mainstream; fig. 583 ***P. purpurea*** p. 238

42. Wings entirely dark except hindwing with white apico-posterior margin. Most of South America east of the Andes, south to the latitude of Buenos Aires; figs 585, 586 *P. seladonica* p. 166
- Wings otherwise coloured 43
43. Wings at least partly pale 44
- All wings entirely very dark, occasionally very slightly paler towards the apex, especially in worn specimens 62
44. Wings partly colourless, often with slight amber tint; the rest moderately infusate, the boundary often very diffuse; antenna with usually several apical segments cream-ochre coloured (at least an apical spot on the last); head strongly transverse, scarcely swollen behind the eyes; hind tibia with many strong, backward-curved bristles. Most Amazon basin specimens belong to this colour form; but this species also occurs in Mexico and Central America; fig. 590 *P. fumipennis* p. 117
- Wings at least partly orange-amber, without colourless areas 45
45. Species of the Southern Cone of South America (see note 2 at the beginning of this key) 46
- Species found north of this area 56
46. Antenna partly orange; large species, BL 32-52; head in dorsal view quite strongly swollen; coarse hair (not very dense) below anterior femur only; teeth of hind tibia usually rather large and upright. Widespread species; figs 587-589 *P. inclyta* p. 89
- Antenna entirely black; coarse hair, if any, usually also below other femora; teeth of hind tibia usually medium to small; other characters variable 47
47. Head behind the eyes strongly swollen in dorsal view (fig. 561); AS3 very short (AEI 72-86); inner spur of hind tibia short (reaching only 0.25-0.3 basitarsus length) but still distinctly longer than outer (1.3-1.5 times as long); forewing venation normal; medium to small species, BL 21-32. Southeastern South America *P. aciculata* p. 254
- If the head behind the eyes is strongly swollen, at least one other character disagrees 48
48. Forewing with 1r-m strongly oblique, 2r-m more-or-less angulate or sharply bent at about the middle, posterior veinlets of SMC3 almost equal; hind tibial spurs of equal length; medium to small species, BL 30-37. Southeastern South America; fig. 558 *P. laetabilis* p. 108
- Forewing with 1r-m not strongly oblique, 2r-m and SMC3 variable; inner spur of hind tibia variable in length but always longer than outer 49
49. Propodeal hair (just behind and below APT) distinctly longer than PST 50
- Propodeal hair (just behind and below APT) at most as long as PST 54
50. Base of forewing broadly but very diffusely infusate (for a distance equal to the whole of the thorax width including tegulae); PPV nearly transverse; MG usually distinct throughout, continued on to posterior face, DTC coarse but PTC weak or absent; teeth of hind tibia often irregularly distant; AS3 rather long, AEI 90-107; head in dorsal view only slightly swollen (fig. 594); medium to small species, BL 25-36. Northwestern Argentina (Salta to Mendoza, including Tucumán, up to 3,200 m) *P. nigricans* p. 180
- Basal infuscation of forewing narrower (sometimes broadly in *P. montezuma* but with boundary fairly well defined); PPV less transverse; MG rarely present for more

- than part of its length at most, PTC often strong; teeth of hind tibia usually regularly, closely spaced; species of various sizes, more widespread 51
51. AEI 81-107; MPN furrow usually narrow; propodeal dorsum more-or-less obscured by long, dense hair 52
- AEI 67-83; MPN furrow more-or-less strongly expanded apicad or apically; the long hair of the propodeal dorsum not dense enough to obscure the surface 53
52. Most of body with long, dense hair, including abundant coarse hair below all femora; inner spur of hind tibia of usual length, reaching to 0.35-0.4 of basitarsus length, and slightly shorter to slightly longer than tarsal segment 3; MT often strong and sharp; AEI 81-107; medium-sized species, BL 18-33. Moderate to high altitudes in Chile and western Argentina; figs 575, 576 ***P. montezuma*** p. 181
- Hair-cover of body less dense (hair below middle and posterior femora much less than that below anterior); inner spur of hind tibia often short, reaching to 0.2-0.25 basitarsus length and up to 1.2 times as long as outer spur; MT usually not very strong; AEI 81-95. BL 14-33, but on average larger than the preceding species. Widespread in Chile and Argentina, including lowlands; fig. 591 ***P. limbata*** p. 199
53. MPN furrow strongly expanded apicad (widely V-shaped), the carinae moderately coarse, shining towards furrow; DTC very dense, with interstices scarcely visible; with long, dense hair partly obscuring surface; small species, BL 18-25. Widespread in Chile and Argentina; fig. 596 ***P. thoreyi*** p. 174
- MPN furrow not strongly expanded apicad; either entirely narrow, or narrow anteriorly and either weakly expanded apicad (narrowly V-shaped) or apically (Y-shaped), the carinae fine, matt. DTC usually with recognizable interstices, at least in front of PTC, the long hair not obscuring the surface; variably sized species, BL 19-34. Widespread in southern Brazil to Argentina; fig. 595 ***P. flavescens*** p. 176
54. Apex of hindwing with irregular, whitish band contrasting with darker colour of rest of wing; apical infuscation of forewing very broad and diffuse (intermediates exist between this form and dark-winged ones); medium-sized species, BL 21-34. Northern Argentina; figs 585, 586 ***P. seladonica*** p. 166
- Apex of hindwing entirely dark or only gradually paler, not contrasting with rest of wing colour; infuscation of forewing apex usually forming a distinct band 55
55. Inner spur of hind tibia long, reaching 0.3-0.45 basitarsus length; MPN equal to or slightly shorter than PST; often proximal part of hind wing markedly paler than remaining surface; variably-sized species, BL 22-37, but usually larger where sympatric with amber-winged *P. viridis*. (For dark form, see couplet 40). Widespread species; fig. 581 ***P. discolor*** p. 193
- Inner spur of hind tibia of moderate length, reaching 0.2-0.35 basitarsus length; MPN distinctly shorter than PST. Rather small species, BL 23-29. Extreme southern Brazil, Uruguay, and eastern Argentine provinces from Buenos Aires to Rio Negro; figs 592, 593 ***P. viridis*** p. 248
56. Wings with quite broad, moderately dark apical border, which becomes paler towards the extreme apex; head strongly transverse, scarcely swollen behind eyes; MPN very short, its furrow extremely wide (about as wide posteriorly as long); hind tibial teeth often tiny, distant (much further apart than their basal width); small species, BL 16-26. This is the commonest form along the Amazon and north of it; fig. 545
..... ***P. amyntas*** p. 123

- If the wings have a dark apical border, other characters disagree 57
- 57. Species very similar in size and colour to *P. amyntas*, but structurally different: body more robust, head more-or-less strongly swollen behind eyes; MPN furrow variable, but never as wide; hind tibial teeth usually larger; BL 18-29. This colour form is found especially in the vicinity of eastern Brazil; fig. 582 ***P. smaragdina*** p. 188
- Species either larger or found elsewhere 58
- 58. Forewing bright orange-amber, hindwing usually slightly paler; forewing with a weakly infusate, extreme apical band which is often very narrow; small species, BL 15-25. Known only from Suriname, southern Guyana and the Lower Amazon; fig. 598 ***P. achterbergi*** p. 191
- Species larger or differently coloured 59
- 59. Rather small, slender species, BL 15-26; body brilliant metallic, varying from golden-green to deep blue, sometimes tinged violet; antenna often with some apical segments orange; wings usually with at least a narrow, apical border moderately infusate, the rest amber to orange, but the pale colour is often reduced to very variable markings; AS3 rather long, AEI 94-113, often with bristles on inner side of AS3; SMC3 more-or-less elongate and bulging postero-distally; femora, especially anterior, with rather sparse but long hairs below. Transandean mainly in Colombia and Ecuador, often at higher altitudes; a few records from Panamá and Amazonian central Perú [confusion possible between unicolorous-winged specimens and *P. gracillima* – see under *P. purpureipes* Distinctions]; fig. 597 ***P. purpureipes*** p. 277
- Larger species; body not as brightly coloured, dark blue-green or tinted violaceous; other characters disagree 60
- 60. Medium-sized species, BL 18-33; most of body with long, dense, black hair; the wings usually have a combination of amber-orange and strongly infusate base and apex, but several different colour forms exist; also extremely variable structurally, see description. This extremely common species is found at moderate to high altitudes from northern Mexico southwards throughout the Andes from Venezuela to Chile and Argentina; in these last two, and in the western coastal desert of South America, it descends to lower altitudes; figs 575, 576 ***P. montezuma*** p. 181
- If the body is densely hairy, the species is much larger 61
- 61. Large, robust species, BL 32-53; antenna with some apical segments orange; wings basically orange-amber with dark base and apical border, but the amber displays all stages of reduction till the wings are completely dark (these last specimens run in a different part of this key); head more-or-less strongly swollen behind eyes and on top; forewing with 1r-m sharply bent anteriorly (the rest straight), and 2r-m gently curved just behind its mid-point; MT weak; hind tibial teeth rather distant (separated by about their width), almost upright, with rounded apex; legs, especially anterior, with subfemoral hair, which is more abundant the higher the altitude. (These are the main tendencies in this very variable species; not all are necessarily present in all individuals). Commonest in southern Brazil to central Argentina, but ranges over most of South America; figs 587-589 ***P. inclyta*** p. 89
- Smaller species, BL 22-35; antenna most often orange (sometimes dull orange or brown) from AS3; wings dark reddish-infusate with veins pale or outlined pale; head little swollen behind the eyes; MPN furrow narrow; propodeum rounded in profile, covered with very fine, yellow-violaceous pubescence (most easily visible

- on posterior face – view from various angles) and also sparser hair at least as long as MPN; PTC weak; see description for further details. This colour form is the commonest in the Guianas, and sometimes occurs also in Venezuela and on the Amazon; figs 599, 600 ***P. gracilis*** p. 223
62. Most of body covered with long, dense, black hair; rather small species, BL 18-33 63
 - If the body has long hair, it is much sparser 64
63. Head strongly transverse, very strongly swollen behind eyes; antenna entirely black; AS3 extremely short, AEI 76 (only one female seen); forewing with SMC3 very narrow anteriorly, anterior vein scarcely longer than proximal abscissa of posterior vein, and distal vein very strongly bulging outwards; MPN shorter than PST, its furrow very strongly expanded apicad; propodeum evenly rounded in profile, PTC absent. Higher elevations in southern and eastern Venezuela; figs 601, 602
 ***P. pilosa*** p. 171
- Head less strongly transverse, less strongly swollen behind eyes; antenna often with some apical segments orange; AS3 longer, AEI 81-107; SMC3 shape much less extreme; MPN as long as PST, its furrow less strongly expanded (although variable); propodeum in profile angulate at the PTC which is usually present (but not always strong). (See couplet 60 for range; this species is extremely variable in colour and structure); figs 575, 576 ***P. montezuma*** p. 181
64. Propodeum without a clear PTC, but usually with a transverse, broad, sometimes irregular, slightly depressed area in place of it; the DTC often continue on to the posterior face in similar but weaker form, except obsolescent centrally; otherwise the posterior face is matt and without strong sculpture; large species, BL 32-40, entirely dark coloured; AS3 104-114; SMC3 rather elongate, 1r-m strongly sloping anterodistad, 2r-m bulging outwards and more-or-less sharply bent just behind its mid-point; MPN shorter than PST, its furrow variable, often obsolescent anteriorly. Known only from southeast Brazil (states of Rio de Janeiro and São Paulo); fig. 606 ***P. convexa*** p. 110
- PTC usually present (sometimes double, when each part is reduced in size); if absent, then the antenna either has some segments pale coloured, or the species is smaller, or is found elsewhere, or has any combination of these; other characters may also disagree 65
65. Antenna with some segments (at least an apical spot) cream-ochre or pale yellow-orange 66
 - If the antenna has any pale colour, it is bright orange to orange-red (occasionally dull brown); otherwise it is entirely black 68
66. Hind tibia without curved bristles, spurs long and slender, inner longer than outer and 0.3-0.4 basitarsus length; PTC strong; AS3 long, AEI 113-125; smaller species, BL 16-34. Central America and Colombia; fig. 608 ***P. lepida*** p. 226
- Hind tibia usually with strong, backward-curved bristles; spurs often shorter; medium-sized species, often found elsewhere BL 23-38 67
67. Antenna very thick, pale yellow-orange from AS3, which is moderately long, AEI 95-110; species robust; head strongly swollen behind eyes; propodeum very robust, more-or-less quadrate; APT small but very sharp, PTC strong, broad; PPT strongly projecting, often very sharp and tooth-like; hind tibial spurs slender, inner spur longer than outer and 0.25-0.3 length of basitarsus. Found mainly in eastern Brazil;

- from Rio Grande do Norte southwards to Santa Catharina, but with isolated records far inland. Very similar to *P. viridis* but that species usually has fewer antennal segments coloured, they are bright orange, and the antenna is thicker; also, the comparable colour form of *P. viridis* is uncommon or absent in most of this species' range; fig. 607 ***P. helvolicornis*** p. 114
- Antenna thinner, the pale parts (at least an apical spot) cream-ochre; AS3 long, AEI 110-125; slender species; head strongly transverse, little swollen behind the eyes; propodeum rounded in profile except a small angle at the weak PTC; APT and PPT weak; hind tibial spurs short, robust, almost equally long, the inner one 0.25-0.3 basitarsus length. This colour form is mostly found in the Guianas and parts of the Amazon; but this species also occurs in Mexico and Central America; fig. 590 ***P. fumipennis*** p. 117
68. DTC extremely fine over most of the surface, with several slightly stronger ones close to the MPN and on the posterior half; SMC3 with distal vein less curved than usual, giving the cell a more "square" appearance; antenna black, with apical half of last segment orange, and narrow, apical rings on several preceding segments; PPT and PTC quite strong; stigmal fenestra very broad, about equal to stigma width; hind tibia with many, strong, backward-curved bristles; anterior femur with abundant (but not very dense) short hair below. Eastern Brazil, including Lower Amazon; figs 603-605 ***P. seifferti*** p. 101
- DTC not mainly extremely fine; SMC3 of different shape; other characters disagree 69
69. Rather small, slender species, BL 15-26; body brilliant metallic coloured, varying from golden-green to deep blue, sometimes tinged violet; antenna often with some apical segments orange; wings usually with at least a narrow, apical border moderately infuscate, the rest amber to orange, but the pale colour is often reduced to very variable markings; AS3 rather long, AEI 94-113, often with bristles on inner side; SMC3 more-or-less elongate and bulging postero-distally; femora, especially anterior, with rather sparse but long hairs below. Transandean mainly in Colombia and Ecuador, often at higher altitudes; a few records from Panamá and Amazonian central Perú. (Only a few specimens of this species are entirely dark-winged, see also couplet 59); fig. 597 ***P. purpureipes*** p. 277
- Body colour dull metallic blue-green or blue-violet (slightly brighter in *P. willinki*, see below) 70
70. AS3 very short, AEI 72-97; small species, BL 16-25; head little swollen behind eyes, MPN furrow broad; PTC weak to absent; front femur with short hair below, especially near its base. Transandean in Colombia, also found in Venezuela and Trinidad, often at some altitude; fig. 614 ***P. cybele*** p. 171
Note.— Somewhat similar to *P. amyntas*, AEI 92-111; see couplet 61.
- AS3 longer; if almost as short, species are larger or allopatric 71
71. Medium-sized, robust species, BL 23-43; head more-or-less strongly swollen behind eyes; AEI 94-118; inner spur of hind tibia rather short, 0.2-0.25 basitarsus length. Mexico: Yucatán to Panamá. (See also couplet 35); fig. 573 ***P. mildei*** p. 229
Notes.— Extremely variable species; two partly-sympatric species easily confused with this one are: *P. festiva* (common) usually distinguishable by the longer AS3 (AEI 114-133), orange beginning at the apex of AS3, and longer hind tibial inner spur (0.3-0.4 basitarsus length); *P. hyalinipennis* (rare)

- by the long AS3, AEI 104-130, and the longer inner spur of hind tibia, 0.3-0.45 basitarsis length; both species also have the head less strongly swollen behind the eyes and a more strongly tapered propodeum.
- Species not occurring north of Colombia, except as above mentioned 72
 - 72. PTC extremely strong, sharp, rounded (viewed from in front or behind); DTC weak, irregular, partly obscured by dense, short pubescence; MT small but sharp; forewing with PPV near-axial, 1r-m angulate in the middle, 2r-m strongly bulging outwards posteriorly, junction of radial vein with costa forming a very shallow angle (cf. *rubra*-group, Part 1). Rather large species, BL 34-36. Known only from eastern Brazil; fig. 615 *P. taschenbergi* p. 148
 - PTC less strong; other characters disagree 73
 - 73. MPN furrow very strongly expanded apicad; DTC strong, even stronger and more distant apicad; PTC absent, or represented by only a slightly thickened DTC; head strongly transverse, at most moderately swollen behind eyes; hind tibial teeth often tiny, inner spur much longer than outer, 0.4-0.5 basitarsus length; small species, BL 16-26; fig. 545 *P. amyntas* p. 123
 - If the MPN furrow is strongly expanded apicad, other characters disagree 74
 - 74. Antenna bright orange from base of AS3; body bright violet to violet-blue; found in or near Paraguay; figs 592, 593 *P. viridis* p. 248
 - If the antenna is coloured thus, the body is dull green or blue-green 75
 - 75. Antenna bright orange from base of AS3 76
 - Antennal orange beginning not before mid-AS3 77
 - 76. Forewing with 1r-m strongly, evenly curved, 2r-m more-or-less sharply bent at about the middle; AS3 rather long, AEI 105-115. Eastern and south-eastern Brazil, Paraguay and Argentina: Misiones; figs 612, 613 *P. brunneicornis* p. 236
 - AEI 76-106, and otherwise disagreeing; (part; in most specimens with this body colour the antennal orange is less extensive, see Distinctions under *P. viridis*; figs 592, 593 *P. viridis* p. 248
 - 77. Propodeum transverse, distance between tips of PPT a little greater than length of dorsal face; PTC strong, VR extremely strong near PTC and very wide apart (approximately equal to width of middle of hind femur) with weak or no sculpture between; DTC, especially anterior, with shallow punctures between (often simulating specks of dust); robust, medium-sized species, BL 27-38; head often strongly swollen behind eyes; antenna usually with only last 3-4 segments orange, but variable. Sparse in Amazon basin, commoner eastwards and southwards to north-eastern Argentina; figs 616, 617 *P. crassicornis* p. 94
 - Propodeum rarely transverse, but if so, other characters disagree 78
 - 78. Front tibial spur apically flattened, round-ended, parallel-sided or slightly expanded in one plane (spatulate); propodeal median ridge narrower and higher posterad **relative to the surrounding surface**, most often with a very narrow but more-or-less sharply incised groove; MT often very sharp; with more-or-less abundant subfemoral hair, especially below anterior femur 79
 - Front tibial spur narrowed apicad and sharply pointed apically however viewed; propodeum with median ridge broader and lower, not or scarcely increasing in height posterad, containing at most a shallow, weakly-impressed groove; other characters often disagree 80

79. MPN longer than PST, its furrow very narrow, suture-like; front tibial spur expanded in apical part; outer spur of hind tibia straight; smaller, rather slender species, BL 21-30. Found in most of South America peripheral to the Amazon basin (occurs very sparsely in the Lower Amazon), commonest in southern Brazil to northern Argentina (part; see mimicry-group keys); fig. 618 ***P. chrysoptera*** p. 144
- MPN shorter than PST, its furrow more-or-less strongly expanded apicad; front tibial spur parallel-sided in apical part; outer spur of hind tibia apically curved; larger, more robust species, BL 24-32. Known only from eastern Brazil from Salvador to Rio de Janeiro; fig. 623 ***P. boharti*** p. 142
80. Large but extremely variable species, BL 32-53; commonest in southeastern South America but this form with entirely dark wings is very widespread elsewhere. See couplet 61 for further characters and details of range; figs 587-589 ... ***P. inclyta*** p. 89
- Smaller species, and otherwise disagreeing 81
81. Antenna entirely dark except sometimes narrow, brown apical rings on some segments or obscure suffusion on a few apical segments 82
- Antenna with some apical segments clearly orange 83
82. Head behind eyes strongly swollen; wings fairly dark with colourless reflections. Northern Bolivia and southeastern Brazil southwards nearly to Buenos Aires; figs 619, 620 ***P. filiola*** p. 230
- Head behind eyes only moderately swollen; wings very dark with weak blue-violet reflections. Everywhere east of the Andes, southwards to northwestern Argentina and La Plata. This form is exceptional; most specimens have a white hindwing margin (see couplet 42); figs 585, 586 ***P. seladonica*** p. 166
83. Slender species, AS3 long to very long, AEI 102-133 85
- AS3 shorter, AEI 76-108 (when over 100, insect very robust) 84
84. Rather large, robust species; wings very dark, with distinct blue-violet reflections. Very common from Argentine Patagonia northwards, becoming sparse towards the Amazon and not reaching it; figs 592, 593 ***P. viridis*** p. 248
- Smaller, more slender species; wings moderately dark with colourless or slightly violaceous reflections on basal half. This dark-winged form is known only from Venezuela and the Guianas, for full range see mimicry-group key; figs 621, 622 ***P. atripennis*** p. 257
85. MPN furrow very narrow, suture-like, becoming totally obsolete anterad, often before reaching anterior margin; MG usually well-marked over most or all of dorsum; even when it is faint, the pair of ridges bordering it continue virtually uninterrupted into the more-or-less strongly divergent VR; PTC weak or absent 86
- MPN furrow moderately broad, usually reaching anterior margin; propodeal dorsum usually without MG or ridges; PTC often strong 87
86. Maximum distance between VR about equal to PST length; hind tibial inner spur short, reaching about 0.2-0.3 basitarsus length; PFC much weaker than DTC; forewing 1r-m (fig. 628) usually evenly curved throughout; antennal orange most often beginning diffusely on AS3. Occurs in vicinity of Amazon mainstream and the Guianas; figs 627, 628 ***P. viridisetosa*** p. 241
- Maximum distance between VR usually much greater than PST length; hindtibial inner spur long, reaching about 0.4-0.45 basitarsus length; PFC at least as strong as DTC; forewing 1r-m (fig. 630) more strongly curved anteriorly; antennal orange

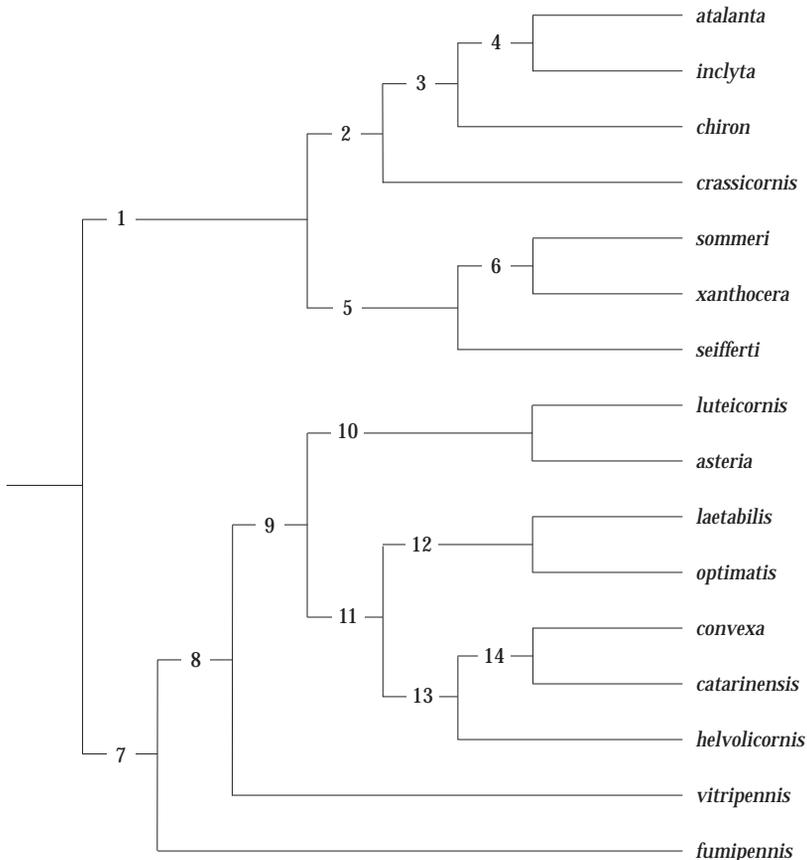
- beginning diffusely on AS4-8, most commonly on 6. Range much more extensive than that of the preceding species; figs 629, 630 *P. infuscata* p. 214
87. VR very weak, indicated mainly at their intersections with the PFC; forewing SMC3 (figs 609, 610, 625, 626) very long, strongly bulging posterodistally; smaller, slender species, BL 18-29 88
- VR moderate to very strong, with or without strong PFC; forewing SMC3 rather short, not always strongly bulging; larger, more robust species, BL 18-35 89
88. Head quite strongly swollen behind eyes; wings with at most very weak blue metallic reflections near base; propodeal dorsum flattened, median ridge scarcely elevated; VR slightly bowed outwards; antennal orange begins on AS5-6; body colour bright blue-green. Found along the entire Amazon, its western headwaters, and the Guianas; figs 624-626 *P. willinki* p. 208
- Head slightly swollen behind eyes; entire wings with strong blue-violet metallic reflections; propodeal dorsum quite strongly convex transversely, with broad median ridge; VR virtually straight, parallel; antennal orange begins on AS3-7; body colour usually dull blue-green; found in Central America, Upper Amazon and tributaries, and the Guianas; figs 609-611 *P. hyalinipennis* p. 216
89. PTC and VR strong, the latter divergent (often re-convergent below); forewing with 2r-m strongly curved in posterior half, so that SMC3 is strongly bulging postero-distally; wings dark or very dark, with strong blue-violet metallic reflections; MPN furrow rather broad (easily possible to see polished bottom at mid-point); hind tibia with teeth strong, pointed, fairly close-set (at most a tooth-width separating them); and with inner spur long, up to 1.5 times as long as outer spur; antennal orange variable, but most often starts at base of AS4. Found in most places from Mexico to Argentina but not West Indies nor west of the Andes south of Colombia; figs 631, 632 *P. festiva* p. 219
- PTC and VR weak, the latter parallel (propodeal sculpture in general markedly weaker than in the preceding species, but see note on west Ecuadorean population below); forewing 2r-m weakly curved in posterior half, so that SMC3 is only weakly bulging; wing colour more variable (sometimes dark red-brown) with little or no metallic reflection; MPN furrow narrow, almost suture-like (difficult to see polished bottom at mid-point); hind tibia with teeth smaller, often round-tipped, further apart (often separated by more than a tooth-width); and with inner spur shorter, up to 1.3 times as long as outer spur; antennal orange extremely variable in beginning and extent (often gradually brighter over several segments). (Note: in the west-Ecuadorean population the DTC are usually strong, the VR sometimes quite strong and convergent below, the MPN furrow often broader, and the hind tibial teeth often closer together; all other characters are as given above). Although not known from Central America, this species is transandean in Ecuador; otherwise found everywhere east of the Andes southwards to a little beyond the Amazon mainstream; figs 599, 600 *P. gracilis* p. 223

The *Pepsis inclyta*-group

Note.— Since this group is so diverse compared with others (see internal relationships below), the characters regarded as basic are emphasized in the following account.

Description.— This group comprises sixteen **medium to large, mostly robust species**, BL males 15-40, females 20-53. **The body of most species is dark blue-black**; occasionally some yellowish or golden hair is present on some parts. The antenna has variable amounts of orange or yellow, or is entirely black. With a few exceptions, the wing colour is either orange-amber with a dark apical border, or **entirely dark** (occasionally a full range of intermediates is found within a single species); when the wings are entirely dark, they often have extremely strong metallic reflections.

Structurally the group is quite diverse; however, in the males of most species **both S.4 and S.5** (in one case S.5 only) **have strongly modified hairs**, but (unlike other groups in Part 3) in some species not only are **the hairs uniform across the segments** (i.e. lacking the more usual differentiation into lateral brushes), but also the hairs on S.5 are stronger than those on S.4. In a few species the S.4 and S.5 hairs in profile form an even slope, decreasing in height posterad. Sometimes the SGP is flattened and more-or-less strongly expanded towards a rounded apex, but is more often **a scarcely modified strap-shape**. Most females have a long AS3, and **coarse, regular PTC**; some have the **inner spur of the hind tibia short**; sometimes the lateral extensions of the S.2 groove are reduced or absent.

Cladogram for the *P. inclyta*-group

Characters:

1. Paramere broad, very short, not or scarcely longer than rest of genitalia; modified hairs of S.4 & 5 spread more-or-less evenly across whole width of sternites.
2. S.5 hairs longer, denser and more widespread than those on S.4. SGP apical hairs long (clearly longer than half max. SGP width). Propodeum with steeply inclined posterior face. Body robust. SGP thick, sides not upturned; with median keel
3. Body size large. Wings partly orange-amber. MT weak. SGP with apical hairs short (reversal).
4. All hairs on S.4 & 5 short. Hairs in mid-S.5 shorter than laterals. SGP median keel absent (reversal)
5. Male: MPN longer than PST, with broad furrow. PPT & PTC strong. Hairs on S.4 longer than on S.5 (but S.5 hairs not modified in *P. seifferti*). SGP thick, more or less strongly expanded apicad. Margins not upturned basally. With short apical hairs. Female: AS3 long. Propodeum tapered apicad, with fine DTC anteriorly; slightly coarser in *P. sommeri* (reversal). Inner spur of hind tibia very short.
6. Anterior hairs of S.4 longer than posterior. S.5 with modified hairs. Lateral extension of S.2 groove absent (reversal).
7. Paramere long; SGP with upturned margins in basal half; apical hairs long. Female DTC strong, regular.
8. SGP thin, narrow, very weakly expanded apicad.
9. S.4 hairs in transverse band, much denser at sides than in centre.
10. Wings without strong metallic reflections (reversal). Back of female head strongly constricted. SMC3 elongate (reversal). Propodeum elongate. Male antenna mainly yellow. Female PPT not sharply pointed.
11. Female propodeum very robust, PPT strong.
12. Male propodeum quadrate, junction of dorsal and posterior faces forming strong angle, PTC strong; female head in dorsal view strongly swollen behind eyes.
13. Male propodeum elongate, shallowly curved at junction of dorsal and posterior faces, PTC weak.
14. PPT extremely strong; central hairs of S.4 strong.

Internal relationships.— The group has an unusual structure, comprising three very unequal subgroups (see characters 2, 5 and 7 in the cladogram); nevertheless, since they display several strong cross-linking characters in various species, it is better to treat them as a single, diverse group. Each of the subgroups includes a pair of species which are very closely related (*P. atalanta* and *P. inclyta*; *P. sommeri* and *P. xanthocera*; *P. luteicornis* and *P. asteria*, respectively).

External relationships.— The strongest affinities of the *inclyta*-group evidently lie with the other groups treated in the present Part. The males of most of its species display similar positions and structures of the sternal hairs to those of these other groups; not only is this regarded as a strong combination of characters but it also occurs in the great majority of species of all the subgroups of the *inclyta*-group. In a few males of the *inclyta*-group, the hairs on S.5 are stronger than those of S.4, a character found in many species of the *sumptuosa*-group but unknown elsewhere in the genus. The general body size of this group is intermediate between that of the *sumptuosa*-group (Part 2) and that of the other groups treated in the present Part. This suggests an intermediate position for the *inclyta*-group, and this is supported by other evidence: although the male SGPs often display upturned margins and a polished surface, they lack the strong basal tubercles and marginal teeth which often accompany them in the *sumptuosa*-group. Some females of the *inclyta*-group possess short inner spurs on the hind tibia and reduced lateral extension of the S.2 groove; two females of *P. xanthocera* have abundant golden facial hair; although all these characters are shared with the *sumptuosa*-group, they are much more common therein. In summary, although this group evidently occupies a phylogenetic position

between the *sumptuosa*-group (Part 2) and the remaining groups in the present work, its overall relationships appear strongest with the latter.

Biology.— See host record for *P. xanthocera*; some males of *P. inclyta* and *P. xanthocera* are very weak members of the *completa* mimicry-group.

Biogeography.— This group is found everywhere south of the USA except the West Indies and Chile. The species generally inhabit lower ground, although in a few cases (e.g. *P. inclyta*) populations are also found at higher levels; however, the record for this species from 2,600 m in north Perú is exceptional.

Pepsis atalanta Mocsáry, 1885
(figs 51-56, 571, 572, 646)

Pepsis atalanta Mocsáry, 1885: 267, no. 48. Lectotype ♀ (TMB), here designated [examined].

Pepsis nitens Mocsáry, 1894: 13, no. 23. Lectotype ♂ (TMB), here designated [examined]. **Syn. nov.**

Pepsis mocsaryi Lucas, 1895: 608, no. 66. Lectotype ♀ (TMB), here designated [examined]. **Syn. nov.**

Type material.— *P. atalanta*: I have seen a single type-material ♀ and labelled it lectotype. *P. nitens*: I have seen 4 ♂♂ standing under this name in TMB. The only one bearing an original Mocsáry identification label “*nitens*” strongly disagrees with the original description; it, and another ♂ labelled “Brazil, Chiriqui” (rather than “Panama, Chiriqui”) do, however, agree with that of *P. lativalvis*, whose description immediately follows that of *P. nitens*. Of the 2 remaining ♂♂ (both with locality Panama, Chiriqui), I have labelled the larger one as lectotype. The other one is the only specimen which is conspecific and can be regarded as a paralectotype. *P. mocsaryi*: I have seen a single type-material ♂ and labelled it lectotype.

Description.— ♂ (figs 51-56). BL 20-32. Body and legs black with metallic blue-green or violaceous sheen. Antenna black with any number of segments bright or dull orange from 3 onwards (the darker the wings, the fewer the orange segments). Wings usually orange-amber with a very variable area infusate (see Variation). S.4 & 5 with short, very dense hairs, whose apices are curved strongly inwards and backwards; those on 4 covering the posterior half of the sternite, shorter and slightly sparser in front, those on 5 covering most of the sternite, slightly shorter and almost straight posterocentrally. SGP slightly expanded into a rounded apex (i.e. weakly spathulate) fringed with hair about half as long as maximum SGP width. Paramere short, about as long as the rest of the genitalia. Inner projection of digitus apex very blunt, rounded.

♀ (figs 571, 572). BL 33-45. AE index 102-122. Colour as in male, except AS3 usually slightly black basally. Head in dorsal view with temple and vertex only slightly swollen. MT weak. MPN slightly longer than PST, its furrow rather narrow, expanded gradually apicad or more strongly apically, sometimes flattened-out anteriorly; its carinae fine, almost transverse. Propodeum: MG sometimes weakly indicated posteriorly in the top of a strong ridge which mostly replaces it. APT weak to moderate, PPT moderate to strong, PTC moderate to very strong, usually round-topped. DTC rather strong, not very dense (more distant near PTC), fairly regular. Propodeal hair about as long as PST. Posterior face: VR represented by weak ridges, sharply divergent from PTC to about 1/3 down face, then gradually reconverging below but obsolete before joining. PFC fairly strong above, rapidly weaker below and between VR; apex (near petiole socket) often slightly shining. Front femur with some fairly coarse but not dense hair below



Fig. 646. Collection localities of *Pepsis atalanta* and *P. inclyta*.

(about as long as maximum femur width), progressively sparser on following femora. Lateral extensions of S.2 groove present, but often shallow. Hind tibia: teeth rather small, sharp and distant (sometimes low and rounded, especially centrally, in larger specimens), with extremely short, dense pubescence between; the subtending spines 2.0-2.5 times as high. On the inner side of the teeth is a line of rather long curved setae, directed backwards. Inner spur short, reaching to 0.2-0.25 basitarsus length (about equal to tarsal segment 3 or slightly less) and only 1.2-1.25 times as long as outer.

Variation.— Mainly concerns the amber colour which spreads in both directions from the centre of the wings; a male of this species from Guatemala (USNM) has the wings rather heavily infuscate, although the black borders are still distinct; the antenna is dull orange as usual. Another male (without head) from Colombia: Villavicencio (MACN) has entirely black wings.

Distinctions.— The male is very like that of a pale-winged *P. inclyta* but its modified sternal hairs are longer and more curved. The most distinctive female characters are the orange antenna, only slightly swollen temple, rather coarse DTC, and short hind tibial inner spur. It is very similar to *optima* of the *sumptuosa* mimicry-group, from which it is distinguished by the inner hind tibial spur being longer, and equal to the outer. See also under *P. chiron*.

Distribution.— Found from southern Mexico to the north-western Andes east to Venezuela, with a single record from lowland Amazonian Colombia (see Variation) ascending to 1,600 m in Mexico (Veracruz). A single record from Chile (BMNH) is most likely based on erroneous labelling. Map fig. 646.

Material depositories.— 30 ♂♂, 88 ♀♀; AEIG, AMNH, ANSP, BMNH, INBIO, LACM, MACN, MCZ, MICR, MIZAM, MLU, MNHNPS, NMV, OLLD, PORTER, SEMKU, TMB, UCALD, UMBREM, USNM, WASBAUER, WILLIAMS, ZSM.

Pepsis inclyta Lepeletier, 1845
(figs 57-62, 587-589, 646)

Pepsis inclyta Lepeletier, 1845: 475-476. Lectotype ♀ (MIZSU), here designated [examined].

Pepsis mutabilis Lepeletier, 1845: 483. Lectotype ♂ (MIZSU), here designated [examined]. **Syn. nov.**

Pepsis vagabunda Lepeletier, 1845: 484. Lectotype ♀ (MIZSU), here designated [examined]. **Syn. nov.**

Pepsis cupripennis Taschenberg, 1869: 28, no. 4. Lectotype ♂ (MLU), here designated [examined]. **Syn. nov.**

Pepsis violaceipennis Mocsáry, 1885: 253, no. 24. Lectotype ♂ (TMB), here designated [examined]. **Syn. nov.**

Pepsis clotho Mocsáry, 1888: 161, no. 2. ♀, Brazil (lost). **Syn. nov.**

Pepsis spengeli Mocsáry, 1888: 162, no. 5. ♂, Brazil (lost). **Syn. nov.**

Pepsis sickmanni Mocsáry, 1888: 163, no. 6. ♀, Brazil (lost). **Syn. nov.**

Pepsis nireus Mocsáry, 1894: 8, no. 14. Lectotype ♂ (TMB), here designated [examined]. **Syn. nov.**

Pepsis atrovirens Lucas, 1895: 507, no. 16. ♂, Brazil (lost). **Syn. nov.**

Pepsis cerastes Lucas, 1895: 639, no. 81. Lectotype ♂ (MNHU), here designated [examined]. **Syn. nov.**

[*Pepsis smaragdina* Dahlbom; Lucas, 1895: 663. Misidentification].

Pepsis pygidialis Brèthes, 1908: 237. ♂ [Brazil:] Rio de Janeiro (lost). **Syn. nov.**

Pepsis guaranitica Brèthes, 1908: 239. Lectotype ♀ (MACN), here designated [examined]. **Syn. nov.**

Pepsis parca Lucas, 1919: 152. ♀, [Brazil:] R[io] G[rande] do Sul, (lost). **Syn. nov.**

Pepsis atahualpa Banks, 1946: 328. Holotype ♂ (MCZ) [examined]. **Syn. nov.**

Pepsis opimicornis Haupt, 1952: 337, no. 3. Lectotype ♂ (MLU), here designated [examined]. **Syn. nov.**

Pepsis atropos Haupt, 1952: 343, no. 8. Lectotype ♀ (MLU), here designated [examined]. **Syn. nov.**

Pepsis azurea Haupt, 1952: 350, no. 4. Holotype ♂ (MLU) [examined]. **Syn. nov.**

Type material.— *P. inclyta*: 2 ♀♀ were standing under the name *Pepsis errans* [= *viridis*] in MIZSU, Turin. One of them disagrees with the original description of that species, but does agree with that of *P. inclyta*. I have therefore labelled it as lectotype of the latter species, and regard it as having been misplaced under *P. errans*. *P. mutabilis*: I have seen a single type-material ♂ and labelled it lectotype. *P. vagabunda*: I have seen a single type-material ♀ and labelled it lectotype. *P. cupripennis*: The 2 ♂♂ mentioned in the original description are in MLU, Halle; they have identical labels. I have labelled as lectotype the one in better condition; the conspecific paralectotype lacks an antenna and most of the gaster. *P. violaceipennis*: I have seen a single type-material ♂ and labelled it lectotype. *P. nireus*: I have seen 3 ♂ syntypes and have labelled as lectotype the one with an aberrant spur-vein on SMC3. Of the other 2, one lacks the genitalia; all 3 are conspecific. *P. cerastes*: I have seen 2 ♂ syntypes and labelled the one in MNHU, Berlin as lectotype. The paralectotype in NM, Vienna is conspecific. *P. guaranitica*: I have seen 4 ♀♀ purporting to be type-material, of which 3 are in MACN. Two of the latter are labelled “Misiones” and are the only ones I regard as type material. I have labelled the smaller one of these two, in better condition, as lectotype; the other is a paralectotype. The third specimen in MACN, and the fourth, in MLP, both bear collectors’ names inappropriate to type-status. However, all 4 specimens are conspecific. *P. opimicornis*: I have seen both ♂ syntypes and labelled one of them lectotype. Haupt’s mention of an holotype is ambiguous, since it is not clear which specimen he was referring to. The paralectotype is conspecific. *P. atropos*: I have seen both ♀ syntypes and labelled one of them lectotype. The paralectotype is conspecific.

Description.— ♂ (figs 57-62). BL 24-40. Body and legs black with blue-green or violet sheen. Antenna black with up to 11 apical segments orange. Wings entirely black to almost entirely amber. In fresh specimens, all femora with coarse hair; most on the middle ones, least on the anterior. S.1-3 with slightly longer and denser hair than usual; S.4 with short hairs strongly hooked apically, concentrated at the sides of the sternite, sparse centrally and on the anterior quarter. S.5 with hairs similar but much denser and covering the entire surface, those in the median line decumbent and directed forwards and outwards; thus there is a median “hollow” in the pilosity of both sternites, but formed in a different way on each. SGP with entirely rounded apex, more-or-less narrowed from pre-apically to base of normally visible part. Parameres very short, equal in length to the rest of the genitalia, apex bluntly pointed. Apex of digitus sharply pointed on the inner side.

♀ (figs 587-589).— BL 32-53. AE index (73-)82-118. Colour as in ♂. Vertex slightly swollen (more so than temple). MT weak to strong (swollen rather than sharp). MPN furrow variably broad, sometimes expanded posterad, but always posteriorly, into a triangle of variable size; rarely also expanded anteriorly into a circular depression; carinae fine to very fine, occasionally with 1-2 anterior carinae stronger than the others. Propodeum: MG absent or very weak, often represented by a slight flattening of the midline. APT moderate to strong, PPT and PTC moderate to very strong, the last usually broad, sometimes connected to PPT. DTC quite strong (occasionally very weak in smaller specimens), more distant and often stronger posteriorly, interstices with shallow punctures. Propodeal hair usually a little shorter than PST, at most equal. Posterior face: VR weakly indicated above; the single uppermost PFC extends inwards from PPT and is very strong, the remainder very weak, in the median line obsolescent in favour of a finely-sculptured, weakly shining area, which is often broad. Lateral extension of S.2

groove well-developed. Hair of anterior femur the most dense, sparser on mid and hind femora. Hind tibia: teeth rather large and blunt, but rather narrow, erect and moderately distant, the subtending spines 1.5-2.0 times as high; inner spur often rather long, attaining 0.25-0.35 basitarsus length (varying in length between that of tarsal segments 2 and 3), and scarcely longer than outer spur (up to 1.1 times as long).

Variation.— The geographical variation in this species is comparable to that in *albocincta* (*rubra*-group), in that antennal and wing colour appear to vary independently. Antennal colour varies as noted above, the orange colour advancing from the apex proximad; the wings vary from entirely black with strong blue-violet reflections, to entirely amber except for a rather narrowly infusate base and very narrow apical band. The amber colour spreads both proximad and distad from the centre of the wings. The wing colour is usually almost entirely pale in specimens from higher altitudes; specimens from central Brazil to Uruguay usually have a variably-sized amber patch in the forewing (when large, it spreads on to the centre of the hindwing); while those from the Amazon, Paraguay and certain parts of Argentina have entirely black wings. Although the distribution of hair is always in relative proportion between the femora as described above, in specimens from higher altitudes (western South America) it is markedly denser overall. A female from Taperinha (near Santarém, Brazil) (NMV) has the body covered with fine, dense, yellowish pubescence.

Structural variation is found in most characters, which sometimes makes this a difficult species to identify with certainty. In the more northerly populations, especially in the eastern parts of Colombia and Ecuador, the female temple is much less swollen than usual. A female from Paraguay: Asunción, Sapucay (MNHU) is abnormal in that the MPN is very short, and drops steeply to the propodeum; the latter's dorsal sculpture is almost entirely effaced, but there is a short but deep median, groove anteriorly, and some irregular carinae around the PTC. In a female from Santarém (ANSP) the propodeum tapers apicad, and lacks a PTC; its hind tibial teeth are very small.

Biology.— Some males in southeastern Brazil, Paraguay and adjoining areas somewhat resemble the members of the *completa* mimicry-group, but the basal band in the present species is not as well defined.

Distinctions.— The male is well characterized by its modified sternal hairs, but the female must be distinguished primarily by its large size and abundant subfemoral hair in fresh specimens; confirmatory characters are the AEI usually quite close to 100, antenna partly orange, slightly swollen vertex, rather weak MT (at least not sharp), the usually strongly anterodistad-sloping 1r-m, the more or less V-shaped radial cell apex, very fine MPN carinae, general configuration of propodeal tubercles and sculpture, slightly unusual (large but erect) hind tibial teeth and often rather long inner spur. Amber-winged forms of this species resemble *P. limbata* in size but that species has the PPT much weaker and the antenna entirely black.

Distribution.— A very wide-ranging species, found in the whole of South America except Chile (but including west of the Andes in northern Perú), southwards to north-western Argentina and Buenos Aires; a record from Costa Rica, Palmar (1 ♂, USNM) needs confirmation; while a record from Guadeloupe (1 ♀, MNHNPS) is probably based on a labelling error; ascending to 2,600 m in northern Peru. Map fig. 646.

Material depositories.— 410 ♂♂, 437 ♀♀; AEIG, AMNH, ANSP, BMNH, BONELLI, CAS, CMNH, CUNY, EMMSU, ETHZ, FDA, FRITZ, IMLT, INPA, INTAC, LACM, MACN, MCZ, MHNGV, MIZSU, MLP, MLU, MNCN, MNHNPS, MNHU, MNRJ, MNS,

MPEG, MZUSP, NHMBAS, NMV, NRS, OLLD, OSUC, PUCEQ, RMNH, SMF, TMB, UCALB, UCALD, UFPVIC, UMBREM, UMOX, UNCBOG, UNLAMB, UNPBOG, USNM, UZMC, WAHIS, WASBAUER, WILLIAMS, ZMHEL, ZMMICH, ZSM).

Pepsis chiron Mocsáry, 1885
(figs 33-38, 574, 647)

Pepsis chiron Mocsáry, 1885: 266, no. 46. Lectotype ♂ (TMB), here designated [examined].

Type-material.— *P. chiron*: I have seen a single type-material ♂ and labelled it lectotype.

Description.— ♂ (figs 33-38). BL 23-31. Body and legs black with blue-violet metallic sheen. Antenna black; orange beginning diffusely over one or two segments, leaving the apical 6-7 entirely bright orange. Wings orange-amber with the base broadly infuscate (about 1/4 of the forewing, 1/3 of the hind) and a rather broad apical band (sometimes as broad as the basal), narrowing posterad on both wings. The junction between the colours is usually rather diffuse. S.4 with a very small, postero-lateral cluster of small hairs; S.5 virtually covered with hairs; laterally a dense, longitudinal row of long hairs with the apexes curved inwards and backwards, anteriorly just as long but sparser and curved backwards, in the centre much shorter and directed forwards. SGP elongate, expanded more-or-less strongly apicad, the extreme apex narrowly upturned; with a weak median keel, which flattens out at the widest part. Paramere broad but narrowly, bluntly pointed, very short, only as long as rest of genitalia. Inner projection of digitus apex acutely pointed, slightly turned distad.

♀ (fig. 574). BL 28-35. AE index 100-103. Colour as in male, except infuscation at base of wings often a little narrower and antennal orange begins between middle and end of AS3. Head in dorsal view with temple and vertex quite strongly swollen. MT very weak. MPN furrow virtually equal to PST, its furrow rather broad and expanded apically, or narrow and expanded apicad; carinae fine to very fine, more-or-less transverse. Propodeum: MG indicated in posterior half only; APT very weak, PPT and PTC moderate to strong (sometimes both very strong); DTC mostly fine except a few beside MG; sometimes some indistinct punctures between them. Propodeal hair almost as long as PST. Posterior face: VR more-or-less strong in upper half, the area between them markedly more shiny than the remaining surface; PFC variably strong, present in upper half at most. Lateral extensions of S.2 groove present but sometimes rather short. Front femur with some hairs below, mostly a little shorter than maximum width of femur; mid femur with similar but fewer hairs. Hind tibia: teeth a little larger, upright and more distant than usual, with very fine, dense hairs between; the subtending spines 1.5-2.0 times as high as the teeth; a few weak, backwardly-curved bristles on the inner side of the teeth. Inner spur reaching to 0.25-0.3 of basitarsus length (about equal to tarsal segment 3) and equal to outer spur.

Variation.— Only as given above.

Distinctions.— The male is distinguished from those of all other species by the long lateral hairs of S.5 and their configuration; a very few other males are a little similar in this respect, but differ strongly in other modified sternal hairs, body size, colour and distribution. The female is distinguished from those of many Central American orange-

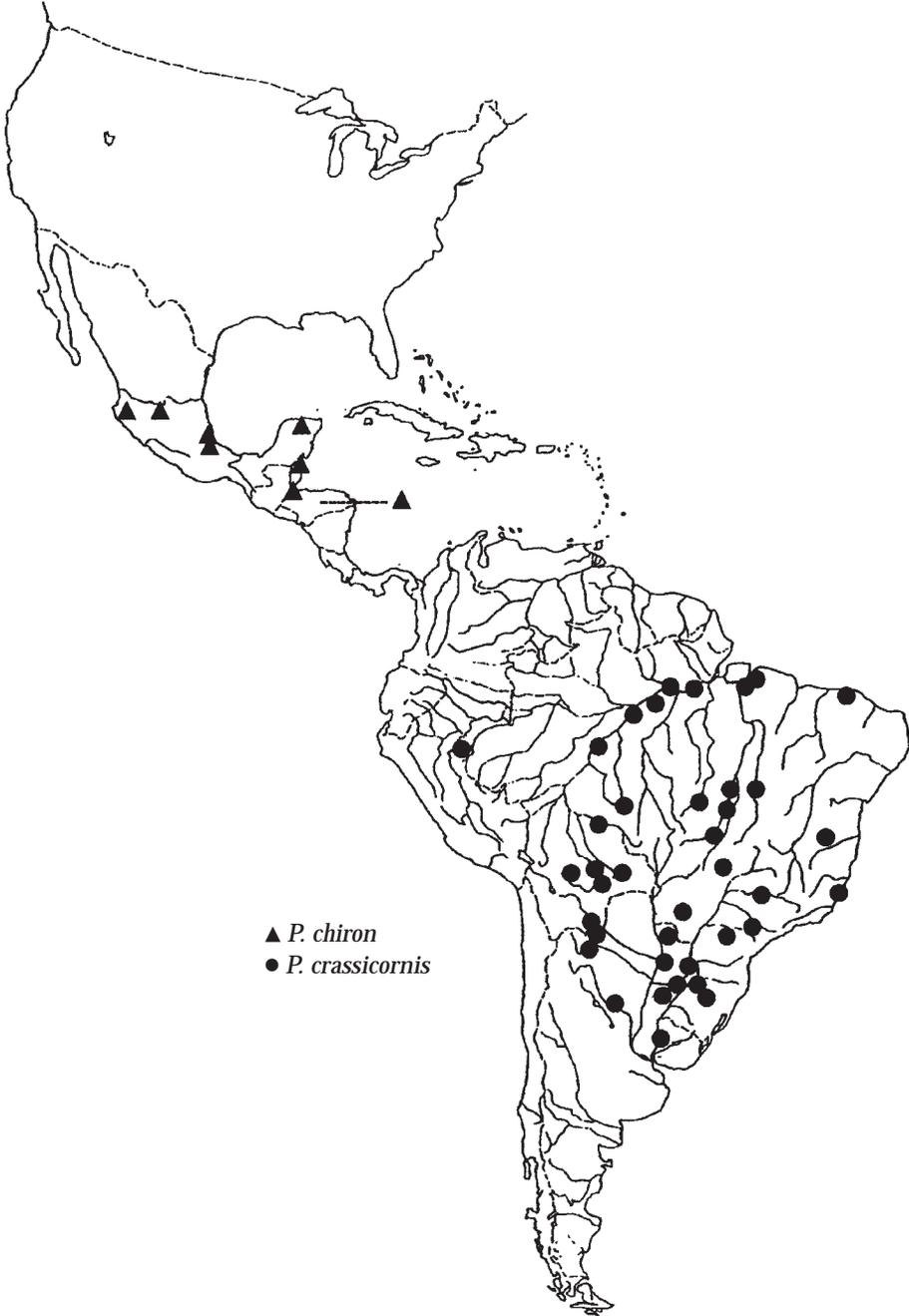


Fig. 647. Collection localities of *Pepsis chiron* and *P. crassicornis*.

amber-winged species by its virtually equal-length hind tibial spurs (the inner one often distinctly longer than the outer in other species); it is distinguished from others as follows (*chiron* characters in brackets): *P. aquila*: MPN distinctly shorter than PST (equal), its furrow broad and with one strong carina (narrow, with many fine carinae), propodeal hair much longer than MPN (equal), DTC coarse, with shallow punctures between (fine), PFC distinct over whole surface (obsolescent, especially posteromedially), lateral extension of S.2 groove absent, occasionally vestigial (present but sometimes rather short); *P. atalanta*: head slightly swollen (quite strongly), propodeum with strong median ridge (weak), VR weak (strong, with area between them more strongly shining than rest of surface), PTC broad, apex rounded (usually narrow, apex truncate); *P. casiope*: extremely long hind tibial spurs (rather short), knife-edged posterior carina of hind femur (carina angulate-rounded); *P. mildei*: this species is so poorly characterized that all other Central American species are best distinguished by their strong characters which are lacking in *mildei*; *P. optima*: head only slightly swollen behind eyes (quite strongly), propodeal hair about 1.5 times as long as MPN (about equal), VR weak (strong, at least in upper 1/3); *P. sommeri*: propodeum elongate, with very long and rather dense hair (short, robust, with shorter and less dense hairs); base of wings usually very broadly infusate (narrowly), AS3 very long, 121-141 (shorter, 100-103); *P. thisbe*: radial vein meeting costa at a very shallow angle [*rubra*-group venation] (meeting at a fairly steep angle); *P. yucatani*: head strongly constricted behind eyes, almost triangular (quite strongly swollen), AS3 very long, AEI 148-158 (shorter, AEI 100-103), wings yellowish, apex pale (orange, with dark border), propodeum strongly tapered apicad (robust, more quadrate) hind tibial inner spur extremely short, slightly shorter than maximum width of tibial apex (longer than tibial apex width).

The following species are not very distantly allopatric: *P. frivaldszkyi*: back and sides of head extremely strongly swollen, clypeus with strong emargination defined by a tooth on each side (head only moderately swollen, clypeus shallowly, arcuately emarginate); *P. basalis*: head strongly rounded (swollen); very long AS3, 132-140 (shorter, 100-103); very narrow but well-defined dark apical wing band (broad, poorly-defined); very strong PFC (weak except uppermost); *P. tricuspidata*: much larger, BL 42-50 (smaller, BL 28-35), hind claw with tooth subapical and setae bent where they pass over it (tooth slightly beyond middle of claw, setae straight) PTC broad, apex rounded (narrow, usually truncate).

Distribution.— Found only from central Mexico to British Honduras, always at low altitudes. Map fig. 647.

Material depositories.— 15 ♂♂, 6 ♀♀; (BMNH, CUNY, LACM, OSUC, SEMKU, SMF, TMB, USNM, WAHIS).

Pepsis crassicornis Mocsáry, 1885
(figs 45-50, 616, 617, 647)

Pepsis crassicornis Mocsáry, 1885: 254, no. 25. Lectotype ♂ (TMB), here designated [examined].

Pepsis sappho Brèthes, 1908: 236. Holotype ♂ (MACN) [examined]. **Syn. nov.**

Pepsis nitocris Brèthes, 1908: 236, ♂, Paraguay (lost). **Syn. nov.**

Pepsis vivida Brèthes, 1908: 236. Holotype ♂ (MACN) [examined]. **Syn. nov.**

Pepsis arechavaletai Brèthes, 1908: 237. Holotype ♂ (MACN) [examined]. **Syn. nov.**

Pepsis lynchii Brèthes, 1908: 237. Lectotype ♂ (MACN), here designated [examined]. **Syn. nov.**

Pepsis operosa Brèthes, 1908: 238. Holotype ♂ (MACN) [examined]. **Syn. nov.**

Pepsis ataragua Banks, 1946: 389. Lectotype ♀ (MCZ) [examined]. **Syn. nov.**

Pepsis splendida Haupt, 1952: 350, no. 5. Holotype ♂ (MLU) [examined]. **Syn. nov.**

Type-material.— *P. crassicornis*: I have seen a single type-material ♂ and labelled it lectotype. *P. nitocris*: Although the type-material is lost, my interpretation of this species is based on two ♂♂, one in each of MACN and MLP. They bear Brèthes identification labels and are conspecific. *P. lynchii*: I have seen the 2 ♂ syntypes, which are conspecific. I have labelled as lectotype the slightly larger one which bears the locality Jujuy. The other, a paralectotype, is labelled Ledesma. *P. operosa*: In addition to the holotype, in MLP is a ♂ from Misiones, Bonpland. It is conspecific but has no type-status. *P. ataragua*: I have seen 2 syntype ♀♀ and labelled one of them lectotype. The paralectotype (also in MCZ) is a specimen of *P. chrysoptera* Burmeister.

Description.— ♂ (figs 45-50). BL 17-33. Body and legs black with a rather weak blue-violet metallic sheen; antenna rather thick, black, with 0-7 apical segments orange; wings black with strong blue-violet reflections. S.4 with a transverse patch of short, dense hairs covering most of the visible part of the segment except the anterior one-third; the anteriormost hairs are straight, the rest strongly curved (mainly apically) inwards and backwards, but slightly shorter and straighter centrally. S.5 with a patch of hairs anteriorly about 1.5 times as high as those of S.4, gradually decreasing posterad to about equal to those of S.4; all strongly curved backwards apically. SGP flat, gradually broadened apicad to about the mid-point, then slightly constricted again just before the apex, which is more-or-less rounded and bears a fringe of hairs almost as long as the minimum SGP width. Paramere broad, apically rounded, very short, about as long as rest of genitalia. Inner projection of digitus apex rather sharply pointed, slightly turned distad.

♀ (figs 616, 617).— BL 27-38. AE index 94-111. Colour as in male, except that usually only up to 5 antennal segments are orange. Head in dorsal view with temple and vertex quite strongly swollen. MT strong to very strong. MPN slightly shorter to slightly longer than PST, centrally depressed, furrow very variable, carinae fine, sometimes with a few stronger ones around the middle. Propodeum: MG a broad ridge; APT, PPT and PTC all strong to very strong; DTC mixed strong and moderate, with usually distinct punctures between, somewhat obscured by pubescence. Propodeal hair about half as long as PST. Posterior face: VR very strong in upper half but obsolete by midpoint, distant from each other by almost or fully 1/3 of width between PPT (occasionally slightly divergent apicad); PFC absent or almost so between VR but otherwise covering whole surface, gradually obsolescent downwards. Lateral extension of S.2 groove present but usually short. Hind tibia: teeth rather small, narrow but tall, distant, with dense but extremely short pubescence between; the subtending spines about 1.5-2.0 times their height, with a row of strong, backwardly-curved bristles on the inner side of the teeth; inner spur reaching to 0.25-0.3 basitarsus length (about equal to tarsal segment 3) and 1.25-1.3 times as long as outer spur (sometimes subequal in very large specimens).

Variation.— In both sexes, fewer apical antennal segments are orange in the northern part of the species' range than in the south (in a female from PERU: Huanuco, Fundo Sinchono 1,300 m (USNM) the orange begins diffusely towards the apex of AS3); the MPN furrow is gradually broadened apicad or more abruptly apically, sometimes

also broader and flattened-out anteriorly; sometimes rather broad throughout.

Distinctions.— The male of this species is unique among black-winged species in having the modified hairs of S.5 longer than those of S.4. The female is distinguished from those of similar appearance by its rather strongly swollen temples, punctate propodeal dorsum and very widely-spaced VR without carinae between; also from *P. seifferti* in having coarser anterior DTC, and the shape of the SMC3.

Distribution.— Found from the Amazon mainstream (although rarely collected in the Peruvian headwaters) southwards to northern Argentina (both east and west); ascending to 1,300 m in eastern Perú. Map fig. 647.

Material depository.— 195 ♂♂, 112 ♀♀; AEIG, ANSP, AMNH, BMNH, CAS, CMNH, CUNY, ETHZ, FDA, FRITZ, IMLT, INPA, MACN, MCZ, MHNGV, MLP, MNHNPS, MNRJ, MNS, MPEG, MZUSP, NHMBAS, NMV, NRS, OLLD, OSUC, PORTER, SMF, UCALB, UMOX, USPRIB, RMNH, TMB, UBRAS, USNM, USU, UZMC, WASBAUER, WILLIAMS, ZSM.

Pepsis sommeri Dahlbom, 1845
(figs 177-181, 568-570, 648)

Pepsis sommeri Dahlbom, 1845: 465, no. 17. Lectotype ♂ (MZEL), here designated [examined].

Pepsis azteca Cameron, 1893: 215, no. 2. Lectotype ♀ (BMNH), here designated [examined]. **Syn. nov.**

Type-material.— *P. sommeri*: I have seen a ♂ and 2 ♀ specimens from MZEL. Although Dahlbom mentioned only the female sex, his description applies better to the male; furthermore, the latter bears an original Dahlbom label: “*P. sommeri*, H. Eur. 465: 17. Mexico. Sommer”; also, male specific characters are much more distinctive than are those of females. For all these reasons, therefore, I have labelled this ♂ as lectotype. Both ♀♀ are paralectotypes; one is labelled “Oaxaca, Mexico”, the other, with a green label “Mineral del Monte, Mexico”; both are large specimens of *P. montezuma* Smith. *P. azteca*: I have seen 2 ♀♀ under this name; the one I have labelled as lectotype is from “Atoyac, Vera Cruz”, which agrees with the description; the other specimen, despite bearing Cameron’s handwritten identification label and the usual BMNH “type” labels, is from Zapote, Guatemala, which locality does not appear in the original description. The latter specimen is therefore not regarded as a syntype; it is a specimen of *P. atalanta* Mocsáry.

Description.— ♂ (figs 177-181). BL 21-28. Body and legs black with very weak, dark blue (sometimes green or violet) sheen. Antenna bright orange except 2 black basal segments. Wings orange-amber; infuscate in the forewing are: 1/4-1/3 basally (boundary with orange diffuse) and a well-defined apical band, not quite touching SMC3 but more-or-less entering radial cell; hindwing similar. S.4 with a uniformly dense patch of hair, becoming shorter posterad, in large specimens often with a thin line of abruptly longer hairs anteriorly. S.5 with a smaller and slightly denser version of the S.4 hairs, the apexes of the two patches together forming a single surface sloping downwards and backwards when the segments are close together as normal. SGP with a very weak median keel, at whose base is a weak tuft of short hairs; strongly expanded towards the rounded apex, which is sometimes slightly emarginate centrally. Paramere short, about equal in length to rest of genitalia, apically blunt. Digitus

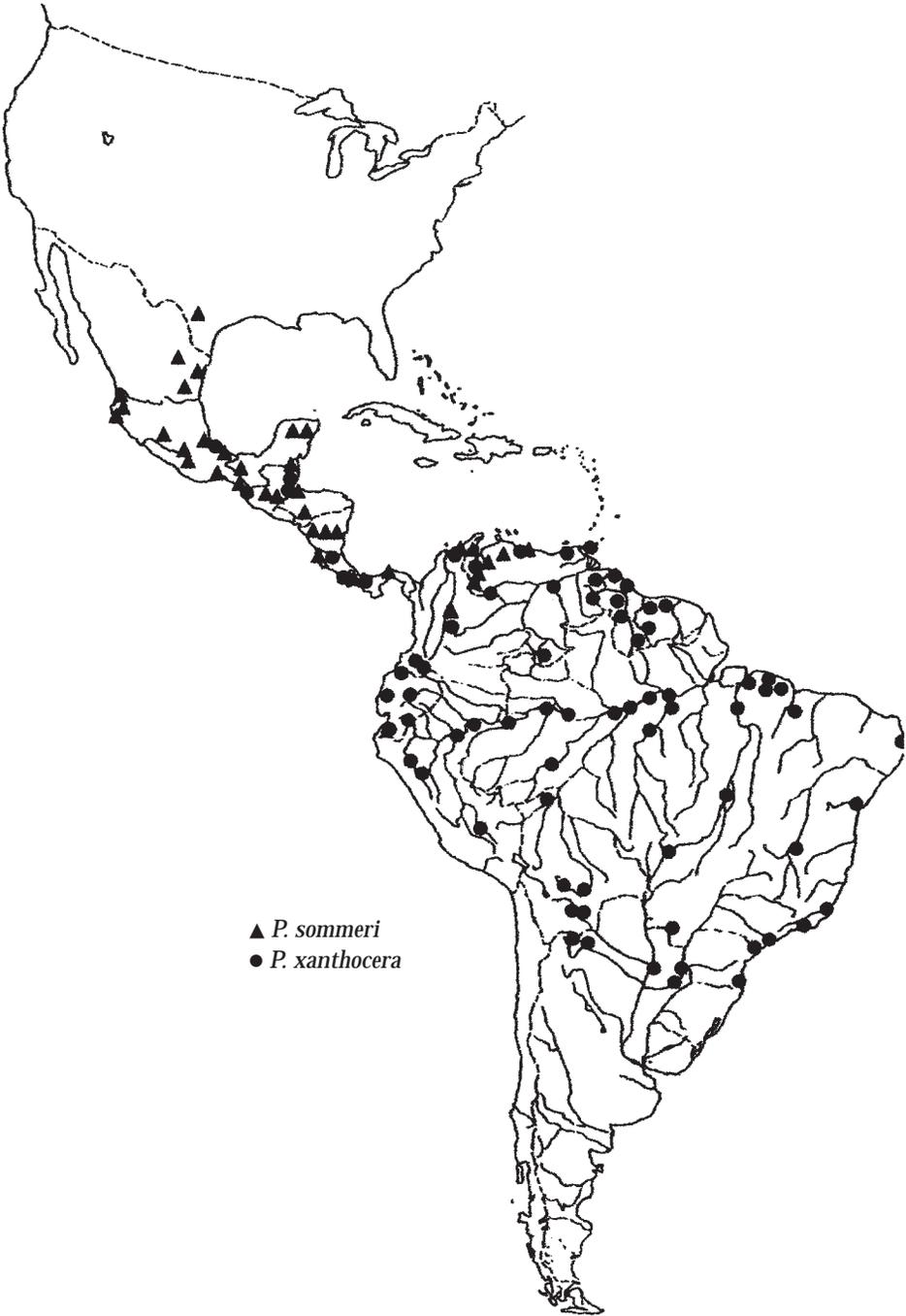


Fig. 648. Collection localities of *Pepsis sommeri* and *P. xanthocera*.

apex with inner projection long, bluntly pointed and directed strongly distad.

♀ (figs 568-570).— BL 24-40. AE index (116-)121-141(-145). Colour as in male except antenna sometimes with less orange. Head in dorsal view with temple and vertex slightly swollen. MT moderate to strong. MPN usually about equal to PST, its furrow narrow, sometimes forming a small, flattened triangle anteriorly, and often more-or-less strongly expanded posterad; carinae fine, sometimes several stronger. Propodeum: elongate, dorsal face almost twice as long as posterior; MG replaced by a broad ridge. APT weak to absent, PPT weak to moderate, PTC moderate to strong, broad and flat; DTC fine anteriorly, stronger and more distant on posterior part; sometimes a few are noticeably stronger than the rest. Propodeal hairs fairly dense, black, longer than MPN. Posterior face: VR quite strong but rapidly obsolescent (absent in lower half), quite strongly divergent from PTC. PFC weak on upper half, obsolescent between VR and below. Lateral extensions of S.2 groove absent or very short. Femora, especially anterior and middle, with a few coarse hairs below in fresh specimens. Hind tibia: teeth of usual size, spines about twice their height. Inner spur very short, reaching only 0.2-0.25 basitarsus length (about equal to tarsal segment 4) and about 1.2 times as long as outer spur.

Variation.— The wings in Venezuelan females sometimes have only narrow, basal infuscation.

Distinctions.— Both sexes are characterized by the wing-colour, especially the broadly infusate base (although this varies) and rather restricted distribution but identifications must be confirmed by using the structural characters, especially in view of the many sympatric species of similar appearance. In the male, the modified sternal hairs and SGP shape are characteristic; in the female, the best characters are the long AS3, slender propodeum with long hairs, lack of S.2 groove lateral extensions and very short hind tibial inner spur. Females are especially difficult to separate from those of *P. xanthocera* where they are sympatric from southern Mexico to Colombia (see table under the last species). See also under *P. chiron*.

Distribution.— This species is found from the U.S.A. (Texas) throughout Mexico and Central America to Colombia and Venezuela, ascending to about 1,700 m in Mexico; single records from Perú (♂, UCALB) and Ecuador (♀, USNM) need confirming. Map fig. 648.

Material depository.— 81 ♂♂, 116 ♀♀; AEIG, AMNH, BMNH, BRIO, CMNH, CUNY, EMMSU, FDA, INBIO, LACM, MACN, MCZ, MNHGV, MICR, MIZAM, MLU, MNHNPS, MZEL, MZUSP, OSUC, PORTER, RMNH, SEMKU, SMF, TMB, UCALB, UMBREM, UMOX, UNAN, UNPBOG, USNM, USU, UZMC, WASBAUER.

Pepsis xanthocera Dahlbom, 1843
(figs 182-186, 556, 648)

Pepsis xanthocera Dahlbom, 1843: 120, no. 2. Lectotype ♀ (MZEL), here designated [examined].

Pepsis nigrescens Smith, 1855: 196. Lectotype ♂ (BMNH), here designated [examined]. **Syn. nov.**

Pepsis fulgidipennis Mocsáry, 1885: 251, no. 19. Lectotype ♂ (TMB), here designated [examined]. **Syn. nov.**

Pepsis hecuba Mocsáry, 1885, 252, no. 22, ♀, Brazilian Amazonas, Pebas [now in Peru]. (Lost). [Synonymized by Lucas, 1895: 587].

Pepsis fusiformis Lucas, 1895: 620. [MS name cited in synonymy].

Pepsis junco Brèthes, 1908: 236. Holotype ♂ (MNHU) [examined]. **Syn. nov.**

Pepsis ismare Banks, 1946: 331. Holotype ♀ (MCZ)[examined]. **Syn. nov.**

Pepsis nigroprasina Haupt, 1952: 351, no. 7. Holotype ♂ (MLU) [examined]. **Syn. nov.**

Type-material.— *P. xanthocera*: I have seen 4 ♀♀, probably all syntypes, from MZEL. One bears the data “91; Bahia; *Pepsis xanthocera* Berl. M. ent. Er. Bahia. Smr.”; I have labelled it lectotype. One of the other 3 also bears old labels; all are paralectotypes conspecific with the lectotype. *P. nigrescens*: I have seen a single type-material male and labelled it lectotype. *P. fulgidipennis*: I have seen a single type-material male and labelled it lectotype.

Description.— ♂ (figs 182-186). BL 19-31. Body and legs black, virtually without metallic sheen. Antenna black with up to 11 segments orange. Wings black with **extremely strong blue-green-violet reflections** (see also *P. vitripennis*), occasionally with a central amber patch. S.4 with transverse patch of moderately long hair, slightly decreasing in height posterad; anteriorly with a fringe of abruptly longer hairs. S.5 with a smaller and shorter patch of hairs, lacking the anterior fringe. SGP rather strongly expanded to the rounded-truncate apex; basal part with a weak median keel beginning at a small but dense basal tuft of short hair. Paramere very short, only about as long as rest of genitalia, apex rounded. Inner projection of digitus apex strongly narrowed, but bluntly pointed and slightly turned distad.

♀ (fig 556). BL 25-43. AE index 110-139. Colour as in male but antenna usually mostly orange. In Central America the antenna is usually entirely black and the wings orange with black base and apical band. Head in dorsal view with temple and vertex moderately swollen. MT weak to moderate. MPN about equal in length to PST, its furrow rather broad, especially posterad, sometimes expanded and flattened-out anteriorly; carinae very fine, matt. Propodeum: elongate, rather strongly tapered posterad, dorsal face almost twice as long as posterior; covered with rather dense, black hairs which are much longer than MPN and weakly shining. MG a broadly-rounded ridge. APT weak, PPT weak to moderate, PTC weak to moderate, occasionally strong; it is sometimes rather broad and rounded, sometimes narrow and flat-topped. DTC rather fine, slightly irregular. Posterior face: VR usually quite strong but obsolete in lower half (occasionally entirely very weak), weakly divergent apicad. A few weak PFC on upper half only, smooth but with very fine sculpture and almost matt below. Lateral extension of S.2 groove absent or very short. Femora, especially the anterior, with some long, coarse hairs below. Hind tibia: teeth variable in shape, spines 1.5-2.0 times their height; inner spur short, reaching 0.2-0.25 basitarsus length (slightly shorter than segment 3) and about 1.5 times as long as outer spur.

Variation.— Most males have the antenna black, often with a few apical segments orange, but those seen from Trinidad have 11 segments dull orange. Most specimens of both sexes have the wings entirely black with the strength of the metallic reflections second only to that of *P. vitripennis*. However, some males from western Venezuela, Ecuador, Perú and Bolivia have a central orange-amber patch of very variable size (sometimes absent) in both fore and hind wings, the antenna also variable in colour; in females the patch is larger and less variable, resembling the pattern in *P. sommeri*; the antenna is often partly or entirely black. Specimens of both sexes from Ecuador often have the wings entirely black and the antenna almost or completely so. Males from Central America are often (always?) totally black, while the females often resemble

those of the sympatric species *P. sommeri*, with their large area of orange in the wings. Occasional specimens (especially very worn ones) may have the wings much paler (to orange-amber) without metallic reflections.

A female from Ecuador: Napo, Muyuna, 5k w Tena (BMNH) has the facial hair golden-yellow (as in many species of the *sumptuosa*-group).

Biology.— A female from Venezuela: Amazonas, Sierra de Unturan (MIZAM) is pinned with its spider prey, ?*Avicularia* sp., an arboreal group, det. A. Smith.

Some males belong to the *completa* mimicry-group.

Distinctions.— Males of this species need distinguishing carefully from those of *P. discolor* where the species are sympatric along the Amazon and southwards; in the latter species, the hairs of S.4 are much sparser, and do not become gradually shorter posterad in profile but are of generally mixed lengths. Females are distinguished from those of *P. festiva* by the distinct lateral extension of the S.2 groove (absent or vestigial in *P. xanthocera*), propodeal hairs only moderately long and rather sparse (very long and dense), variable number of AS orange, but usually starting at base of AS3 (antenna usually entirely black in Central American specimens). Both sexes are distinguished from those of *P. seifferti* as given under that species. Where this species is sympatric with *P. sommeri* in Central America, males are easily distinguished: in profile the S.4 hairs are gradually stepped-down posterad in *P. sommeri*, while they are of two main lengths and hence step down abruptly in *P. xanthocera*. Females can be very difficult to separate from those of *P. sommeri* in their sympatric zone (southern Mexico to Colombia). The following table will help to distinguish them.

Table to separate females of *Pepsis sommeri* and *P. xanthocera*:

Note.— The characters in **bold** appear to be the least variable.

<i>P. sommeri</i>	<i>P. xanthocera</i>
PTC usually rather broad and flat-topped or shallowly arcuate in anterior view.	PTC usually narrow and strongly arcuate in anterior view.
VR usually strong, more-or-less parallel.	VR usually weak, often strongly divergent downwards.
DTC & PFC often much stronger near PTC.	DTC & PFC a little stronger near PTC.
Forewing with apical, dark band diverging rapidly from radial cell after leaving costa, or totally clear of radial cell (figs 568, 569).	Forewing with apical, dark band leaving little more than a vein-width clear along anterior half of radial cell (fig. 556).
Forewing with often less than basal one-third dark.	Forewing with usually at least basal one-third dark.
Antenna usually mainly orange.	Antenna usually entirely black.
Propodeal hair length about equal to PST and half MPN lengths together.	Propodeal hair length about equal to PST and MPN lengths together.

Females need careful separation from those of *P. lepida* where they are sympatric in Central America. The following table will assist in this.

<i>P. xanthocera</i>	<i>P. lepida</i>
Larger species, BL 25-43.	Smaller species, BL 16-34.
Antenna black or partly orange.	Antenna usually partly yellow.
DTC fine, partly obscured by very long, dense hair.	DTC fairly strong, not obscured by the sparse, shorter hairs.
VR strong.	VR weak.

Hind tibial spurs short, thick.	Hind tibial spurs longer and more slender than usual.
Many strong, backwardly-curved hairs on inner side of hind tibial teeth.	Few, very weak backwardly-directed but not curved hairs on inner side of hind tibial teeth.
SMC3 not unusually short anteriorly and only rounded postero-distally.	SMC3 short anteriorly and strongly projecting postero-distally.

Distribution.— Found from south Mexico southwards to the west coast of northern Perú, and everywhere east of the Andes south to northern Argentina; ascending to 2,000 m in Bolivia. Map fig. 648.

Material depositories.— 117 ♂♂, 305 ♀♀; AEIG, AMNH, ANSP, BMNH, BONELLI, BRIO, CARPENTER, CAS, CMNH, CUNY, EMMSU, ETHZ, FDA, FRITZ, IMLT, INBIO, INPA, LACM, MACN, MCZ, MICR, MHNGV, MHNNEU, MIZAM, MLU, MNHNPS, MNHU, MNRJ, MPEG, MZEL, MZFIR, MZUSP, NMW, NRS, PUCEQ, RMNH, RSM, SEMKU, SMF, TMB, UCALB, UFPCUR, UFVIC, UMBREM, UMOX, USNM, UZMC, WAHIS, WASBAUER, WILLIAMS, ZMMOSC, ZSM.

Pepsis seifferti Lucas, 1895
(figs 239-244, 603-605, 649)

Pepsis seifferti Lucas, 1895: 561, no. 44. Lectotype ♂ (MNHU), here designated [examined].

Pepsis cornuta Lucas, 1895: 641, no. 82. Lectotype ♂ (NMV), here designated [examined]. **Syn. nov.**

Pepsis moebiusi Lucas, 1895: 694, no. 115. Lectotype ♀ (MNHU), here designated [examined]. **Syn. nov.**

Pepsis stygia Lucas, 1895: 695, no. 116. Lectotype ♀ (MNHU), here designated [examined]. **Syn. nov.**

Type-material.— *P. seifferti*: I have seen a single type-material ♂ and labelled it lectotype. *P. cornuta*: I have seen a single ♂ syntype from Bahia [Brazil], which I have labelled lectotype. *P. moebiusi*: I have seen a single type-material ♀ and labelled it lectotype. *P. stygia*: I have seen a single type-material ♀ and labelled it lectotype.

Description.— ♂ (figs 239-244). BL 23-26. Body and legs black, antenna black with sometimes a minute, dull orange apical spot. Wings very dark with fairly strong blue-violet reflections, the veins sometimes very weakly outlined paler. S.4 with a large patch of moderately dense hairs, as long as maximum width of hind femur and quite strongly incurved, not quite meeting in the middle, thus more-or-less forming an arc. Centrally there are a few shorter, straighter, less dense hairs. S.5 has a few short hairs across the posterior part, mainly in sparse lateral tufts, i.e. effectively not modified. SGP rather broad, moderately strongly expanded towards the rounded apex, which has short hairs; towards the base, the SGP becomes double-edged, with the edge continuous with the apical part slightly raised and polished with a slight elongate depression near and parallel to it. Paramere short, only as long as the rest of the genitalia, **with a small but sharp, inward-pointing spine at the apex – a diagnostic character**. Inner projection of digitus apex very broad, round-ended.

♀ (figs 603-605). BL 28-34. AE index 110-125. Colour as in male but with a more extensive but poorly-defined orange apical spot on the last antennal segment, and narrow, apical rings on a few of the more distal segments. MT Moderate to strong. SMC3 of forewing long anteriorly, more “square” than usual, distal vein straighter than usual. MPN equal in length to PST, its furrow broad and expanded still further

posteriorly; carinae fine, matt. Propodeum: MG scarcely indicated anteriorly, replaced by a strong ridge, rounded medially and flattened at the sides. APT weak, PPT weak to moderate. DTC mostly extremely fine, sometimes a few slightly stronger ones mixed in, and usually a few much stronger ones posteriorly. PTC quite strong, narrow, occasionally double. Propodeal hair about as long as PST. Posterior face: VR strong, obsolescent apicad (usually obsolete by mid-point), divergent from PTC then reconvergent below; PFC strong above and gradually weaker apicad, replaced by fine, matt sculpture only medially below; rest of surface somewhat shining. Lateral extension of S.2 groove deep and long. Hind tibia: teeth rather small, narrow, upright; the subtending spines strong, slightly curved and strongly directed backwards, as also is a fairly dense line of setae on the inner side of the teeth; teeth with extremely short but dense hair between. Inner spur rather short, reaching to (0.2-)0.25-0.3 basitarsus length (about equal to tarsal segment 3 or slightly less), and 1.1-1.2 times as long as outer spur.

Variation.— Only as noted above.

Distinctions.— The male differs from others as follows: *P. fumipennis*: [see under that species]; *P. crassicornis*: S.5 with more and longer hairs than S.4; *P. xanthocera*: S.4 with sparser, less curved hairs, not forming an arc; SGP very strongly expanded apicad and widest at the apex; paramere weakly pointed apically; *P. discolor*: very similar but allopatric; differs in (characters of *P. seifferti* in parentheses): elongate shape of SMC3 (more square); DTC almost entirely strong (mainly fine); VR virtually absent, indicated only by slightly raised PFC at relevant points (strong in upper half); S.4 hairs weakly curved (strongly); S.5 with longest hairs, although few, centrally (laterally); paramere long, about 1.5 times as long as rest of genitalia, apex round-pointed, no spine (short, equal to rest of genitalia, apex truncate, **with a unique inward-pointing spine**).

The female is distinguished as follows: *P. fumipennis*: [see table under that species]; *P. crassicornis*: head in dorsal view swollen behind eyes; SMC3 less square; dorsum of propodeum punctate between carinae; VR further apart, fully 1/3 of distance between PPT, and smooth between; *P. xanthocera*: very strong blue-violet reflections on wings; antenna usually orange from AS3; head scarcely swollen behind eyes; AS3 longer; propodeum strongly tapered posterad; lateral extensions of S.2 groove vestigial; *P. discolor*: very similar but allopatric; differs in (characters of *P. seifferti* in parentheses): AS3 shorter than UID (longer); head in dorsal view strongly swollen behind eyes (weakly); SMC3 shape, as in male; propodeal dorsal face scarcely longer than posterior (about 1.5 times as long); DTC, as in male; VR, as male; hind tibia with: no hairs between teeth (many fine hairs between teeth, about half as high as the latter); inner spur reaching to about 0.4 basitarsus length (0.2), and about equal to tarsal segment 2 (segment 3); *P. festiva*: antenna usually with extensive orange colour (mostly black), head less swollen (more), SMC3 long, bulging posterodistally (shorter, scarcely bulging), inner spur of hind tibia longer (shorter).

Distribution.— Known only from eastern Brazil, including the Lower Amazon; at low altitudes. Map fig. 649.

Material depositories.— 7 ♂♂, 18 ♀♀; BMNH, CMNH, MCZ, MHNGV, MNHU, MNRJ, MZUSP, NMV, RSM, UCALB, USNM, WILLIAMS.

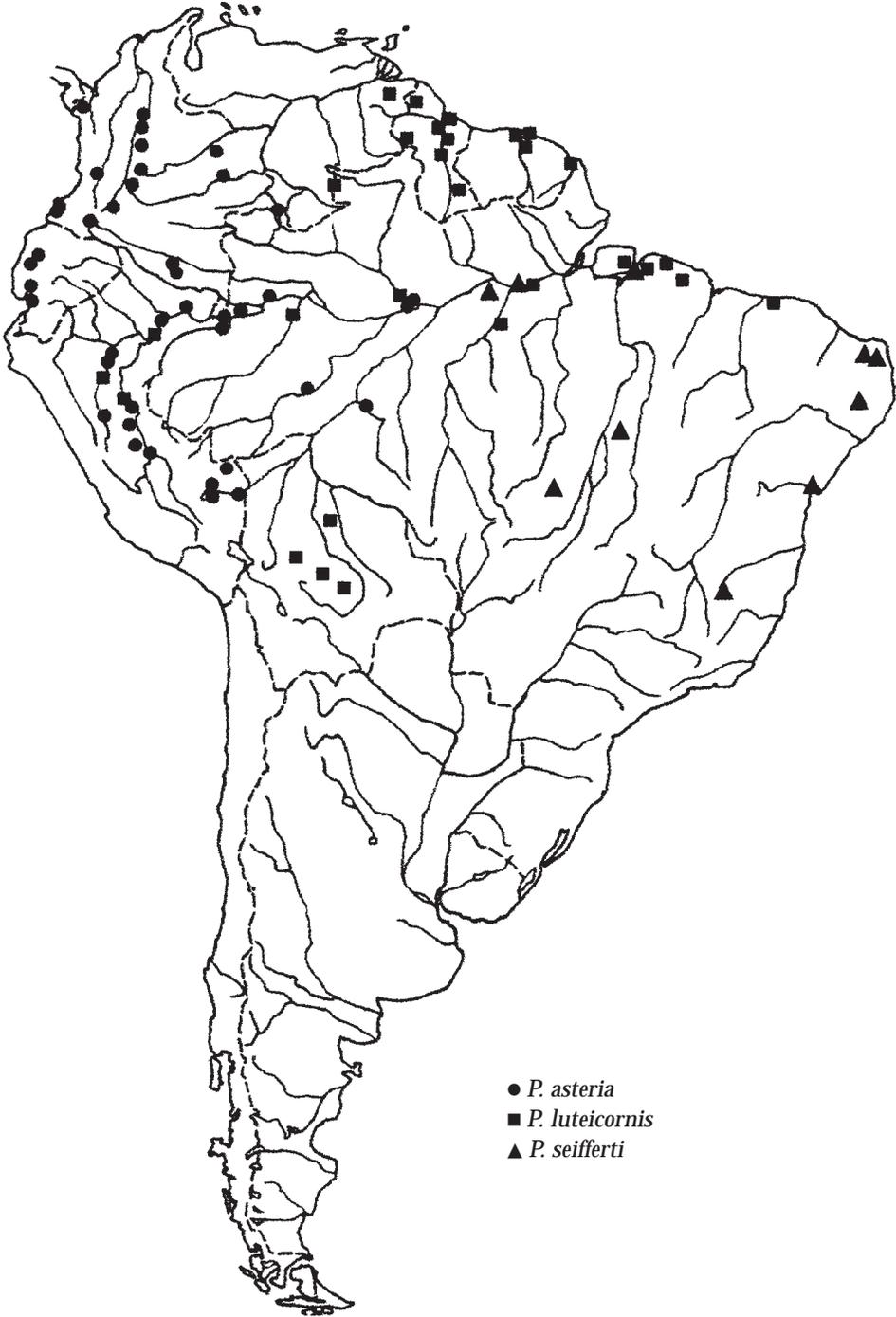


Fig. 649. Collection localities of *Pepsis asteria*, *P. luteicornis* and *P. seifferti*.

Pepsis luteicornis Fabricius, 1804
(figs 215-220, 541, 542, 649)

Pepsis luteicornis Fabricius, 1804: 214, no. 35. Lectotype ♂ (UZMC), here designated [examined].

Pepsis strenua Erichson, 1848: 588. Lectotype ♀ (MNHU), here designated [examined]. **Syn. nov.**

Pepsis tinctipennis Smith, 1873: 50. Lectotype ♀ (BMNH), here designated [examined]. **Syn. nov.**

Pepsis citreicornis Mocsáry, 1894: 11, no. 19. Lectotype ♂ (TMB), here designated [examined]. **Syn. nov.** [*Salix kirbyi* Bingham; Kaye, 1913: 7. Misidentification].

Pepsis venosa Banks, 1945: 85. Lectotype ♀ (MCZ), here designated [examined]. **Syn. nov.**

Pepsis alector Banks, 1946: 370. Holotype ♀ (CUNY) [examined]. **Syn. nov.**

Type-material.— *P. luteicornis*: Petersen (pers. comm.) noted 5 ♂ specimens in Copenhagen referable to *P. luteicornis*, 3 in UZMC, 2 in UZMC(K). One of the two latter specimens has an original label “*luteicornis*” and both are labelled *P. luteicornis* by Wahis. One of the specimens in UZMC has an original Fabrician label “*P. luteicornis* ex Amer: Schmidt”; I have seen this specimen and labelled it lectotype. The remaining 4 specimens are paralectotypes. *P. strenua*. I have seen a single type-material ♀ and labelled it lectotype. *P. tinctipennis*. I have seen a single type-material ♀ and labelled it lectotype. *P. citreicornis*. I have seen 3 conspecific ♂ syntypes (all with identical original labels), and labelled one of them lectotype. The other 2 are paralectotypes. *P. venosa*. Since Banks evidently confused the data of his type-specimens, full details of the specimens I have seen are given here. Banks stated “Type from Cayenne (Le Moul), paratype Moengo, Boven, Cottica River, Suriname, 16 May (Cornell). Type M.C.Z. no. 26689.” This gives the impression that he saw only two specimens, whereas it seems that he saw four. I have seen 4 conspecific ♀♀, labelled (1): Suriname [white label]; M.C.Z./Type/26689 [red label]; *Pepsis*/(*Stenopepsis*)/*venosa*/ type Bks [handwritten on red-edged label] (MCZ). (2): Moengo, Boven/CotticaR. SURINAME/May 16 1927 [white label]; Cornell U./Lot 760/Sub 59 [white label]; *Pepsis*/(*Stenopepsis*)/*venosa*/ paraty Bks [handwritten on black-edged label]; PARATYPE/Cornell U./No.2491 [blue label](CUNY). (3): [exactly the same labels, including Banks’ handwritten identification label, except that the date is May 21 1927; the second white label reads “Sub 69”; and there is no blue label] (CUNY); (4): [exactly as (3) but with only the first two labels; the first of which bears the date May 18 1927] (MCZ). I have labelled as lectotype the first-mentioned specimen in MCZ and the other one, also the two in CUNY, as paralectotypes. I have seen no type-material from Cayenne; Banks may have accidentally taken this data from a specimen of a different species.

Description.— ♂ (figs 215-220). BL 15-33. Body and legs black with dark metallic green or violet sheen; antenna with 0-11 segments orange or yellow; wings pale orange with a dark border, varying to entirely black. S.4 with a very narrow, transverse line of rather sparse hairs; the laterals long, curved strongly inwards and backwards; towards the middle, changing abruptly to very sparse, short, thin, straight hairs. S.5 with a sparse, transverse line of hairs similar to the short ones of S.4. SGP flat, with edges slightly upturned in basal half; sides very weakly expanded to the rounded, often slightly pointed apex which has a fringe of hairs about as long as the basal (i.e. minimum) width of the SGP. Paramere very long, about 1.5 times as long as the rest of the genitalia, apically pointed and also with long hairs. Inner projection of digitus apex with a slender point, slightly turned distad.

♀ (figs 541, 542). BL 21-35. AE index 96-122. Colour of body and legs as in male, but antenna much darker on average, with at most 7 apical segments orange. Wings dark brown with apical one-third yellow-amber, to entirely pale amber with a pale or dark apex (see Variation). Head in dorsal view with temple strongly constricted, but head fairly deep from front to back (globular-triangular). MT weak to moderate. MPN equal to or slightly shorter than PST, furrow broad, occasionally narrow, usually not reaching anterior margin; carinae extremely fine, sometimes 1-2 stronger, matt. Propodeum: MG occasionally weakly indicated anteriorly, more usually replaced by a broad ridge, which is often flat-topped. APT moderate to strong, PPT moderate to strong, PTC weak to strong, DTC fine to moderate, becoming stronger and more distant apicad, dorsum with only a few longer hairs anteriorly. Propodeal hair absent from usual position used for comparison (see Abbreviations in Introduction), but those just below are usually about 2/3 PST length. Posterior face: VR quite strong, more-or-less bowed outwards centrally; PFC strong and regular, weaker below and rapidly obsolescent between VR. Lateral extensions of S.2 groove very variable, most often short and/or weak. Hind tibia: teeth vestigial, the subtending spines about as long as minimum (basal) tibia width; with a row of rather long, backwardly-directed hairs on the inner side of the teeth. Inner spur short, reaching to 0.25-0.3 basitarsus length (about equal to tarsal segment 3) and 1.1-1.2 times as long as outer spur.

Variation.— The metallic body sheen is stronger in Peruvian specimens of both sexes than in specimens from other areas.

Male: antennal colour varies from entirely bright lemon-yellow (except the 2 basal segments) in the Guianas and Lower Amazon, to entirely black in Perú; in the latter, however, at least the tip of the last segment is usually orange. The wings are black in the Guianas; on the Amazon they are moderately infusate, often with a slightly darker border, while in Perú they are deep orange-amber with a usually distinct, dark, narrow border. A single aberrant male from Brazil: Belém do Pará has long hairs on each side of S.5, resembling those on S.4 but fewer, and the SGP apex is a little more broadly rounded than usual, with a narrowly translucent margin. The specimen is normal in other respects.

Female: in the Guianas, the antenna has a very few antennal segments obscurely orange, and similar along at least the Lower Amazon; in Perú more segments are brighter orange. The wing colour in specimens from Guiana is like that of no other species: it is dark brown with the apical one-third of the forewing a rather bright yellow-amber, the junction of the colours zigzag but usually distinct (very diffuse in one specimen). The extreme apex of the hindwing is the same yellow colour. In Cayenne and Suriname, however, the wings are entirely yellow-amber with a slightly paler apex and an extremely narrow, weak, dark band around the extreme apex. On the Amazon, and especially in Perú and Bolivia, an apical dark border becomes increasingly apparent while the pale colour of the extreme apex often disappears. The lateral extensions of the S.2 groove are very variable: they are distinct in most large specimens, sometimes vestigial in small ones; specimens from the eastern Andes have a higher than average AE index.

Distinctions.— The male is very similar to that of *P. elongata* in general appearance, but the latter has the S.4 hair-brushes less transversely oriented, denser, and with a distinct gap between; also a semi-cylindrical SGP rather than the essentially flat one of *P. luteicornis*. The male also needs careful distinguishing from other males with weak S.4 hairs, e.g. *P. asteria*, which see.

Females from only Guyana exhibit a totally distinct wing-colour (“chocolate and lemon”), unique in the genus except that a single, aberrant female of *P. infuscata* duplicates it, and some variants of *P. hymenaea* (Part 2, p. 75) somewhat resemble it; those from the other Guianas and elsewhere must be distinguished on the basis of the extremely small hind tibial teeth and dorsal propodeal sculpture: the regular DTC virtually without hair cover imparts a characteristic, very “hard” appearance. The usually weak lateral extensions of the S.2 groove also help to characterize the female.

Biology.— This species (Kaye, 1913: 7 [as *Salix kirbyi*]) is mimicked by the syntomid moth *Pterygopterus caeruleus* Hampson.

Distribution.— Found in the Guianas and along the entire Amazon mainstream, but apparently not penetrating further south except in the eastern Andes, where it ascends to 1,600 m in Bolivia. There is a single record from Colombia, but without further locality (1 ♂, FSAG); none from Ecuador. Map fig. 649.

Material depositories.— 108 ♂♂, 50 ♀♀; AMNH, ANSP, BMNH, CMNH, CUNY, ETHZ, FSAG, LACM, MCZ, MIZAM, MNHNPS, MNRJ, MPEG, MZ FIR, MZUSP, NMV, NMW, OSUC, PAGLIANO, RSM, TMB, UMBREM, UMOX, USNM, WAHIS, ZMMICH, ZSM.

Pepsis asteria Mocsáry, 1894
(figs 257-262, 577, 578, 649)

Pepsis asteria Mocsáry, 1894: 4, no. 5. Lectotype ♀ (TMB), here designated [examined].

Pepsis luridicornis Brèthes, 1926: 10. Lectotype ♂ (MACN), here designated [examined]. **Syn. nov.**

Type-material.— *P. asteria*: I have seen 2 ♀ syntypes and have labelled the slightly larger one (locality Iquitos) as lectotype. The paralectotype (locality Yurimaguas) is conspecific. *P. luridicornis*. I have seen a single type-material ♂ and labelled it lectotype.

Description.— ♂ (figs 257-262). BL 18-28. Body and legs black, sometimes with an extremely weak metallic sheen, sometimes with patterns of brassy pubescence (see Variation). Antenna lemon-yellow with 2-7 basal segments black. Wings slightly infusate yellowish-amber to fairly strongly infusate, the apex sometimes slightly paler. S.4 with a very sparse patch of long, black or brown lateral hairs, mostly long and curved inwards and backwards; in the centre are a few much shorter hairs, and along the posterior margin of the sternite is a band of very dense, short hairs. S.5 has a similar but much sparser posterior band, sometimes with a few longer hairs on each side. SGP flat, the edges slightly upturned in the basal half, the sides very slightly expanded towards the strongly-rounded (sometimes slightly truncate) apex; the latter bears a fringe of long hairs a little shorter than SGP basal width. A weak median ridge, obsolescent apicad, extends from the base. Paramere very long, about twice as long as rest of genitalia, also with very long apical hairs. Inner projection of digitus apex more-or-less slender, sometimes slightly turned distad.

♀ (figs 577, 578). BL 25-42. AE index 116-128. Colour as in male except that body pubescence is darker and restricted to head, thorax and propodeum; the antenna has up to 8 basal segments black, and the rest orange. The forewing apex is often more distinctly pale. Head in dorsal view with temple scarcely swollen (although vertex often moderately so). MT moderate to strong. MPN slightly shorter than PST, its furrow narrow, often

flattened-out anteriorly and more-or-less expanded posteriorly; carinae very fine, matt. Propodeum: MG sometimes indicated weakly anteriorly, otherwise replaced by a very broad ridge. APT weak to strong, PPT strong to very strong. PTC strong to very strong, rounded. DTC strong, regular, scarcely pubescent, imparting a very "hard" appearance (as in *P. luteicornis*). Propodeal hair about as long as PST, but very often totally abraded. Posterior face: VR rather weak, strongly divergent from PTC (except when the latter is very wide), rapidly obsolescent apicad; PFC weak to strong above, weaker below, but often not obsolete. Lateral extension of S.2 groove weak or absent. Femora, especially the anterior, with fairly abundant (but not dense) hairs below, of very mixed length and thickness and soon partly abraded, the longest about equal to minimum femur thickness. Hind tibia: teeth usually tiny (but sharp), distant; the subtending spines 2-3 times as high; on the inner side of the teeth is a line of backwardly-directed bristles (sometimes the proximal ones are more decumbent than the others, appearing at first sight to be missing); inner spur reaching to 0.2-0.4 basitarsus length (varying in length between tarsal segments 2 and 3) and 1.2-1.5 times as long as outer spur.

Variation.— This transandean species exhibits obvious population differences in colour but more subtle ones in structure. In specimens from the eastern watershed, the whole body (except the gaster in females) often has conspicuous patterns of golden pubescence, and the wings are dirty yellowish in the males, weakly infuscate in the females (in the latter the pale forewing apex is more distinct). In males from the western watershed the wings are fairly strongly infuscate, in females less so and tending to orange-brown; the pubescence patterns in both sexes are much more restricted and darker, i.e. not conspicuous. Also, the pale forewing apices are less distinct in both sexes. In eastern males the sternal and SGP hairs are brown, in western ones black. Examples of structural differences are: in eastern males, the paramere is usually more rounded sub-basally on the inner side (more obtusely angulate in western); the inner projection of the digitus apex is more robust on average in eastern than in western specimens. In view of the greater variation in female structure generally, such differences are much more difficult to define in that sex.

Distinctions.— Both sexes are very similar in appearance to those of *P. luteicornis* in the western Amazon basin, where the species are sympatric. In the male of the latter species, the S.4 hairs are shorter, denser and more separated into lateral groups and there is no posterior band of short, dense hairs; on the other hand, S.5 has a transverse band of fairly strong hairs. The antenna is mainly black rather than mainly lemon-yellow (but *P. luteicornis* males have the antenna lemon-yellow in the Lower Amazon where *P. asteria* is not known to occur). The female of *P. asteria* is similar to that of *P. luteicornis* but has (characters of latter in parentheses): distinct pale forewing apex (narrowly infuscate border); more slender antenna, hence higher AE index (antenna thicker, with lower AE index); virtually no lateral extension of S.2 groove (at least a short one); golden pubescence pattern on body (lacking); tiny but sharp hind tibial teeth (vestigial, blunt).

Biology.— Some specimens are full members of the *plutus* mimicry-group (i.e. have much golden body hair), some not, while others are intermediate, with only little golden hair.

Note.— The degree to which individuals pertained to the mimicry-group was not recorded for all specimens; accordingly, one map is given for all records of the species,

and another for the mimicry-group records alone. Although the last is incomplete, it appears that no west-Andean specimens belong to the mimicry-group; also that where the phenomenon does occur, it is very irregular in its distribution.

Distribution.— Found from Central-American Colombia (Darién) southwards on the west coast to Ecuador, and east of the Andes in Colombia, Ecuador and Perú, ascending to at least 1,700 m, and eastwards along the Upper Amazon as far as Manaos. Map fig. 649.

Material depositories.— 29 ♂♂, 33 ♀♀; AMNH, BMNH, CAS, CMNH, COOPER, CUNY, FDA, FRITZ, MACN, MCZ, MEM, MLU, MNHNPS, MNRJ, MZUSP, NMV, PMA, SMF, TMB, UMBREM, UNCBG, UNPBG, UPAN, USNM.

Pepsis laetabilis Brèthes, 1908
(figs 39-44, 558, 650)

Pepsis laetabilis Brèthes, 1908: 241. Holotype ♂, Paraguay, Encarnación (lost).

Description.— ♂ (figs 39-44). BL 16-29. Body and legs black with metallic blue-green or violet sheen. Antenna black, except sometimes a tiny apical spot orange. Wings orange-amber, more-or-less narrowly infuscate basally, and with a moderately to weakly infuscate apical band, more distinct on the forewing, where it covers most of the area beyond the cells and sometimes spreads along the anterior edge of the radial cell; often invisible in worn specimens. Whole length of S.4 with quite dense but extremely short hair, mainly lateral, rapidly becoming shorter and sparser centrad; S.5 with similar but slightly longer hairs. SGP scarcely expanded towards the rounded-truncate, narrowly translucent apex, and with a weak sub-apical impression. Paramere bluntly pointed, about 1.5 times as long as the rest of the genitalia, with apical hairs shorter than paramere width; apical projection of digitus sharply angulate but not narrowly extended.

♀ (fig. 558). BL 30-37. AE index 74-78. Antenna black, AS3 onwards usually with brown apical rings, last segment mainly obscure brown. Forewing with anterior part of radial cell weakly infuscate, area beyond cells more strongly so. Head with vertex and temples very strongly swollen. MT moderate to very strong but not very sharp. Forewing with proximal vein of SMC3 (1 r-m) strongly sloping antero-distally, so that the postero-basal veinlet of SMC3 is about equal to the postero-distal veinlet. MPN equal to or slightly shorter than PST, its furrow evenly broad, sometimes not reaching anterior margin; carinae fine to very fine. Propodeum: MG ridge broad, low. APT moderate, PPT and PTC weak to moderate. DTC moderately coarse (coarser in larger specimens). Propodeal hair shorter than PST. Posterior face: VR extremely weak, distant; PFC strong above, becoming weaker below, all obsolescent towards the midline, where they are replaced by a broad area of microsculpture (the latter also found between the PFC). Lateral extension of S.2 groove well-developed but sometimes rather short. Femora with some coarse hair below [none of the females examined are in good enough condition to assess this character properly]. Hind tibia: teeth of usual size, the subtending spines about twice as high; inner spur reaching 0.25-0.3 basitarsus length (as long as or slightly shorter than tarsal segment 3), and equal to outer spur.

Variation.— As given above.

Distinctions.— The male is at once distinguished by the extremely short, mainly

lateral hair on S.4 and 5, which at first sight creates the impression of a very worn specimen of some other species. The most distinctive female characters are the strongly swollen head, orientation of the proximal vein of SMC3, propodeal hair shorter than PST, and hind tibial spurs of equal length. It resembles *P. thoreyi* in general appearance but has a much more strongly swollen head. It is even more similar to the female of *P. aciculata* (with which it is largely sympatric), but differs as follows (*P. aciculata* characters in parentheses): medium-sized species (small); 1 r-m strongly oblique, thus altering the shape of SMC3 (normal, more transverse); coarser DTC (fine); femora with some coarse hair (almost without); hind tibial inner spur reaching about 1/4 basitarsus length, about equal to outer spur (1/3, longer).

Distribution.— Known only from Brazil (Santa Catharina), Paraguay (Encarnación) and Argentina (Buenos Aires, eastern Córdoba, Entre Ríos, Misiones and Santa Fé) always at low altitude. Map fig. 650.

Material depositories.— 17 ♂♂, 11 ♀♀; BMNH, EMMSU, IMLT, MACN, MLP, MNS, OLLD, TMB, USNM, ZSM.

Pepsis optimatis Smith, 1873
(figs 331-336, 557, 650)

Pepsis optimatis Smith, 1873: 50. Lectotype ♀ (BMNH), here designated [examined].

Type-material.— *P. optimatis*. I have seen a single type-material ♀ and labelled it lectotype.

Description.— ♂ (figs 331-336). BL 18-25. Body and legs black with blue or green metallic sheen; entire body from pronotum to propodeum, except mesoscutum, usually with abundant, dense golden hair. Antenna variably bright orange from AS2 onwards. Wings orange-amber (when usually with a narrow, indistinct dark apical border) to fairly heavily infusate. PPT and PTC very strong. S.4 with lateral tufts of fairly long and dense hairs, sloping inwards and backwards, apically strongly hooked; between and behind them are dense, shorter, straight hairs. S.5 with short, rather sparse, lateral patches of straight hairs. SGP with basal half slightly flattened and expanded laterally, the sides slightly turned up; apical half slightly bent up, convex and in outline strongly rounded, with fairly dense, short hairs. Paramere rather narrow, about 1.5 times as long as rest of genitalia. Apex of digitus with bluntly-pointed inner projection.

♀ (fig 557). BL 24-38. AE index 90-104. Colour as in male. Head in dorsal view with temples and vertex moderately swollen. MT weak to moderate. Forewing with PPV strongly transverse, SMC3 rather elongate. MPN distinctly shorter than PST, its furrow beginning short of the anterior margin, very narrow but gradually broadening apicad until finally quite wide; carinae fine, hidden except near furrow, often somewhat oblique. Propodeum: strongly quadrate; MG replaced by a strong ridge, broadest anteriorly; APT moderate to strong; PPT and PTC strong to very strong. DTC moderate to rather coarse, usually hidden by pubescence. Propodeal hair of 2 kinds: long (about as long as PST), moderately dense; and shorter, appressed and very dense. Posterior face: VR fairly strong near PTC, slightly divergent, becoming obsolete by about mid-face. PFC similar to DTC above, gradually weaker apicad. Lateral exten-

sion of S.2 groove fairly strong. Hind tibia: teeth rather small, the subtending spines 2.0-2.5 times as high; on the inner side of the teeth in fresh specimens is a sparse row of rather long, backwardly-directed setae; inner spur rather short, reaching to only about 0.2-0.25 basitarsus length (about equal to tarsal segment 3); 1.25-1.50 times as long as outer spur.

Variation.— In Amazon specimens, the wings are more-or-less heavily infuscate (but leaving the veins outlined in amber) and the body has dense, brassy pubescence; the further south, the paler the wings and the less bright the pubescence, until northern Paraguay, where the wings are entirely amber with a weak, narrow dark border and the body is entirely blue-black except for weak patches of dull brownish pubescence not visible to the naked eye (note that only one male, and no females, have been seen from Paraguay). Specimens from the Mato Grosso display a range of intermediate variation.

Distinctions.— Both sexes are usually instantly recognizable by their small size, brassy pubescence and very strong propodeal projections; the latter remains diagnostic in those specimens with dull hair. The male sternal hairs and SGP are also distinctive.

Biology.— Specimens of both sexes from the northern part of this species' range (and some from further south, where intermediates also occur) belong to the *plutus* mimicry-group.

Distribution.— The currently known range of this species is unusual: it extends from the Lower Amazon, extending southwards in an apparently rather narrow band (possibly the result of under-collecting) to northern Paraguay; always at low altitude. Map fig. 650.

Material depositories.— 27 ♂♂, 14 ♀♀; ANSP, BMNH, CMNH, FRITZ, MCZ, MPEG, MNHNPS, MNHNPG, MNRJ, MZUSP, TMB, UCALB, WASBAUER, WILLIAMS.

Pepsis convexa Lucas, 1895
(figs 429-434, 606, 650)

Pepsis convexa Lucas, 1895: 689, no. 110. Lectotype ♀ (MLU), here designated [examined].

Pepsis humeralis Brèthes, 1914: 294, no. 55. Holotype ♂ (MZUSP) [examined]. **Syn. nov.**

Type-material.— *P. convexa*: I have seen a single type-material ♀ from "Rio d. Jan." and labelled it lectotype. This specimen and its labels agree perfectly with most of Lucas' description; furthermore, there is evidence that this is the only specimen he saw: "the specimen I have before me"; a single set of measurements; no variation in any other character; the single locality. However, Lucas also says: "the UID is equal to the AS3 in the larger specimen, or greater in the smaller specimens". In the lectotype the UID is less than the AS3, i.e. it disagrees with both. Perhaps this latter part of Lucas' account was transferred in error from that of another species; however, he also sometimes described a species on the basis of only one of multiple specimens he had before him - see for example the comments under *P. nigrocincta* in the synonymy of *P. menechma*.

Description.— ♂ (figs 429-434). 22-28. Body and legs black with dark blue-green metallic sheen. Antenna entirely black. Wings strongly infuscate with very weak blue-violet reflections; occasionally the forewing apex is slightly paler. S.4 with a large,

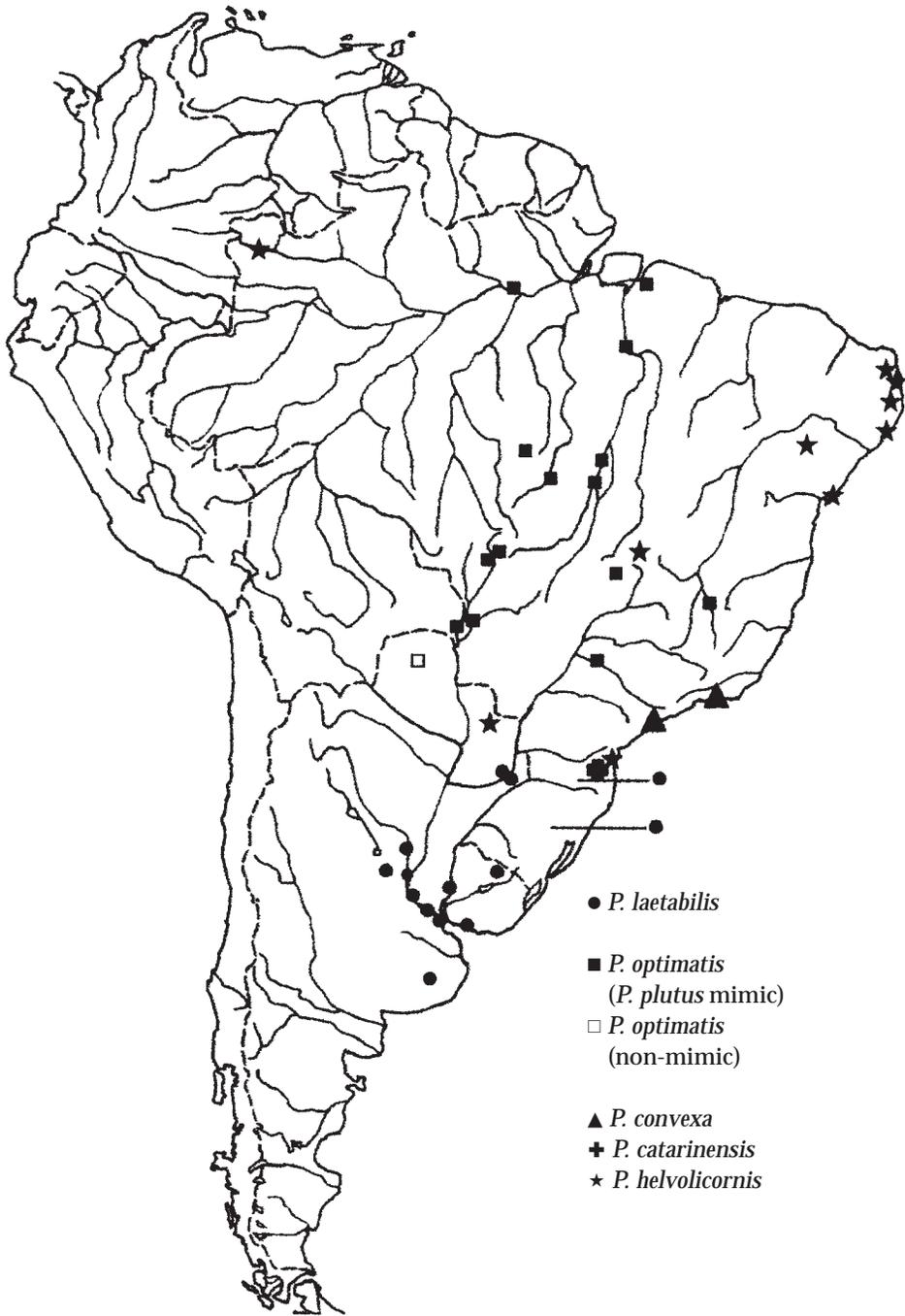


Fig. 650. Collection localities of *Pepsis laetabilis*, *P. optimatis*, *P. convexa*, *P. catarinensis* and *P. helvolicornis*.

lateral, fairly dense hair patch, the hairs long and directed strongly inwards and backwards, the extreme apices strongly hooked, not or scarcely touching those of opposite side; between the two patches are numerous short hairs. S.5 with a few long, irregular hairs anteriorly. SGP elongate, the apex slightly expanded, rounded; apical hairs at most as long as half maximum width of SGP. Paramere rather narrow, blunt, about as long as rest of genitalia. Inner projection of digitus apex rather sharply pointed and turned slightly distad.

♀ (fig 606). BL 32-40. AE index 104-114. Colour as in male but slightly darker; occasionally the last antennal segment has an apical orange spot. Head in dorsal view with temple slightly swollen, AS3 appearing rather long, sometimes with a few bristles on the inner side near the base. Forewing with stigmal fenestra rather broad; PPV short, rather transverse; SMC3 long, 1r-m strongly sloping antero-distally and slightly curved anteriorly, 2r-m more-or-less strongly bent just behind middle. MT moderately strong, blunt or sharp. MPN a little shorter than PST, its furrow rather broad, more-or-less strongly expanded posteriorly (see Variation); carinae very fine. Propodeum: MG absent (see below). APT and PPT moderately strong, usually almost tooth-like; PTC absent, but the posterior part of the dorsal face is often slightly sunken, causing the median ridge (which replaces the MG) to become accentuated; at the beginning and end of this area are one or two slightly stronger DTC; these latter are strong and regular before the area, slightly stronger within it, and only slightly weaker behind it. There is accordingly no defined posterior face, and no VR. Propodeal hair about as long as MPN. Lateral extension of S.2 groove well-developed. All femora have more-or-less abundant hair below. Hind tibia: teeth often more-or-less rounded (the anterior side often slightly angulate near the base, so that the teeth appear bevelled), crowded, the subtending spines 2-3 times as high; inner spur reaching to about 0.25 basitarsus length (about equal to tarsal segment 3 or slightly shorter) and scarcely longer than outer spur.

Variation.— In the female, the MPN furrow is very variable anteriorly; sometimes reaching the anterior margin complete, sometimes in attenuate form, sometimes not at all.

Distinctions.— The male is very similar to that of *P. catarinensis* but that species lacks the dense, shorter hairs in mid-S.4; has a distinctly keeled SGP; and some apical antenna segments orange. The female of *P. convexa*, with its strongly convex propodeum and strong DTC but lacking a PTC or posterior face, is quite distinctive. Both sexes are much larger than, and allopatric from, any other species likely to be confused with them.

Distribution.— Known only from a small area of eastern Brazil (vicinity of Rio de Janeiro and São Paulo states), at low altitudes. Map fig. 650.

Material depositories.— 6 ♂♂, 7 ♀♀; BMNH, MLU, MNRJ, MZUSP, UCALB, UMOX, UZMC, ZSM).

Pepsis catarinensis spec. nov.
(figs 423-428, 650)

Type-material.— Holotype ♂, **Brazil**: Santa Catarina, Rio Vermelho (Dirings); iv.1949 [back of label] (MZUSP).

Etymology.— Named after the type locality.

Description.— ♂ (figs 423-428). BL 26. Body dark blue-green, antenna black, wings strongly infusate. Head in dorsal view strongly swollen behind eyes. MT very large but blunt. PPV very long, about equal to the first abscissa of the radial vein. SMC3 narrow anteriorly, its distal vein strongly bulging posteriorly. MPN as long as PST, its furrow broad, becoming broader still posterad; carinae very fine. Propodeum rather short, anterior two-thirds with a flat-topped median ridge. DTC coarse and fine mixed, irregular; APT quite strong, PPT very strong, extended longitudinally in a short ridge. PTC in the form of a centrally exaggerated DTC. S.4 with long hairs forming a distinct semicircle, fairly dense throughout but slightly denser laterally, the laterals gradually curved inwards, those of opposite sides overlapping; those in the centre shorter but straighter, so that all are equal in height. S.5 with the usual posterolateral hair tufts quite strong, connected by some very weak, short hairs forming a semicircle across the centre of the sternite. SGP very strongly expanded to the rounded-truncate apex, with a fairly strong keel in the basal half. Paramere about twice as long as the rest of the genitalia, slightly swollen in the apical half, the apex rounded. Digitus with the inner, apical projection very long and slender, finger-like, slightly curved distad.

♀. Unknown.

Distinctions.— At first sight the male looks like a large, aberrant *P. convexa*, but there are important differences which cannot be extrapolated from the variation found in that species (see the following table). At least some of the non-gastral characters (and the entirely black antenna) should be reflected in the female if found.

Table to distinguish between males of *Pepsis convexa* and *P. catarinensis*:

<i>P. convexa</i>	<i>P. catarinensis</i>
Head in dorsal view scarcely swollen behind eyes.	Head in dorsal view strongly swollen behind eyes (also vertex)
Forewing with PPV much shorter than first abscissa of radial vein.	Forewing with PPV very long, about equal to first abscissa of radial vein.
SMC3 fairly broad anteriorly, only slightly bulging postero-distally.	SMC3 narrow anteriorly, strongly bulging postero-distally.
Propodeum with narrow, rounded median ridge ending in the PTC.	Propodeum with flat-topped median ridge in anterior two-thirds only; PTC separated, further back.
Dorsum across PPT distinctly narrower than at APT.	Dorsum across PPT almost as wide as at APT.
S.4 with central hairs much lower than the laterals.	S.4 central hairs as high as the laterals.
SGP weakly expanded apicad, apex strongly rounded.	SGP very strongly expanded apicad, apex truncate-rounded.
Digitus apex with inner projection only sharply pointed.	Digitus apex with inner projection very slender, finger-like.

Distribution.— Known only from the type locality; several exist with the same name, but this is almost certainly the one c.40k west of Joinville. Map fig. 650.

Material depository.— 1 ♂; MZUSP.

Pepsis helvolicornis Lucas, 1895
(figs 209-214, 607, 650)

Pepsis helvolicornis Lucas, 1895: 585, no. 54. Lectotype ♀ (MNHU), here designated [examined].

Pepsis bahiae Brèthes, 1914: 288, no. 47. Lectotype ♀ (MZUSP), here designated [examined]. **Syn. nov.**

Type-material.— *P. helvolicornis*: I have seen 2 ♀ syntypes from MNHU, and labelled the one with locality “Brazil, Bahia” as lectotype; the paralectotype is conspecific. Another ♀ paralectotype in NMV, with locality “Brazil” only, is also conspecific. *P. bahiae*: I have seen both ♀ syntypes mentioned in the original description and have labelled the larger specimen as lectotype. The paralectotype, which is conspecific, is less worn but lacks the last two tarsal segments of each hind leg.

Description.— ♂ (figs 209-214). BL 19-22. Body and legs black with dull blue-green metallic sheen, sometimes also with obscure patches of short, pale silver-golden-violet hair on thorax and propodeum. Antenna with AS1-2 black, the rest bright orange to brownish-orange. Wings strongly infusate with rather weak blue-violet reflections. S.4 with a very small, lateral patch of rather long hairs, curved inwards and backwards, forming a weakly-defined brush; between the brushes of opposite sides, and close to the apical margin, is a narrow, rather sparse band of shorter, straight hairs. S.5 with very similar hairs but lacking the lateral brushes. SGP rather elongate, more-or-less strongly expanded apicad, the sides narrowly upturned in the basal half, creating a broad, central depression; the apex is strongly rounded and bears a fringe of long hairs, about as long as minimum SGP width. Paramere almost twice as long as the rest of the genitalia, bluntly pointed. Inner projection of digitus apex slender, sharply pointed, turned slightly distad.

♀ (fig. 607). BL 23-38. AE index 95-110. Colour as in male but antenna from AS3 sulphur-yellow to ochre-yellow. Head in dorsal view with temple quite strongly (but vertex only slightly) swollen. Antenna very thick, robust, AS3 appearing short. MT moderate to strong, sharp to very sharp. MPN equal to or slightly shorter than PST, its furrow rather broad, not always reaching anterior margin, more-or-less strongly expanded apicad; carinae fine, sometimes also 1-3 slightly stronger ones. Propodeum: MG absent, replaced by a broad, rounded ridge. APT and PPT moderate to strong, usually very sharp. DTC more-or-less strong and regular, often stronger still and more distant posteriorly. PTC moderate to strong, sharp, often very broad. Propodeal hair equal to or slightly shorter than MPN. Posterior face: VR weak, present near PTC only. PFC moderately strong in larger specimens, covering whole of face, present only above in smaller specimens and always more-or-less weaker in the median line. Lateral extension of S.2 groove well-developed. Hind tibia: teeth often rather small and sharp, subtending spines about 2.0 times as high; on their inner side is a fairly dense row of more-or-less alternating shorter spines and strongly backwardly-curved bristles. Inner spur reaching to about 0.25-0.3 basitarsus length (about equal to tarsal segment 3) and 1.3-1.5 times as long as outer spur.

Variation.— Only as noted above.

Distinctions.— The male is distinguished from that of other species by the configuration of its sternal hairs; the SGP also has an unusual shape. The female is very similar

to that of *P. viridis*, with which it is partly sympatric, but most of the antenna is yellow and appears slightly thicker (orange and thinner in *P. viridis*); the APT and PPT are usually much sharper than in *P. viridis*.

Distribution.— This apparently uncommon species is known mainly from eastern Brazil (Rio Grande to Santa Catarina) but with a few records far inland. A record from the Rio Uaupes, Taracua (in northeastern Brazil) (MZUSP) needs confirming. Ascends to 1,500 m. Map fig. 650.

Material depositories.— 3 ♂♂, 18 ♀♀; BMNH, LACM, MCZ, MNHNPS, MNHU, MZUSP, NMV, OLLD, TMB, UCALB, UMOX, USNM, WILLIAMS.

Pepsis vitripennis Smith, 1855
(figs 227-232, 550-552, 651)

Pepsis obscura Lepeletier, 1845: 490, no. 35, not Fabricius, 1804. ♂, ♀. Brazil. (Lost). **Syn. nov.**

Pepsis vitripennis Smith, 1855: 197. Lectotype ♀ (UMOX), here designated [examined].

Pepsis amabilis Mocsáry, 1885: 253, no. 23. Lectotype ♀ (TMB), here designated [examined]. **Syn. nov.**

Pepsis centralis Cameron, 1893: 221, no. 20. Lectotype ♀ (BMNH), here designated [examined]. **Syn. nov.**

Pepsis margarete Lucas, 1895: 631, no. 78. Lectotype ♀ (NMV), here designated [examined]. **Syn. nov.**

Pepsis venezuelae Kaye, 1913: pl. 1, fig. 13a [only: no textual description]. ♀. Venezuela: Caracas, coastal mountains at 3,500 ft. (Lost). **Syn. nov.**

Pepsis aeneipennis Banks, 1946: 372. Holotype ♀ (AMNH) [examined]. **Syn. nov.**

Pepsis palliata Hurd, 1950: 133. Replacement name for *obscura* Lepeletier, 1845 not Fabricius, 1804.

Pepsis helenae Haupt, 1952: 349, no. 3. Holotype ♀ (MLU) [examined]. **Syn. nov.**

Pepsis coeruleoviridis Haupt, 1952: 350, no. 6. Holotype ♀ (MLU) [examined]. **Syn. nov.**

Type-material.— *P. vitripennis*: I have seen 2 ♀ syntypes in UMOX and have labelled the one in better condition as lectotype. The other is a conspecific paralectotype. *P. amabilis*. I have seen a single type-material ♀ and labelled it lectotype. *P. centralis*. I have seen 2 syntype ♀♀; I have labelled as lectotype the larger specimen which also bears the usual BMNH “type” labels. The smaller ♀ is a conspecific paralectotype. I have also seen a ♂ labelled “*centralis*” which, although agreeing with Cameron’s description, bears a wrong locality. It is a specimen of *P. mildei* Stål. *P. margarete*: I have seen only a single ♀ syntype (with locality “Venezuela”) and labelled it lectotype. *P. helenae*. The holotype is labelled “*helenae*”.

Description.— ♂ (figs 227-232). BL 15-28. Entire insect black, wings with **extremely strong blue-green-violet reflections** (see also *P. xanthocera*). S.1 and especially S.2 with longer and denser, but otherwise unmodified, hairs. S.4 with a thick crescent, or just a transverse band, of rather long but not very dense hairs, the anterior ones curved backwards, the laterals inwards. SGP more-or-less strongly expanded towards the rounded apex which is fringed with long hairs, their length about 0.75-1.0 maximum SGP width. Paramere long, about 1.5 times as long as the rest of the genitalia, apically pointed and with even longer hairs than those of the SGP. Inner projection of digitus apex with a slender point, strongly directed distad.

♀ (figs 550-552). BL 20-39. AE index 93-111. Colour as in male. Head in dorsal view with temple and vertex slightly swollen. MT weak to strong. PPV of forewing usually very short and more transverse than usual. MPN equal to or slightly shorter than PST;



Fig. 651. Collection localities of *Pepsis vitripennis*.

the central area depressed (rather as in *P. chrysoptera*), its furrow narrow, gradually expanded posterad or abruptly expanded posteriorly, sometimes obsolescent anteriorly; carinae very fine, almost matt. Propodeum: MG variable; APT weak, PPT and PTC moderate to very strong, DTC moderately coarse, sometimes slightly irregular. Propodeal hair about 2/3 as long as PST. Posterior face: VR very weak, slightly divergent from PTC. PFC very weak but covering most of face except between VR and below. Lateral extensions of S.2 groove absent. Fore and mid femora with a few, fairly coarse, hairs below in fresh specimens. Hind tibia: teeth usually tiny and distant (sometimes larger in small specimens), the spines 3-4 times their height; inner spur reaching about 0.3 basitarsus length (about equal to tarsal segment 3) and about 1.5 times as long as outer spur.

Variation.— MG in the female sometimes complete in large specimens, but usually absent at least centrally, and often entirely. Occasional females have the hairs subtending the hind tibial spines on their inner side strongly curved backwards. In the southern part of the species' range, there is a tendency for the DTC of the propodeal dorsum to be coarser and more regular, particularly in the females.

Distinctions.— Both sexes are usually recognizable by the brilliantly shining wings and their size being smaller than *P. xanthocera*; the latter species usually has some orange about its wings or antennae in both sexes, whereas *P. vitripennis* is always entirely black (both species lack the lateral extensions of the S.2 groove in the female). The male of *P. vitripennis* has quite distinctive S.4 hairs; the SGP shape and hair-fringe are also good guides. The female is best distinguished from the occasional all-black specimen of *P. xanthocera* by the propodeum not being tapered posterad, the extreme weakness of the VR, and the usually tiny hind tibial teeth.

Biology.— This species is mimicked by a reduviid bug, *Zelurus ater*; also by a syntomid moth, *Macrocneme adonis* (Kaye, 1913: 7).

Distribution.— Found southwards from Honduras (2 records from Mexico without further locality (1 ♀ CUNY; 1 ♀ BMNH) are likely to be correct but need confirmation), the west coast of South America southwards to at least northern Perú (a record from just north of Lima, Lomas de Lachay (1 ♀, CAS) needs confirmation), the entire north coast of South America, the whole of the Amazon and east of the Andes south to Bolivia; the highest recorded altitude reached (and regarded as authentic) is 2,000 m; records (3 ♂♂, 1 ♀, all TMB) from Perú: Sicuani and Vilcanota (both above 4,000 m), are likely to represent labelling errors. Map fig. 651.

Material depositories.— 340 ♂♂, 207 ♀♀; AEIG, AMNH, ANSP, BMNH, BRIO, CAS, CMNH, COOPER, CUNY, FDA, FSAG, FRITZ, IMLT, INBIO, INPA, LACM, MACN, MCZ, MEM, MHNGV, MHNNNEU, MICR, MIZAM, MNHNPS, MNS, MLU, MNRJ, MZUSP, NHMLIM, NMV, OLLD, ONORE, OSUC, PMA, PORTER, RMNH, RSM, SEMKU, SMF, TEXAMU, TMB, UCALB, UCALD, UCR, UMOX, UNLAMB, UNPBOG, UPAN, USNM, USU, UZMC, WAHIS, WASBAUER, ZMMOSC, ZSM.

Pepsis fumipennis Smith, 1855
(figs 171-176, 590, 652)

Pepsis fumipennis Smith, 1855: 192. Lectotype ♂ (BMNH), here designated [examined].

Pepsis pallidicornis Mocsáry, 1885: 256, no. 28. Lectotype ♂ (TMB), here designated [examined]. **Syn. nov.**

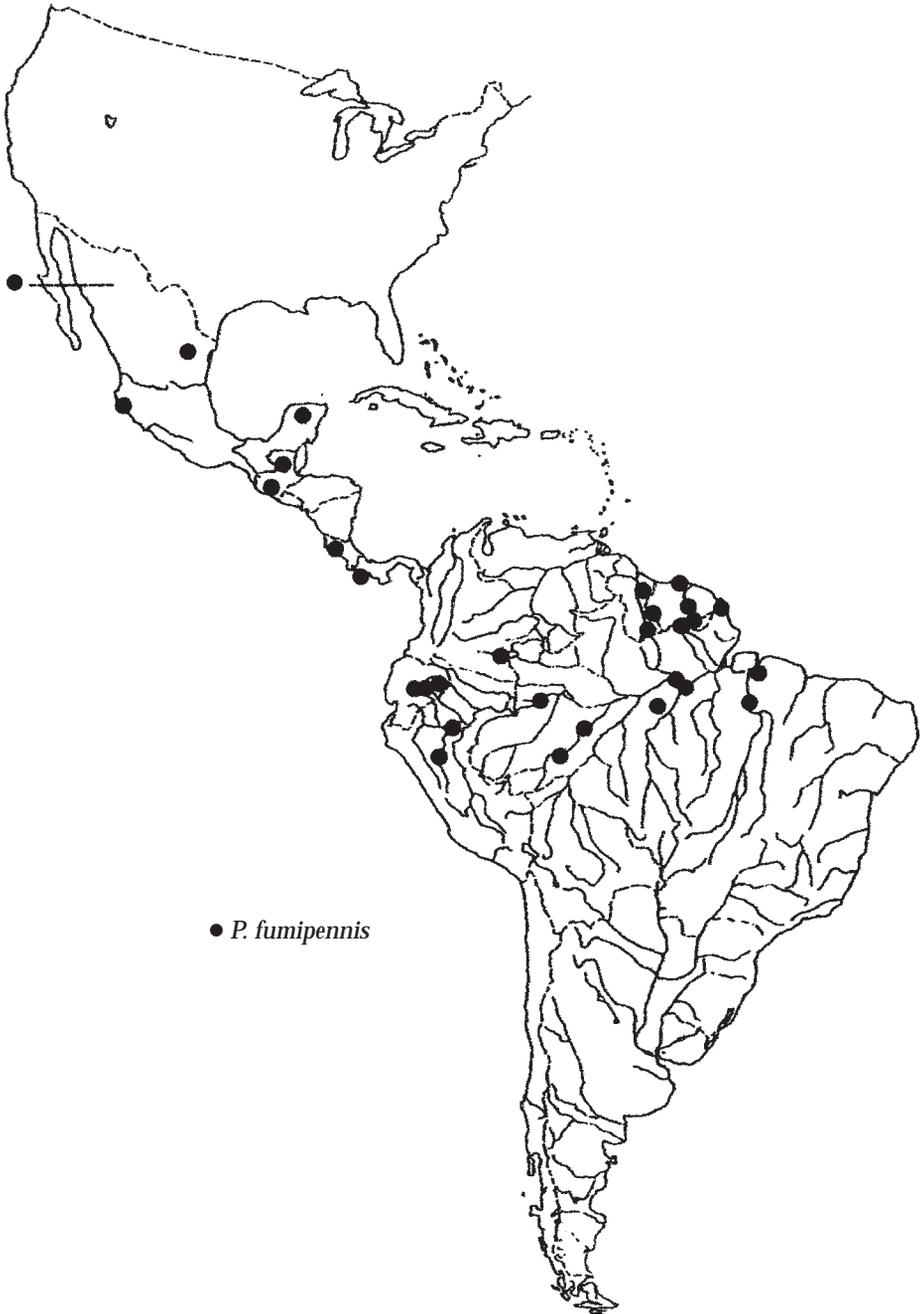


Fig. 652. Collection localities of *Pepsis fumipennis*.

Type-material.— *P. fumipennis*: I have seen the following six conspecific syntypes: two ♂♂ (“Para”) and a ♀ (“Braz.”) in BMNH, and two ♂♂ and a ♀ (all “Para”) in UMOX. I have labelled as lectotype the larger of the two ♂♂ in BMNH; the five remaining specimens are all paralectotypes. *P. pallidicornis*: I have seen 2 syntypes, a ♂ (“Massauary”) and a ♀ (“Obidos”) in TMB, and labelled the ♂ as lectotype. The ♀, a paralectotype, is conspecific. A further ♂ in TMB has no type-status because of its provenance (Peru, Cumbaru).

Description.— ♂ (figs 171-176). BL 22-34. Body and legs black, often with weak blue-green or blue-violet sheen, and with patches of short, pale yellowish hair. Antenna black with at least an apical pale yellow spot (see Variation). Wings almost entirely clear to entirely black (see Variation). S.4 with a broad, semicircular band of long, erect, scarcely curved hairs, a little shorter than maximum width of hind femur; the semicircle filled in (i.e. postero-centrally) by denser hairs about half as long. S.5 with a narrow, apical but fairly dense, fringe of hairs about as long as shorter ones of S.4. SGP with a weak basal tubercle, which is emphasized by bearing a small, dense tuft of very fine, short, erect hairs. SGP strongly expanded apicad, usually with slightly convex sides, widest before the apex which is strongly rounded and centrally slightly depressed; apex with a fringe of long hairs, about half as long as its greatest width; the parameres are about 1.5 times as long as the rest of the genitalia, abruptly narrowed in the distal half, sharply-pointed, and with a long hair fringe. Inner projection of digitus apex bluntly pointed.

♀ (fig. 590). BL 28-35. AE index 110-126. Colour as in male. MT weak to moderate. MPN scarcely to markedly shorter than PST, its furrow usually very narrow (sometimes scarcely more than a suture), more-or-less expanded posteriorly (sometimes broader in very large specimens); MPN carinae fine to extremely fine, surface matt. Propodeum: MG replaced by a broad ridge. APT weak to moderate, PPT and PTC moderate to strong. DTC rather coarse, becoming more distant (and sometimes coarser) apicad. Propodeal hair a little shorter than PST. Posterior face: VR moderate to very strong, parallel or divergent apicad, usually completely obsolescent by mid-point. PFC rather weak near PTC, rapidly weaker apicad (stronger on VR), the whole remaining area with fine, matt sculpture. Lateral extension of S.2 groove quite well-developed but often very shallow in distal half. Hind tibia: teeth usually very small, sharp and distant, accompanied on their inner side by a double line of rather fine, very strongly backwardly-curved hairs; between the teeth are extremely short but dense hairs. The spines subtending the teeth are 2-3 times as high as the latter. Inner spur short, robust, apically curved, reaching to 0.2-0.25(-0.3) basitarsus length (approximately equal to tarsal segment 3) and 1.1-1.2 times as long as outer spur.

Variation.— In the male, usually from 3-10 apical antennal segments are pale yellow, but specimens from Suriname have only a small apical spot (not so reduced in females). Wings in Amazon basin specimens usually with apical infuscation varying in intensity, in the forewing usually covering about the apical two-thirds of the radial cell and all of SMC3, the boundary very diffuse. Rest of wings glass-clear to deep amber; central and western Amazon specimens (Brazil: Maçauari; Colombia; Ecuador; Perú) have the wings mainly dark with weak violaceous reflections, while those from the Guianas have the wings entirely black with strong blue-violet reflections.

Variation in female wing-colour roughly parallels that in the male but is often darker: a specimen from Obidos has the wings entirely rather dark, whereas they are black in Guianas specimens. In a male from Massauary [= Maçauari] (lectotype of *P. pallidicornis*) the SGP sides are concave basally, the basal hooklets of the lamina volsellaris are smaller than usual, and the apical projection of the cuspis more slender. The parameres are missing. The specimen is otherwise indistinguishable from typical *P. fumipennis* and is therefore considered to represent no more than exceptional individual variation.

Westwards along the Amazon, females have the hind tibial teeth progressively larger and closer together (more like those of *P. seifferti*); the length of the inner spur of the hind tibia is more than usually variable (its average condition is very short).

Distinctions.— The male is distinguished from those of other similar *Pepsis* species as follows: *P. crassicornis*: S.5 with more and longer hairs than S.4, SGP weakly expanded in the middle; *P. seifferti*: S.4 hairs as long as maximum width of hind femur, lacking denser mass of shorter, intervening hairs. SGP less strongly expanded apicad, apex with only short hairs, parameres short (only as long as rest of genitalia) and blunt, with short apical hairs. Antenna usually entirely black; *P. xanthocera*: SGP very strongly expanded apicad, widest at the apex which is truncate, parameres short (only as long as rest of genitalia).

The female is distinguished from those of other similar *Pepsis* species as follows: *P. crassicornis*: head in dorsal view swollen behind eyes, antenna either all black or with orange (not cream-colour); MT very sharp, PTC and PPT very strong, VR fully 1/3 as wide as distance between PPT; *P. seifferti*: (see table below); *P. xanthocera*: antenna usually mainly orange, DTC fine, propodeum tapering apicad, dorsal face much longer than posterior. VR sharp, distance between them about 1/4 of that between PPT; hind tibial teeth larger, hairs few, only anterior ones curved backwards, inner spur very short, reaching only to c.0.2 basitarsus length. Lateral extensions of S.2 transverse groove vestigial.

Distinctions between female *Pepsis fumipennis* and *P. seifferti*.

	<i>P. fumipennis</i>	<i>P. seifferti</i>
Head in dorsal view.	Scarcely swollen behind eyes.	Moderately swollen behind eyes.
Antennal colour.	With at least a pale apical spot.	Usually entirely black.
Wing-colour.	Commonly partly clear.	Entirely black.
SMC3 shape.	A little elongate, 1r-m curved anteriorly, 2r-m strongly curved.	Rather short, 1r-m evenly curved, 2r-m weakly curved.
MT.	Blunt.	Sharp.
MPN length compared with PST; furrow.	Often shorter; usually strongly expanded posteriorly.	Usually equal; evenly wide.
Longest hairs on side of propodeum.	Shorter than maximum width of hind femur.	Equal to maximum width of hind femur.
DTC.	Coarse.	Fine.
Propodeal shape.	More transverse, so that dorsal face is about as long as posterior.	Tapered posterad, so that dorsal face is distinctly longer than posterior.

PTC.	Broad, low.	Narrow, high.
Sculpture of propodeal posterior face.	VR weak, distance between them almost 1/3 of that between PPT; surface mainly smooth except above near VR.	VR strong, distance between them only about 1/4 of that between PPT; surface with many PFC.
Hind tibial teeth.	Often tiny and distant, hairs on inner side of teeth long, strongly curved backwards, their apexes parallel to the substrate, about half length of inner spur.	Usually narrow but long and upright, hairs short, weakly curved, their apexes at about 45° to the substrate, about 1/3 of length of inner spur.
Inner spur.	Short, robust, reaching to c. 0.25 times basitarsus length.	Slender, reaching to c. 0.3 times basitarsus length.

Distribution.— Found sparingly from northern Mexico southwards; a record from Chihuahua, Santo Niño (not precisely located) (♂, ♀, WASBAUER) is the northernmost locality known. The species is more frequent east of the Andes, in the Guianas and Amazon basin but not extending very far south of the Amazon mainstream. There is only a single record from eastern Colombia, and none from Venezuela, creating an apparent disjunction; however, this may result from under-collecting in this uncommon species. Ascends to about 700 m in Mexico and Costa Rica. Map fig. 652.

Material depositories.— 37 ♂♂, 36 ♀♀; ANSP, BMNH, CMNH, COOPER, CUNY, FRITZ, MACN, MCZ, MNHNPS, MNRJ, MPEG, NRS, RMNH, TMB, UMOX, UPAN, UZMC, WASBAUER.

The *Pepsis menechma*-group

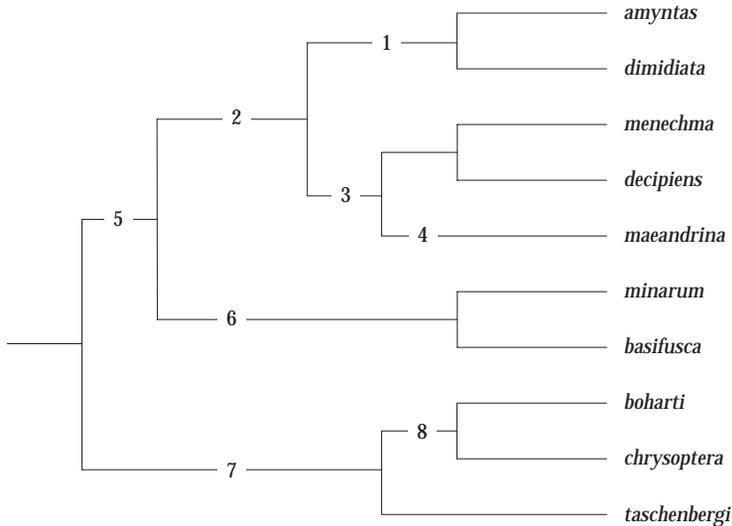
Description.— This group includes ten species; most are small (BL males 12-28, females 15-32; two larger species males 18-28, females 24-36); all are more-or-less robust.

The body colour in both sexes is dark blue or green, sometimes violet tinged; the brilliant, golden-green colour of many males in other groups is totally lacking here. The antenna is sometimes entirely black, but more often has a variable number of apical segments orange, occasionally cream-yellow. The wings display various combinations of black and orange-amber or yellowish, sometimes with great intraspecific variation; sometimes the dark colour is overlain by strong metallic reflections.

The main structural characteristics (of which no single one holds good for all species, and not all occur in any one) are: male S.4 hairs in thin but usually complete, transverse line, basally adpressed and sinuate in two planes, their apexes with small hooks and converging centrad (but usually not quite touching); S.5 with at most a few, weakly modified, hairs; the SGP very variable, in most species with the lateral margins narrowly upturned at least near the base, sometimes strongly keeled, or swollen apically, but always at least slightly modified; female head in dorsal view swollen behind eyes; AS3 very short; body very robust, MT sharp; MPN extremely short with a very broad furrow; propodeum rounded in profile, with no or weak PTC; femora with abundant bristly hair below. The MPN and propodeal characters appear to be ancestral (Hennig's

“ground-plan”) characters, as they are the norm in a large number of other pompilid genera; but they are rare elsewhere in this genus.

Cladogram for the *P. menechma*-group



Characters:

1. Male wings clear with dark apex. Most of SGP flattened with lateral margins upturned. Paramere narrow. Digitus with inner, apical projection sharply pointed. Female MPN about 3/4 as long as PST.
2. Female with short MPN; mid tibial spurs curved.
3. AS3 short; MPN short; legs with dense, subfemoral hair; head strongly transverse, vertex with transverse, arcuate groove.
4. AS3 extremely short; body small; body strongly punctate.
5. SGP basally flattened, with weak median keel.
6. Wings pale; male SGP elongate, sides slightly raised, digitus with inner, apical projection very slender; female head moderately swollen, AS3 more-or-less equal to UID, MT very weak, MPN as long as PST.
7. Large species; wings dark; SGP strongly keeled, elongate; female anterior tibial spur round-ended; female SMC3 strongly bulging posterodistally.
8. S.4 hairs in strongly curved line. Male MPN as long as PST, its furrow very narrow, carinae very fine. Female propodeum with strong, narrow median ridge and sharply-incised MG; PTC more or less tooth-like. Front tibial spur apically flattened.

Internal relationships.— Within the group, the *taschenbergi-boharti-chrysoptera* and the *amyntas-dimidiata* subgroups are reasonably coherent, although none of the species are particularly closely related to each other. However, each of the remaining five species is distinguished by its own strong apomorphies, displaying little in common with any other species; indeed, where “strong” characters are shared with other species, other strong characters contradict the apparent relationship. This suggests that many character reversals have occurred, making internal relationships, and hence group structure, extremely difficult to assess.

External relationships.— The group most closely allied to that of *menechma* is *elongata*, its sister-group.

Biology.— Several species are members of the *atripennis* or *completa* mimicry-groups. In view of its possession of evidently ancestral characters, it is particularly unfortunate that no prey records exist either for this group or for any of the other four species-groups closely associated with it, despite the fact that many of the species are exceedingly common (see note under Biogeography).

Biogeography.— At first sight the distribution of this group is puzzling: despite having reached and become widespread in the USA, it is absent from the West Indies; no other species-group exhibits these two attributes simultaneously. This can be most simply explained if we assume that (1) the group was unable to cross the Andes during the early part of its evolutionary history (almost all records from higher altitudes are in Mexico and western Argentina; both are regarded as examples of late, i.e. secondary adaptation. This suggests that the group circumvented the Andes rather than crossed them) but (2) was very successful at colonizing lower ground once it had reached it (no species of this genus has reached Florida except *menechma* itself, and *basifusca* is the only species of this group found exclusively north of the Andes). The *sumptuosa*-group resembles this one in the first respect but not the second. The species of the *menechma*-group are much smaller, and this may be connected with an ability to spread rapidly. Furthermore, in view of the distinctive structure of the females of this group, they probably use spider prey different from those of other groups, enabling them to avoid competition.

Another noteworthy aspect, unique in the genus, concerns two of the most widespread species of the group – *P. amyntas* and *dimidiata*. These are the most closely related pair within the group, and they both exhibit a remarkable distributional phenomenon. Both species occur along the Amazon mainstream and far to the north and south, but whereas the males are uniform throughout the range, the female populations to the north and the south, away from the Amazon itself, exhibit structural differences (as well as colour ones) markedly greater than those usually found in populations distant from one another. Females from near the mainstream are intermediate between those from the north and the south; however, both species are rare there. This is scarcely an artifact of collecting, because the Amazon mainstream is far better collected than the less accessible adjacent areas. It would appear that northern and southern populations have adapted to somewhat different conditions, and a sparse population surviving in less than optimum conditions near the Amazon itself is just sufficient to maintain a very low level of gene-flow between them. Although *P. menechma* and *P. chrysoptera* also display comparable distribution patterns within the Amazon basin, population differences are not obvious there; however, *P. menechma* does show strong clinal differences in Central America. In summary, all species of this group more-or-less completely avoid the Amazon proper; either they occur exclusively north or south of it, or in the case of widespread species, they are rare there.

Pepsis amyntas Mocsáry, 1885
(figs 283-288, 545, 653)

Pepsis amyntas Mocsáry, 1885: 241, no. 4. Lectotype ♂ (TMB), here designated [examined].

Pepsis vicina Lucas, 1895: 836, no. 184. Lectotype ♀ (MNHU), here designated [examined]. **Syn. nov.**

Pepsis clarinervis Brèthes, 1908: 238. Lectotype ♀ (MACN), here designated [examined]. **Syn. nov.**

Pepsis amyntoides Lucas, 1919: 22. ♂, BRAZIL: Esp[írito] Santo (lost). **Syn. nov.**

Pepsis eurydice Lucas, 1919: 23. ♂, [BRAZIL:] São Paulo (lost). **Syn. nov.**

Type-material.— *P. amyntas*: I have seen 3 conspecific ♂ syntypes in TMB, 1 from Obidos which I have labelled lectotype, and 2 from Villa Bella which are paralectotypes. *P. vicina*. I have seen a single type-material ♀ and labelled it lectotype. *P. clarinervis*. I have seen both of the ♀ syntypes (in MACN), and labelled the larger one as lectotype. The paralectotype is conspecific.

Description.— ♂ (figs 283-288). BL 14-21. Body and legs black with dark blue-green sheen. Antenna black, with 0-5 apical segments very pale yellow. Wings usually clear or slightly yellowish; both with black base, forewing with fairly heavy infuscation covering all of area outside cells and most or all of radial cell and SMC3, but only extreme apex of hindwing (weakly or not at all); sometimes extending diffusely over a much greater area (see Variation). S.4 with a very narrow line of hairs basally; the outer ones are long, basally flush with the surface, then curved away, then backwards and inwards, the tips with small hooks; becoming shorter but of similar shape towards the sternite centre; the apexes rather narrowly separated from those of the opposite side. SGP slightly expanded apicad, with narrowly upturned, slightly polished sides (thus slightly cupped), the apex more or less truncate, occasionally shallowly emarginate. Paramere rather narrow, bluntly pointed, about 1.5 times as long as rest of genitalia. Inner projection of digitus apex with a rather broad point.

♀ (fig. 545). BL 16-26(-31). AE index (87-92-111(-117)). Antenna black, usually with some apical segments orange (see Variation). Body and legs black with blue-green sheen. Wings either entirely black, black with sub-basal orange band, or almost entirely orange (see Variation). Head in dorsal view transverse, with temple usually strongly constricted. MT strong to very strong. MPN often slightly shorter than PST; furrow extremely broad, often almost quadrate, polished; carinae: usually 1-3 coarse, the rest finer. Propodeum: MG sometimes weakly indicated, usually replaced by a broad ridge. APT weak to strong, PPT weak to moderate, PTC absent to weak, DTC usually moderately coarse and regular, sometimes very coarse and less regular, especially in large, southern specimens. Propodeal hair usually a little shorter than PST. Posterior face: usually with a pair of quite strong, parallel VR in upper half; if extended further down, then converging. DTC continued as PFC on posterior face but becoming weaker posterad. Lateral extension of S.2 groove present but sometimes weak. Hind tibia: teeth usually tiny, occasionally larger in large, southern specimens; subtending spines at most as long as minimum (basal) width of tibia. Inner spur usually reaching to 0.4-0.5 basitarsus length (longer than tarsal segment 2) and 1.4-1.5 times as long as outer spur. All spurs of mid and hind tibiae most often with a tiny hook apically.

Variation.— ♂. Antenna occasionally entirely black; sometimes there is a creamy-white apical spot on the last segment; most often the last few segments are entirely creamy-white. While at least the forewing usually has the infuscate apex quite well defined, in specimens from the Amazon river northwards the infuscation of both wings extends very diffusely basad, over more than half the forewing and about a third of the hindwing. These specimens also have parts of the thorax and propodeum covered with rather dense, silvery pubescence.

♀. The unusual Amazonian variation found in the females of this species and of *P. dimidiata* is alluded to under that species (below, under Structural variation) and in this group's Introduction. Details are: the extent of orange colour on the antenna varies considerably: sometimes it starts as early as AS3 (weakly, when AS2 often has an apical ring), sometimes only the last segment is very dull orange (especially in southern specimens). Wing-colour divides into three distinct patterns: 1. entirely orange with a dark border, darker and narrower (about half area beyond cells) in the south, weaker but broader (most of area beyond cells, occasionally including some cells) in the north; 2. black with an almost basal orange band; 3. entirely black (see map fig. ...).

Biology.— Some females belong to the *atripennis* mimicry-group (no. 2 under Variation).

Distinctions.— ♂. Very similar to that of *P. dimidiata*, but that species almost always has the antenna entirely black (rarely the last segment has a creamy-white apical spot); the S.4 hairs form a broader, much denser line; the apexes are more strongly hooked and the SGP has the apex broadly upturned rather than the sides narrowly.

♀. Most specimens are well characterized by the combination of extremely broad MPN furrow and tiny hind tibial teeth; but very variable, especially in the south - see the table given under *P. dimidiata* to distinguish it from that species (occasional specimens may resemble *P. festiva*, which see). Females of both species together are distinguished from those of other species by the combination of very broad MPN furrow and apically hooked spurs of mid and hind tibiae. They lack the peculiar MPN and propodeal sculpture of *P. chrysoptera*, and the curved hairs of the hind tibia in *P. menechma* (the latter lacks these hairs only in Mesoamerica, where it is allopatric from the other species mentioned).

Distribution.— This species exhibits an almost disjunct distribution; however, the patterns shown by the closely-related *P. chrysoptera*, *P. dimidiata* and *P. menechma* cast doubt on whether the disjunction is complete, or whether the species is merely rare in the middle of its range, as are the others. It is found along the Lower Amazon and in northern South America, including the Cauca valley in western Colombia; and again from Bolivia and southeastern Brazil to northern Argentina, where it ascends to 1,500 m in Salta province. A record from Argentina, Chubut, Rawson (1 ♂, IMLT) probably represents a labelling error. Map fig. 653.

Material depositories.— 153 ♂♂, 126 ♀♀; AEIG, AMNH, ANSP, BMNH, BONELLI, CMNH, COOPER, CUNY, FRITZ, IMLT, INPA, LACM, MACN, MCZ, MHNGV, MIZAM, MLP, MLU, MNCN, MNHNPS, MNHU, MNRJ, MNS, MPEG, MZUSP, NHM-BAS, NMV, NRS, OSUC, PAGLIANO, RMNH, RSM, SMF, TMB, UCALB, UCALD, UFPUR, UMBREM, UMOX, UNPBOG, USNM, WAHIS, WASBAUER, ZSM.

Pepsis dimidiata Fabricius, 1804

(figs 417-422, 636, 654)

Pepsis dimidiata Fabricius, 1804: 216, no. 47. Lectotype ♀ (UZMC), here designated [examined].

Pepsis vittigera Lucas, 1897: 295, no. 4. Lectotype ♀ (CMNH), here designated [examined]. **Syn. nov.**

Pepsis argentina Bréthes, 1908: 233. Lectotype ♂ (MACN), here designated [examined]. **Syn. nov.**

Pepsis sanctaeannae Bréthes, 1908: 233. Holotype ♂ (MACN) [examined]. **Syn. nov.**

Pepsis virgo Bréthes, 1908: 233. Holotype ♂ (MACN) [examined]. **Syn. nov.**

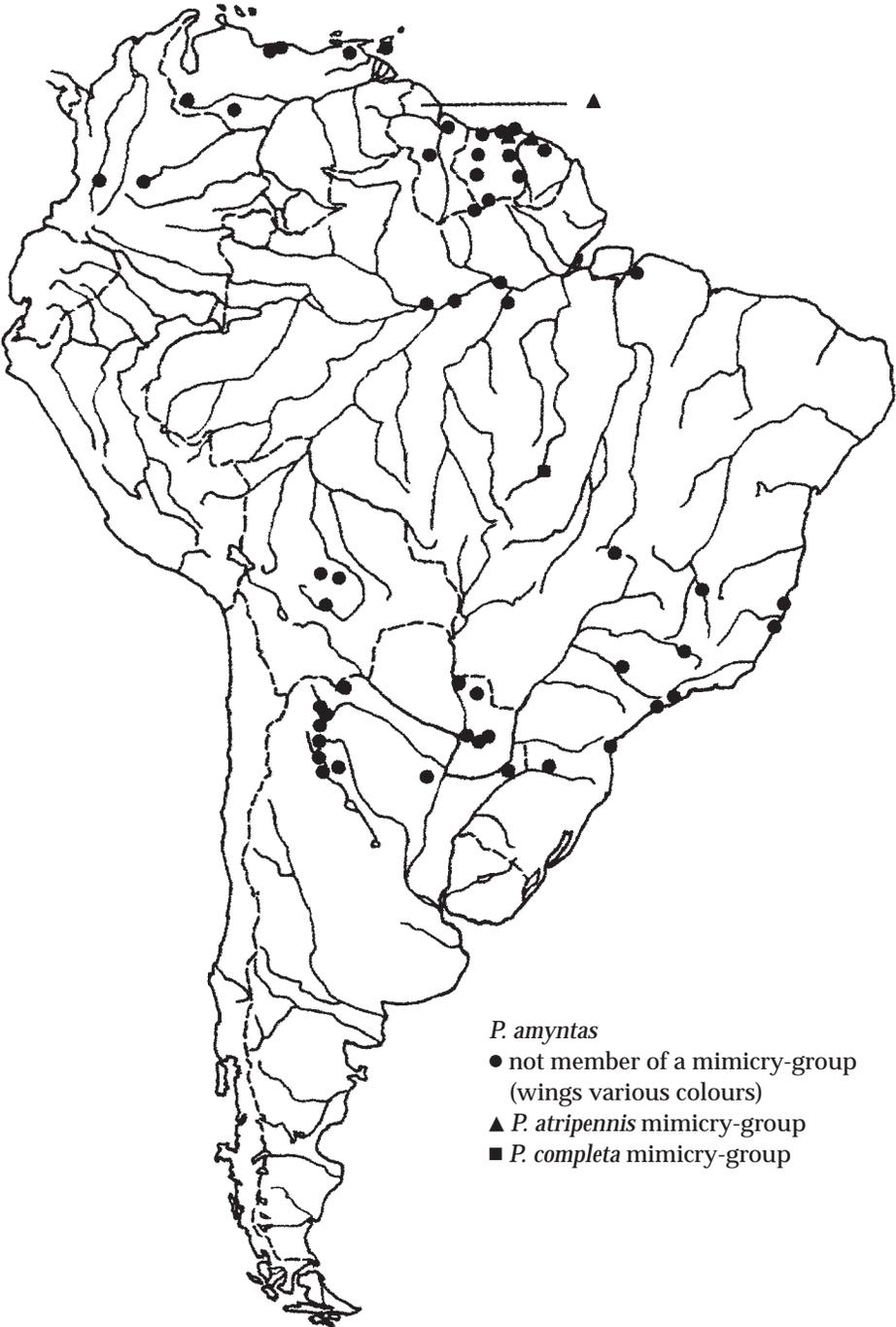


Fig. 653. Collection localities of *Pepsis amyntas*.

Pepsis externa Brèthes, 1908: 235. Holotype ♀ (MACN) [examined]. **Syn. nov.**

Pepsis transversa Brèthes, 1908: 235. Lectotype ♀ (MACN), here designated [examined]. **Syn. nov.**

Pepsis cordubensis Brèthes, 1908: 243. Lectotype ♀ (MACN), here designated [examined]. **Syn. nov.**

Pepsis banghaasi Lucas, 1919: 151. Lectotype ♀ (SMTD), here designated [examined]. **Syn. nov.**

Type-material.— *P. dimidiata*: I have seen a single type-material ♀ bearing an original Fabrician label, and have labelled it lectotype. *P. vittigera*. I have seen a single type-material ♀ and labelled it lectotype. *P. argentina*. I have seen two conspecific syntype ♂♂, and have labelled the one in MACN as lectotype. The one in MLP is a paralectotype. *P. transversa*. I have seen both ♀ syntypes (in MACN) and labelled the one with locality “Misiones” as lectotype. The other one is a conspecific paralectotype but lacks a locality. *P. cordubensis*. I have seen 3 of the several ♀ syntypes, 2 in MACN and 1 in MLP. I have labelled as lectotype the slightly larger one in MACN with a large, white Brèthes’ identification label. Both paralectotypes are conspecific with the lectotype. *P. banghaasi*. I have seen 4 probable syntype ♀♀, and labelled as lectotype the only one bearing a handwritten label “*Pepsis banghaasi* Luc.”. The other 3 specimens are conspecific paralectotypes.

Description.— ♂ (figs 417-422). BL 12-28. Body and legs black with dull green (sometimes blue) metallic sheen. Antennal and wing colour variable (see below). S.4 with a rather dense, transverse band of hairs, basally decumbent posterad then directed upwards and slightly inwards and backwards, the tips strongly hooked; towards the sternite centre, the hairs become shorter, the central ones almost perpendicular to the surface, and about half the height (one-third the length) of the longest hairs. S.5 with a lateral patch of strong but rather short and not very dense hairs. SGP narrowed slightly at the base of the normally visible part, often with a weak median elevation at that point; sides pre-apically slightly upturned and polished, apically downturned; the rounded-truncate apex itself more or less upturned, thin. Often the apex is very strongly expanded, almost spatulate, sometimes also slightly centrally emarginate; in such cases the pre-apical upturned sides are less apparent. Paramere rather narrow, bluntly pointed, about 1.5 times as long as rest of genitalia. Inner projection of digitus apex with a rather slender point slightly turned distad.

♀ (fig. 636). BL 15-30. AE index 77-89(-94). Body and legs black with dull blue sheen (sometimes weakly violet). Antennal and wing colour variable (see below). Head in dorsal view with temple and vertex moderately swollen. MT moderate to very strong. MPN usually shorter than PST, its furrow entirely very broad, or broadly V-shaped, carinae usually rather fine, sometimes 1-3 stronger than the rest, often weakly angled. Propodeum: MG sometimes weakly present anteriorly and posteriorly, more often replaced by a broad ridge. APT moderate to strong, PPT weak to moderate, PTC absent to weak. DTC usually coarse, rarely as fine as in some specimens of *P. amyntas*; continued on posterior face as PFC but usually more weakly. Propodeal hair about 1/2-3/4 PST length. Posterior face: VR usually fairly strong and close together, the furrow so formed sometimes continuous with that on the dorsal surface, sometimes interrupted by a weak PTC. Lateral extension of S.2 groove usually present but often weak or short. In fresh specimens there is often a moderate amount of short but quite strong hairs below the femora. Hind tibia: teeth of normal size (larger than those of *P. amyntas*), the subtending spines 2.5 times as high, Inner spur reaching to 0.3-0.45 basitarsus length (longer than tarsal segment 2) and 1.3-1.5 times as long as outer spur. Outer spur, also both of middle tibia, more-or-less

strongly curved; all spurs of mid and hind tibiae usually hooked apically.

Variation (colour).— ♂. Specimens from south of the Amazon have the wings clear, with apical infuscation entering the outermost cells in the forewing and fairly well defined, or more extensive, covering up to half of the forewing, when the clear area often tends to become orange, especially in Argentine specimens, and the boundary very diffuse; these forms most often have the antenna either black or with the last segment partly cream-coloured (usually only an apical spot). 2 males from Colombia: Tame have an almost basal, transverse, yellowish wing-band, the rest of the wings dark brown, while the apical 2-5 antennal segments are yellow. 2 males from Venezuela: Tachira, Rio Frio; El Valle, near Caracas have entirely dark wings and the antenna entirely orange except the basal 2 segments. 2 males from Panamá (USNM, SEMKU) are entirely dark except for the antenna, which has the last 3 segments gradually paler apicad (pale yellow in one, bright orange-pink in the other). All males have at least the extreme base of the wings infuscate.

♀. At one extreme, the wings are wholly orange-amber with the apex infuscate, covering also the anterior half of the marginal cell; then the infuscation progressively invades the remaining surface patchwise, gradually narrowing the orange-amber area to a sub-basal band, which then disappears entirely, leaving the wings entirely dark at the other extreme; these last sometimes have a variable number of apical antennal segments more-or-less orange. 2 females from Venezuela: El Valle, near Caracas have a rather broad, almost basal, yellow wing-band and the antenna orange from mid-AS3 onwards.

Variation (structural).— In southern females, the variation in MPN and propodeal sculpture overlaps that of *P. amyntas*. The lectotype of *P. banghaasi* has a unique deformity: the DTC are oblique in a single direction across the entire surface of the propodeal dorsum.

Note.— At first sight it appeared possible that specimens of this species from north and south of the Amazon might represent two extremely closely-related species (all those seen from the north are very small specimens). However, northern and southern males are not distinguishable structurally, while all of the females of widespread species in this group vary geographically in structure in any case. See also remarks under *P. amyntas* and in this group's Introduction.

Distinctions.— The male is very similar in general appearance to that of *P. amyntas*, which see for distinguishing characters. The female is also often difficult to distinguish from that of *P. amyntas*, especially in the south: see the table given below. Both females are distinguishable from those of other species as given under *P. amyntas*. Females from northern South America with dark wings and mainly orange antenna are very similar to *P. ianthina* but that species has the AS3 shorter and usually orange to the base of AS3, a longer MPN (equal to PST) with a narrow furrow, and the inner spur of the hind tibia shorter (c. 1/3 basitarsus length). Near the northern coast of South America, the form of this species with yellow-banded wings closely resembles that of *P. cybele*; see that species for distinctions.

Table for distinguishing between *Pepsis dimidiata* and *P. amyntas* females.

	<i>P. dimidiata</i>	<i>P. amyntas</i>
Body:	More robust.	More slender.
Head shape:	Strongly swollen behind eyes.	Weakly swollen behind eyes.
Antenna:	Usually entirely black, south of Amazon.	Usually at least the last segment dull orange, often more segments and brighter.
AS3:	Usually much shorter than UID, robust.	Usually a little shorter to a little longer than UID, slender.
SMC3:	Anterior veinlet about equal to postero-distal veinlet.	Anterior veinlet longer than postero-distal veinlet.
MPN:	Much shorter than PST. With 1 very strong carina; furrow extremely broad or very strongly and abruptly expanded posteriorly.	Not or slightly shorter than PST. With 1-3 moderately strong carinae; furrow broad, or strongly expanded posterad.
Propodeum:	Massive, quadrate or transverse. MG most obvious (though narrow) just anterior to PTC. DTC very coarse, usually irregular, PFC often weaker. VR weak, separated by less than 1/4 of distance between PPTs.	More-or-less normal, slightly elongate. MG least obvious just before PTC. DTC moderate, usually regular, PFC often equally strong. VR strong, separated by almost 1/3 the distance between PPTs.
Hind tibia:	Teeth normal-sized, spines about twice their height.	Teeth tiny (except in large specimens), spines more than twice as high.

Argentine females with mainly amber wings.

Black forewing border:	Broad, at least touching radial and SMC3 cells, often with dark patches in cells.	Narrow, at most touching radial cell, not forming dark patches in cells.
PPV:	About 1/2 length of radial vein abscissa 1.	About 2/3 length of radial vein abscissa 1.
Hind tibial teeth:	Often rather blunt.	Sharp.
Inner spur:	Sometimes shorter than 1/2 basitarsus length.	Always about 1/2 basitarsus length.

Biology.— Some specimens of both sexes belong to the *atripennis* mimicry-group, also some females to the *completa* mimicry-group.

Distribution.— The unusual distribution pattern of this species is interesting in that it almost mirrors that of the closely-related *P. amyntas*, which see. It is found sparingly in Panamá (see Variation), Colombia and Venezuela (but not known from directly west of the Andes); likewise on the Lower Amazon and central and eastern Brazil, thence becoming more common southwards to central Argentina; apparently absent from the entire Amazon headwaters from Ecuador to Bolivia. It ascends to 1,500 m in Argentina, Salta. Map fig. 654.

Material depositories.— 112 ♂♂, 78 ♀♀; AEIG, BMNH, BRIO, CAS, CMNH, FRITZ, IMLT, MACN, MCZ, MIZAM, MLP, MNCN, MNHNPS, MNHNPG, MNRJ, MNS, MZUPS, PMA, RMNH, SEMKU, SMF, SMTD, TMB, UCALB, UMOX, UNPBOG, USNM, USPRIB, UZMC, WAHIS.

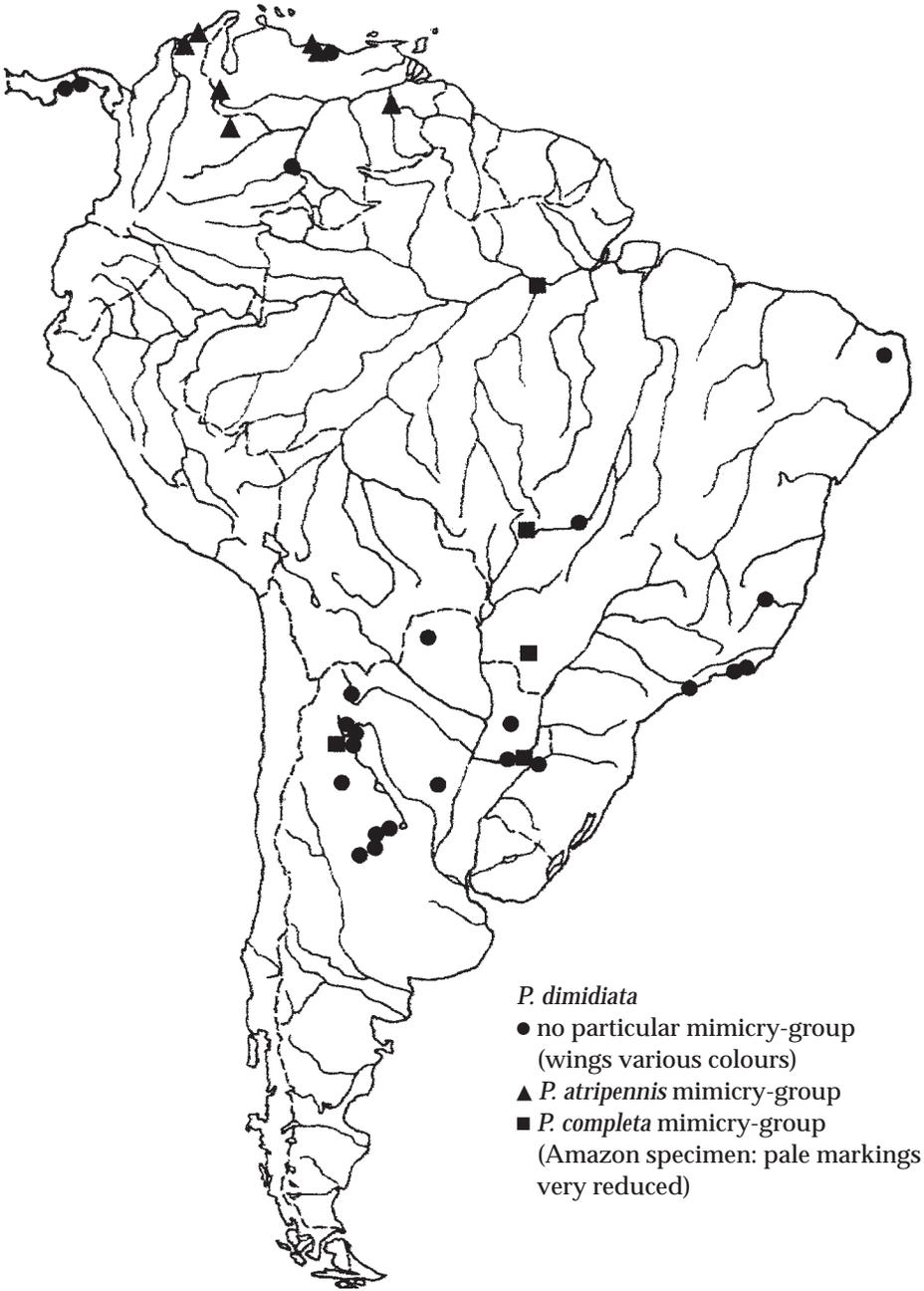


Fig. 654. Collection localities of *Pepsis dimidiata*.

Pepsis menechma Lepeletier, 1845
(figs 296-303, 546-549, 655)

- [*Pepsis luteicornis* Fabricius; Palisot de Beauvois, 1805: 39, pl. 1, f. 5, ♀, South Carolina. Misidentification].
Pepsis menechma Lepeletier, 1845: 481. Lectotype ♂ (MIZSU), here designated [examined].
Pepsis elegans Lepeletier, 1845: 489, ♂. Pennsylvania [lost]. **Syn. nov.**
Pepsis dubitata Cresson, 1867: 144. Lectotype ♀ (ANSP), here designated [examined]. **Syn. nov.**
Pepsis prismatica Smith, 1855: 200. Lectotype ♂ (BMNH), here designated [examined]. **Syn. nov.**
Pepsis advena Mocsáry, 1885: 256, no. 29. Lectotype ♀ (MHNNEU), here designated [examined]. **Syn. nov.**
Pepsis cinctipennis Mocsáry, 1885: 265, no. 44. Lectotype ♀ (TMB), here designated [examined]. **Syn. nov.**
Pepsis guatemalensis Cameron, 1893: 216. Lectotype ♀ (BMNH), here designated [examined]. **Syn. nov.**
Pepsis nestor Mocsáry, 1894: 7, no. 11. Lectotype ♂ (TMB), here designated [examined]. **Syn. nov.**
Pepsis nigricornis Mocsáry, 1894: 8, no. 13. Lectotype ♀ (TMB), here designated [examined]. **Syn. nov.**
Pepsis auranticornis Lucas, 1895: 605, no. 65. Lectotype ♂ (MNHU), here designated [examined]. **Syn. nov.**
Pepsis fruhstorferi Lucas, 1895: 673, no. 97. Lectotype ♂ (MNHU), here designated [examined]. **Syn. nov.**
Pepsis concolor Lucas, 1895: 693, no. 114, male, Mexico (lost). **Syn. nov.**
Pepsis cerberus Lucas, 1895: 790, no. 169. Lectotype ♂ (MNHU), here designated [examined]. **Syn. nov.**
Pepsis euchroma Lucas, 1895: 792, no. 171. Lectotype ♀ (MNHU), here designated [examined]. **Syn. nov.**
Pepsis nigrocincta Lucas, 1895: 799, no. 176. Lectotype ♀ (MNHU), here designated [examined]. **Syn. nov.**
Pepsis mordax Lucas, 1895: 800, no. 177. Lectotype ♀ (MNHU), here designated [examined]. **Syn. nov.**
Pepsis inermis Fox, 1898: 146. Lectotype ♀ (ANSP), here designated [examined]. **Syn. nov.**
Pepsis roberti Brèthes, 1908: 237. Lectotype ♂ (MACN), here designated [examined]. **Syn. nov.**
Pepsis janira Brèthes, 1908: 237. Lectotype ♀ (MACN), here designated [examined]. **Syn. nov.**
Pepsis cultrata Brèthes, 1908: 242. Holotype ♀ (MACN) [examined]. **Syn. nov.**
Pepsis novitia Banks, 1921: 21. Lectotype ♂ (MCZ), here designated [examined]. **Syn. nov.**
Pepsis duplicata Cresson; Gillaspay, 1990: 21 [lapsus for *dubitata* Cresson] (as *P. novitia* Banks).

Type-material.— *P. menechma*: I have seen 2 conspecific syntypes, a ♂ and a ♀. I have labelled the ♂ as lectotype; its identity conforms with the current interpretation of *P. elegans*. The ♀ is a paralectotype. *P. dubitata*: I have seen only a single ♀ syntype (Cresson listed also 4 ♂ ♂); I have labelled it lectotype. *P. prismatica*: I have seen a single type-material ♂ and labelled it lectotype. *P. advena*: I have seen a single type-material ♀ and labelled it lectotype. *P. cinctipennis*: I have seen six ♀ syntypes, two in TMB and four in MHNNEU. I have labelled one of those in TMB as lectotype; the other five are paralectotypes. The second specimen in TMB is conspecific with the lectotype, as are two of those in MHNNEU; the remaining specimens are one each of *P. montezuma* and *P. terminata*. *P. guatemalensis*: I have seen two syntypes, ♂ and ♀. I have labelled the ♀ as lectotype; the ♂, a paralectotype, is a specimen of *P. aquila* Lucas. *P. nestor*: I have seen a single type-material ♂ and labelled it lectotype. *P. nigricornis*: I have seen 2 ♀ syntypes and labelled the slightly smaller one from Perú: Tarapoto, as lectotype. The other specimen from Perú: Cumbara) is a conspecific paralectotype. *P. auranticornis*: I have labelled as lectotype a ♂ syntype in MNHU bearing the locality “Am. m.” [= America meridionale]. Lucas, like Banks, mistakenly interpreted this term as restricted to South America (see note in Introduction, Part 1). A second syntype, a ♀ in NMV, bears no locality but originated from Brazil according to Lucas; it is a paralectotype conspecific with the lectotype. Since the range of the population to which these two specimens are referable is only known to include the U.S.A. and Mexico, the locality “Brazil” would appear to be an error. *P. fruhstorferi*: I have seen a single type-material ♂ and labelled it lectotype. Not only does it lack the genitalia, but Lucas’ figure (pl. 33, fig. 106) seems to pertain

to a different species. *P. cerberus*: I have seen 5 ♂ syntypes, 3 in MNHU and 2 in TMB. I have labelled as lectotype the largest of the 3 MNHU ♂♂ with the data "Mexico, Deppe" which is in better condition than the smaller one. These 2, and the 2 in TMB, are all conspecific. The third ♂ in MNHU (with the data "Mexico, Chapultepek, Bilimek") is a specimen of *P. basifusca* Lucas; according to Lucas it should be in NMV. It is a paralectotype, as are the remaining 3 specimens. *P. euchroma*: I have seen 2 conspecific ♀ syntypes. One, which I have labelled as lectotype, is in MNHU; the other, a paralectotype, is in NMV. *P. nigrocincta*: Lucas' description is confusing because it appears to refer to *P. terminata*, but this is because it is based on mixed species. I have seen three ♀ specimens standing under this name in MNHU. Two of these are regarded as syntypes, and I have labelled as lectotype the one without a "type" label because it is in better condition (wings less damaged, gastral segments intact; but both specimens lack the head). Both are specimens of *P. menechma* Lepeletier. The description disagrees with these specimens in that Lucas mentions a "hyaline forewing apex"; the third specimen (only) agrees in this character. However, it is a specimen of *P. thoreyi* and bears one label "Valparaiso" and another handwritten in Gothic German script "Probably type of *thoreyi*". Since this name appears only two places after *P. nigrocincta* in Lucas' sequence of descriptions, it appears that he became confused between the two species. [A lectotype of *P. thoreyi* has been chosen from material in MZEL.] *P. mordax*: I have seen a single type-material ♀ and labelled it lectotype. *P. inermis*: I have seen only one of the 3 ♀ syntypes, and labelled it lectotype. *P. roberti*: I have seen 2 of the 3 ♂ syntypes, 1 from Jujuy in MACN and 1 from Córdoba in MLP; I have labelled as lectotype the one from Jujuy. The other specimen is a conspecific paralectotype. *P. janira*: I have seen 3 of the several ♀ syntypes in MACN; of the 2 smaller ones, I have labelled the slightly larger one, with a large white Brèthes' identification label, as lectotype. The other specimens are paralectotypes; the small one is conspecific with the lectotype, but the other is a specimen of *P. inclyta* Lep. *P. novitia*: I have seen a single type-material ♂ and have labelled it lectotype.

Description.— ♂ (figs 296-303). BL 18-26. Robust; head with vertex and temples strongly swollen. Body and legs black with blue to violet, sometimes green, metallic reflections; antenna with 2 basal segments always black; the rest entirely black to entirely orange or orange-yellow. Wings varying from orange-amber with basal and apical infuscation, to entirely black with strong blue-violet reflections (see Variation). S.4 with very narrow but rather dense, transverse band of hairs, often basally adpressed, then directed posterad; the outer ones long, weakly curved inwards and backwards, the apexes with small hooks; not quite meeting those of opposite side. Hairs towards centre of sternite without hooks, becoming shorter and sparser; more erect except for bases; leaving a small central gap. SGP spatulate, with a three-ridged base and usually a swollen apical half; with a rather long hair fringe. Paramere long, pointed, likewise with long hairs, especially apically, about twice as long as rest of genitalia; inner projection of digitus apex forming a more-or-less obtuse angle.

♀ (figs 546-549). BL 16-28. AE index 63-86(-103). Colour as in male. Head in dorsal view with temple usually strongly swollen (sometimes scarcely). MT usually very strong and sharp. MPN shorter than or equal to PST, its furrow usually broad, at least posteriorly, the carinae usually rather fine, often with some stronger ones; directed posterad at junction with furrow. Propodeum: MG narrow and shallow, sometimes broader anterad. APT virtually absent (occasionally strong), PPT weak to moderate

(more or less size-related), PTC weak (sometimes strong), DTC fine to rather coarse, often coarser and more distant centrally, general surface slightly shining or matt. Propodeal hair usually about half PST length, sometimes longer, but apparently soon abraded. Posterior face: VR usually strong near PTC, obsolete by mid-point apicad; PFC also strong over most of face (slightly weaker below) except between VR, where the surface is matt with fine sculpture. Lateral extension of S.2 groove present, sometimes a little short or weak. Middle and hind tibiae with spurs strongly curved at apex. Hind tibia: teeth vestigial to strong (see Variation), with strong, backwardly-curved bristles overlying them; inner spur reaching to 0.25-0.45 basitarsus length (about equal to tarsal segment 3, 2 or even 3+4), and 1.1-1.5 times as long as outer spur.

Variation.— Discussion. This species is one of the most structurally variable in the genus. Considering that this variation concerns populations as much as it does individuals, and that the colour is also highly variable, it is easy to understand why Hurd (1952) was puzzled by the situation in the U.S.A. His alleged distinctions between the dark-winged eastern population (“*elegans*”) and the orange-winged western (“*cerberus*”) are based on a mixture of population and individual differences. The key to the situation is provided by an almost perfectly intermediate population (“*novitia*”) occurring in the zone where the two populations meet. Hurd’s discussion of the status of this form is complicated and unconvincing; the zone, centred around the 97th. meridian, closely approximates to the 100th. meridian overlap zone between eastern and western populations of *Sphex ichneumoneus* Linnaeus (see Bohart & Menke, 1963: 125); the sphecids differ only in colour, however. Surprisingly however, *Pepsis grossa* (as *P. formosa* in Hurd, 1952: 294) exhibits the exact opposite of this situation. Other USA *Pepsis* species display either non-comparable clines or none at all. Clearly, Bohart & Menke’s (1963: 125) explanation of the phenomenon is of limited application. Further intensive investigations on *Pepsis menechma*, despite being based on the premise that multiple species are concerned, have failed to substantiate any constant specific distinctions either in structure or in colour; however, both show strong geographical clines: east-west in the USA and north-south in Mesoamerica.

Variation.— Colour. In the eastern USA the wings of both sexes are entirely quite strongly infusate and the antenna bright orange except for AS1-2. In the west the male wings are rather broadly infusate basally and apically, the junctions with the orange-amber of the remaining surface usually diffuse. The female wings are similar except that the basal and apical bands are usually narrower and more sharply defined. The antenna is entirely black in both sexes. In the intermediate forms (mostly found in Texas) usually the antennal orange begins at the apex and extends proximad, but in many specimens the colour begins on the middle segments and extends in both directions. This dichotomy of colour found in the USA extends southwards into Mexico, where the black- and orange-winged forms are distributed as shown on the map for this species. Intermediate forms are much more common here, however; perhaps a reflection of the fact that Mexico is very subdivided by mountainous terrain. Southwards from about the area of Oaxaca in southern Mexico, the apical dark band of the female forewing becomes black rather than merely strongly infusate, acquiring also blue-violet metallic reflections. Further south, on average the proportion of black increases from the wing-base distad. In Costa Rica most females are entirely dark-winged; but most males still have mainly orange wings. Orange-yellow antennae are the norm in both

sexes here. The proportion of black in the wings, and the number of black-winged specimens (especially females), increases as one goes southwards. All of the (admittedly few) specimens of both sexes seen from Panama are black-winged; the antennae still have a variable number of segments orange. From Colombia to Argentina the wings of both sexes are usually entirely black with quite strong blue-violet metallic reflections, except that two females from the north coast of Venezuela: Merida and Maracaibo, are similar to the Central American orange-winged form; their antennae have approximately the apical half orange. Elsewhere in South America light-winged forms occur sporadically in small numbers. South American females usually have the antennae entirely black, but many males have orange colour extending both ways from mid-antenna.

Variation.— Structure. In the USA the MPN is usually shorter than the PST, especially in females; its median groove is strongly expanded posteriorly, and anteriorly sometimes represented by only a suture or completely absent. The male SGP varies considerably in the strength of the three ridges of the basal half, and in the degree of swelling of the apical half; in cases where the latter is less swollen, the centre ridge continues further distad, where it is however partly obscured by increasing pilosity. Where the SGP is strongly swollen, the apical margin is often centrally emarginate. The insertion pattern of the modified hairs of S.4 varies from a shallow “V” to a strong curve. In the eastern USA, on average the female hind tibial teeth are smaller than in the west; the subtending bristles are shorter, thinner and straighter; and the spurs longer and straighter - but still curved apically. As one proceeds southwards through Mexico, all possible combinations of these are met with. However, by the time Oaxaca, in southern Mexico, is reached, certain tendencies become clear in the females, as represented in the majority of specimens: the MPN is longer (equal to the PST); its median groove is moderately expanded apicad (V-shaped) instead of strongly apically (Y-shaped); the DTC are even coarser and the PTC stronger; on the hind tibia the teeth are tiny and distant (confusion with *P. sabina* is possible on this character), the subtending hairs long, thin and weakly curved, and the spurs long, slender, but still curved apically. All these structural characters are displayed in the same form by the majority of South American specimens except that the PTC is often so strong in the male that it gives rise to a short, median carina proceeding forwards, while in the female it is so broad that it is often emarginate centrally; the hind tibial bristles are quite strongly curved; in a few specimens the DTC are only moderately coarse.

Exceptional specimens are as follows: females from Brazil (Bahia and Espiritu Santo) are rather large and robust (BL 28-33); their wing colour is most often deep orange-amber, but varies to quite strongly infusate, often with pale tips. The last 4-7 antennal segments are orange. Although the hind tibia displays the usual backward-curved bristles, the spurs are only very weakly hooked apically. The MG is usually well-marked, giving a superficial resemblance to the female of *P. boharti*. Very small females (BL 16-18) from Mexico and Central America (BMNH) are very difficult to identify, because they lack the most distinctive characters, i.e. the propodeal sculpture is very weak, the hind tibia has weak, straight hairs, and straight spurs; several such specimens have been seen and they all have amber wings. A single very small female (BL 22) has been seen from Ecuador: Guayaquil (NMV); its propodeum has only a very weak PTC and the DTC are very fine; the apical hooks of the hind tibial spurs are scarcely developed and most of the tibial bristles are missing. In these respects it strongly resembles the above-mentioned small

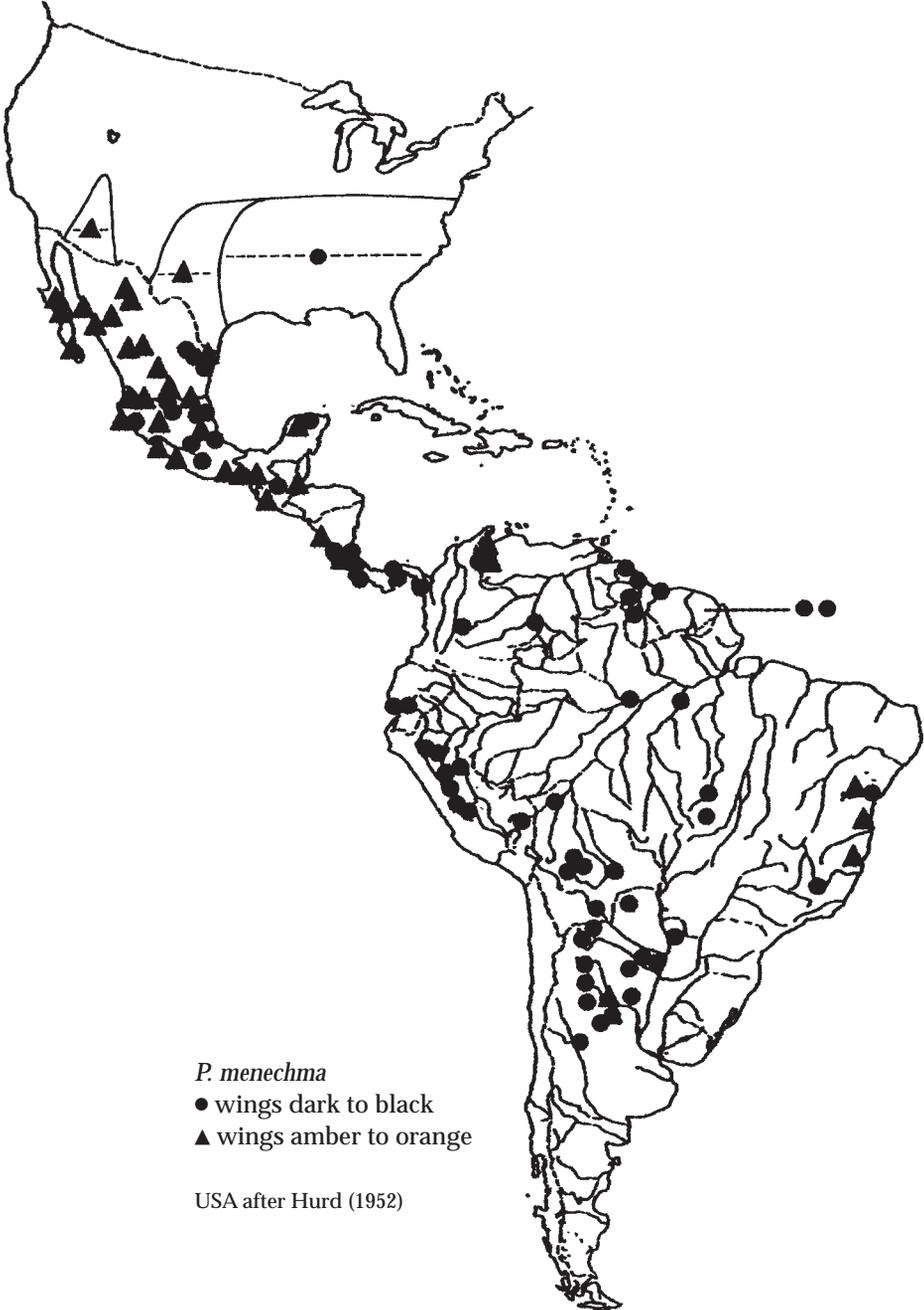


Fig. 655. Collection localities of *Pepsis menechma*.

specimens from Mexico; however, it belongs to the lygarochromic colour group peculiar to the area where it was collected, and this fact causes it to resemble *P. multichroma* spec. nov. (*lampas*-group); but the pygidium of that species strongly distinguishes the two.

Distinctions.— The male is best distinguished from others by its possession of a thin line of hairs on S.4 and the SGP having three ridges basally and being strongly thickened in the apical half, rather than merely expanded laterally; the female by the apically strongly curved spurs and usually curved bristles of the hind tibia. Small Central American females strongly resemble those of *P. ianthina*. However, unlike in that species the hind tibial teeth are minute, some strongly curved hairs are present between them, and the inner spur (which extends to about 0.4 basitarsus length rather than about 0.3) has a small but distinct apical hook.

Distribution.— USA and the entire neotropical region except the West Indies and west of the Andes in South America (except for a single record from coastal Ecuador); apparently also absent from most of eastern and south-eastern Brazil; probably a record from PERU: Sicuani (♀, TMB) represents a labelling error, since this locality is at 4,000 m; ascending to 2,800 m in Mexico. Map fig. 655.

Material depositories.— 487 ♂♂, 447 ♀♀; AEIG, AMNH, ANSP, BMNH, BPBM, BRIO, CAS, CMNH, CSU, CUNY, EMMSU, ETHZ, FDA, FRITZ, GILLASPY, IMLT, INBIO, INPA, IRSNB, LACM, MACN, MCZ, MHNGV, MHNNEU, MICR, MIZSU, MLP, MLU, MNCN, MNHNPS, MNHNPG, MNHU, MNRI, MNS, NMV, NRS, OLLD, OSUC, PORTER, RMNH, SEMKU, SMF, TEXAMU, TMB, UCALB, UCALD, UMOX, UNPBOG, UPAN, USNM, USU, UZMC, WAHIS, WASBAUER, ZSM).

Pepsis decipiens Lucas, 1895
(figs 197-202, 637, 638, 656)

Pepsis decipiens Lucas, 1895: 533. Holotype ♀ (MNHU) [examined]. Not *decipiens* Campos, 1929 [nomen nudum].

Pepsis similis Lucas, 1895: 536, no. 32. Lectotype ♀ (MNHU), here designated [examined]. **Syn. nov.**

Type-material.— *P. similis*: I have seen a single type-material ♀ and labelled it lectotype.

Description.— ♂ (figs 197-202). BL 18-24. Body and legs black with deep blue-green metallic sheen. Antenna black with 3-3.5 apical segments orange or yellow-orange. Wings with variable yellowish-white band. S.4 with a rather small patch of fairly long, coarse hairs on each side, directed quite strongly backwards and some of them weakly curved inwards apically; among them are a few shorter, thinner hairs; centrally is a gap virtually without hairs, except that along the posterior margin is a band of very short and fine, but dense, hairs. On S.5 the pattern is repeated but much more weakly, except that the shorter lateral hairs are more numerous. SGP weakly narrowed in the middle, flat except for a fairly strong but blunt median ridge which is obsolescent apicad (finally obsolete at about 2/3 from base); apex strongly truncate, with a dense fringe of coarse hairs at most about as long as 1/3 minimum width of SGP. Parameres about 1 1/2 times as long as rest of genitalia; digitus of unusual shape.

♀ (figs 637, 638). BL 18-32. AE index 67-91. Colour as in male except that no antennal segments are completely orange; with at most obscure, narrow, brown apical rings on segments 3 onwards. Head in dorsal view rather weakly swollen behind eyes. An-

tenna very robust, with all segments black (some apicals orange in *P. completa*); AS3 with sub-basal bristles on inner side. PPV longer and more parallel to wing axis. SMC3 narrower anteriorly, cell shorter. MPN very slightly shorter than PST, furrow rather strongly expanded posterad or posteriorly, 1-2 carinae stronger than the rest. Propodeum: rather massive, usually noticeably swollen in the middle of its dorsal length (convex at that point in profile) as well as in the usual place around the PTC; MG sometimes weakly indicated between these two sites. APT, PPT and PTC sometimes very strong. Posterior face: VR only weakly indicated near PTC; PFC a few in upper part, rapidly obsolescent, absent by mid point, below which they are replaced by very fine, regular carinae, the lower of which are often weakly curved around the apical valve (in *P. completa*, VR usually present, at least above, and PFC gradually weaker right to apex). S.2 groove with very short or no lateral extension. Femora rather densely covered with short, strong hair, longest and densest on the anterior. Mid and hind femora with inner, posterior angles very sharp, carinescent apicad. Hind tibia: teeth broad but rather low, their posterior face more-or-less perpendicular to the substrate, thus they appear to point strongly backwards; spines about 2-2.5 times their height; inner spur reaching to about 0.4-0.45 basitarsus length (about equal to tarsal segment 2) and about 1.25 times as long as outer.

Variation.— The width and position of the wing-bands vary a little, overlapping the pattern of *P. completa* but not that of *P. atripennis*. The forewing band begins 1-1.5 head-widths from the wing-base, and ends a little beyond the mid-point. The band is carried straight on to the hind wing, but its proportions differ in accord with the shorter wing length. In the female types of *P. decipiens* and *P. similis* the SMC3 of the forewing is strongly rounded postero-distally and totally lacks a spur-vein.

Particular variation.— In one male the anterior DTC turn forwards centrally so that they run parallel anterad. In the female holotype, the wing-band is narrow and very irregular, extending only on to the anterior 1/3 of the hindwing width. Its identity is further obscured by the head being broken and by its being a very worn specimen, so that little trace of its characteristic femoral hairs remains (although the large, numerous hair-pits are still visible).

Distinctions.— Colour-wise, the pale, sub-basal wing-bands distinguish this species from all others except those in the *completa* mimicry-group; from these, the male differs in its modified sternal hairs while the female is best distinguished, especially from *P. completa* itself (which it particularly resembles) by the dense, coarse femoral hair; the S.2 groove lateral extensions absent or almost so; and the mid and hind femora sharply carinate behind; also the antennal colour differs (see Description above).

Biology.— Both sexes belong more-or-less perfectly to the *completa* mimicry-group.

Distribution.— Known only from low altitudes in south-eastern Brazil and Paraguay. Map fig. 656.

Material depositories.— 4 ♂♂, 8 ♀♀; BMNH, CMNH, FRITZ, MNHNPS, MNHU, MZUSP, OSUC, SMF, UFPCUR, UMOX, USNM.

Pepsis maeandrina Lucas, 1895
(figs 269-274, 635, 656)

Pepsis maeandrina Lucas, 1895: 541, no. 35. Lectotype ♀ (MNHU), here designated [examined].

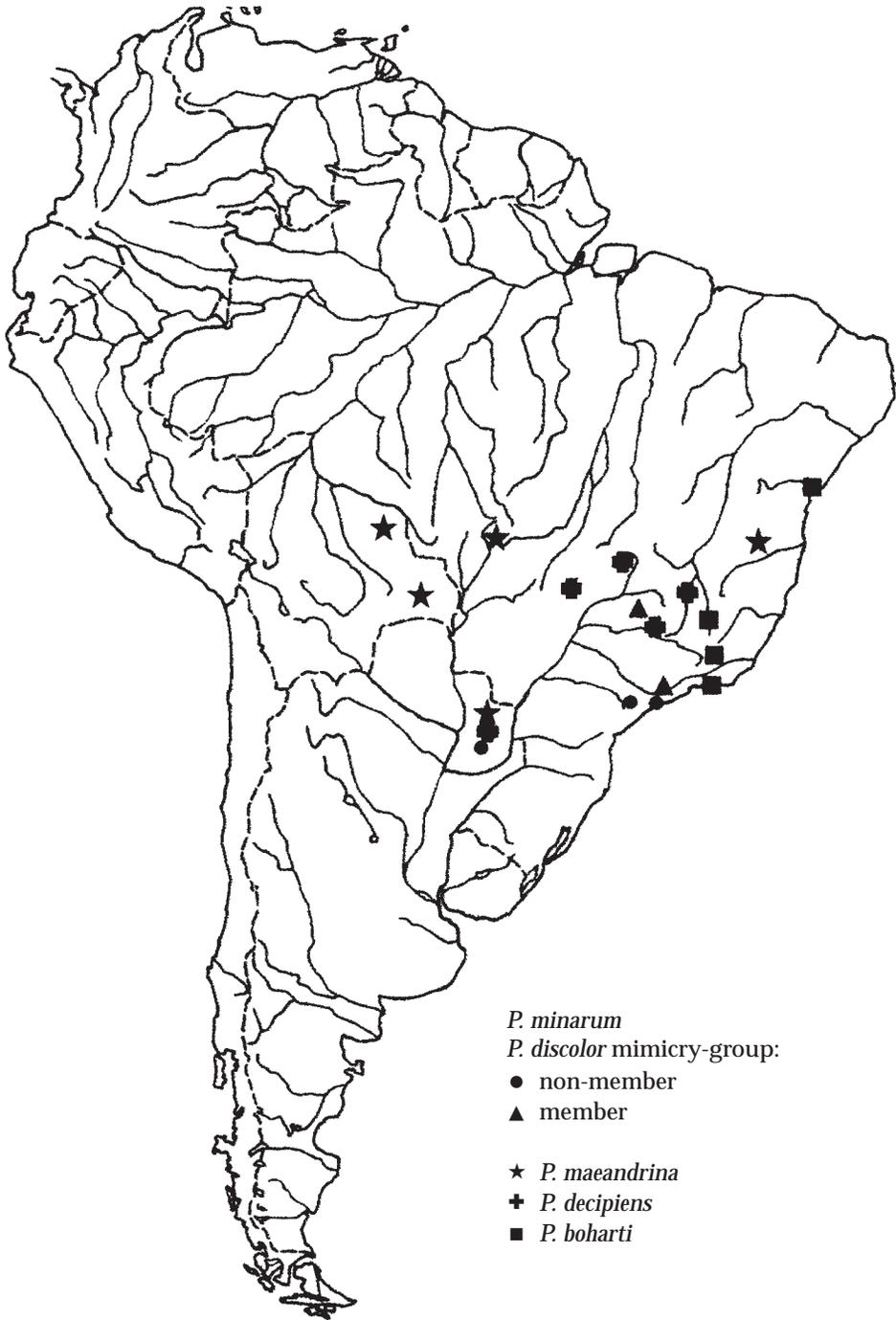


Fig. 656. Collection localities of *Pepsis minarum*, *P. maeandrina*, *P. decipiens* and *P. boharti*.

Type-material.— *P. maeandrina*: I have seen only a single syntype ♀, and labelled it lectotype.

Description.— ♂ (figs 269-274). BL 15-19. Body and legs black with dark green metallic sheen, slightly paler on the gaster. Antenna black with some more or less distinct pale orange marks on the last 1-2 segments. Wings heavily infusate, with a rather broad, irregular, pale yellow transverse band across the middle of the forewing, but extending only part-way towards the posterior edge of the hindwing. Side of thorax and whole of propodeum heavily punctate-rugose, the head less so. S.4 with thin, transverse band of coarse hair anteriorly, basally adpressed, then directed obliquely upwards, backwards and inwards, the outermost with tiny, apical hooks; the hairs towards the centre of the segment gradually becoming shorter, thinner and more erect, but evenly spaced throughout. SGP parallel-sided or scarcely expanded apicad; transversely shallowly rounded, sometimes with a very weak central ridge basally; apex strongly rounded with a narrow but distinct, translucent margin. Paramere pointed (strongly obliquely truncate) and rather short, a little longer than rest of genitalia. Inner projection of digitus apex very bluntly pointed. Femora with a few short hairs below.

♀ (fig. 635). BL 18-22. AE index 60-67. Otherwise as male, except: body colour blue-green to blue-violet. Last few antennal segments obscurely brownish beneath. In some larger females the pale wing-band is broader and almost reaches the posterior margin of the hindwing. Body very robust, gaster slightly dorsoventrally compressed. The body puncturation and rugosity is much stronger in this sex, the former even extending to the gaster and legs. Head in dorsal view with temple slightly swollen, head rather transverse. MT moderate to strong, MPN very short, about 2/3 PST length its furrow broad, especially posteriorly, with 1-2 very strong carinae, often very irregular. Propodeum: MG very broad and shallow. APT strong, PPT weak to moderate, PTC weak. DTC mainly transformed into irregular rugosity, punctate between. Propodeal hair virtually nil. Posterior face: VR virtually absent, PFC fairly strong, but strongly sinuate, recognizable only in median area, laterally anastomosing and with large punctures between. Lateral extension of S.2 groove rather short. Femora almost entirely covered with short, fairly dense bristles. Mid tibial spurs quite strongly curved. Hind tibia: teeth rather small, spines very long, about 2.5-3.0 times as high; long, slightly curved hairs on inner side of teeth; inner spur reaching to 0.4-0.45 basitarsus length (longer than tarsal segment 2, almost as long as 3 + 4), and 1.1-1.2 times as long as outer spur.

Variation.— Only as already noted.

Distinctions.— Absolutely distinct from all other species of the genus by its very strong rugosity and puncturation; however, among the members of the *completa* mimicry-group, in the male it is necessary to look at the mesopleuron to see the puncturation most clearly.

Biology.— Both sexes belong to the *completa* mimicry-group.

Distribution.— Known only from Bolivia, central-southern Brazil and Paraguay, ascending to 800 m in Brazil, Minas Geraes (map fig. 656).

Material depositories.— 8 ♂♂, 16 ♀♀; AEIG, BMNH, CMNH, FRITZ, MNHU, MNHNPS, MNRJ, MZUSP, WASBAUER.

Pepsis minarum Brèthes, 1914
(figs 251-256, 584, 656)

Pepsis minarum Brèthes, 1914: 286, no. 44. Lectotype ♀ (MZUSP), here designated [examined].

Pepsis pulchra Brèthes, 1914: 323, no. 108. Lectotype ♂ (MZUSP), here designated [examined]. **Syn. nov.**

Type-material.— *P. minarum*: I have seen a single type-material ♀ and labelled it lectotype. *P. pulchra*: I have seen a single type-material ♂ and labelled it lectotype.

Description.— ♂ (figs 251-256). BL 19-21. Body and legs black with rich, deep blue-green sheen. Antenna black. Forewing weakly, hindwing very weakly infuscate-amber, apex of forewing paler; the junction diffuse; with a faint yellowish basal area. S.4 with a broad, transverse band of rather long, sparse hairs, the outer curved inwards, the central backwards, most attaining a similar height (not length). S.5 with fewer but similar, more-or-less central hairs. SGP flat, parallel-sided or slightly expanded apicad, surface with few large and many small punctures, the truncate apex with a dense fringe of strong hairs, their length about 1/3-1/2 SGP apex width. Paramere broad, narrowed apicad, about 1.5 times as long as rest of genitalia; apex with long hair fringe about equal to maximum paramere width. Apex of digitus with slender inner projection curved distad. Fore femur with coarse, fairly short and dense hair below. All claw-joints strongly curved; all claws likewise, especially the hind which is **bent almost at a right-angle**.

♀ (fig 584). BL 20-25. AS3 short, with a few short, strong bristles on the inner side; AE index 73-86. Colour as in male except wings a little darker, with a more noticeable yellowish-amber area at the base, and a more distinctly pale apex. Head with temples quite strongly swollen. MT weak to moderate. MPN usually distinctly shorter than PST, its furrow rather broad, more-or-less expanded apicad; carinae rather fine. Propodeum: dorsum flattened, sometimes with very shallow MG. APT moderate to strong, PPT weak to moderate. PTC weak to moderate, broadly tooth-like. Propodeal hair shorter than PST. DTC moderate, becoming stronger apicad. Posterior face: VR usually present near PTC; when traces are visible below this they are strongly divergent apicad. PFC strong in upper, outer parts only, obsolescent over rest of surface and often totally absent from the central area. Gastral S.2 transverse groove with rather short lateral extensions. Anterior femur with rather short but quite dense hair below, sparser on mid femur. Hind tibia: teeth rather small, the subtending spines quite strongly curved backwards and 2.5-3.0 times their height; the row of bristles on their inner side (and about equal in length) directed (scarcely curved) backwards. Inner spur very short, reaching to only about 0.2-0.25 basitarsus length (about equal to tarsal segment 3); about 1.15-1.2 times as long as outer spur. The claw-joints are more strongly curved than in the male, but the claws less so; the tooth is just beyond mid-claw, and overlain by 2-3 strong setae which are slightly sinuate where they cross over the tooth.

Variation.— Only as recorded above.

Distinctions.— The sexual characters of the male look superficially like those of a small species of the *luteicornis*-group (sub-group of *P. inclyta*), but the strongly curved claw-joints and strongly bent claws are distinctive. The female tibial and tarsal characters, on the other hand, resemble the group-characters of the *sumptuosa*-group, but it is much smaller than most species of that group, has a much shorter AS3 and the head more swollen than in any species of that group of comparable size.

Biology.— This species belongs to the *discolor* mimicry-group.

Distribution.— Known only from low altitudes in Paraguay and southeastern Brazil. Map fig. 656.

Material depositories.— 6 ♂♂, 13 ♀♀; BMNH, BONELLI, FRITZ, MCZ, MNRJ, MZUSP, NMV, TMB, UFPCUR, UMOX, USPRIB.

Pepsis basifusca Lucas, 1895
(figs 459-467, 579, 580, 657)

Pepsis basifusca Lucas, 1895: 798, no. 174. Lectotype ♂ (MNHU), here designated [examined].

Pepsis angustimarginata Viereck, 1908: 398. Holotype ♀ (SEMKU) [examined]. **Syn. nov.**

Type-material.— *P. basifusca*: I have seen 2 ♂ syntypes and labelled the one in MNHU as lectotype. The one in NMV is a conspecific paralectotype.

Description.— ♂ (figs 459-467). BL 11-22. Body and legs black with dark blue-green metallic sheen. Antenna black. Wings orange-amber with the base strongly infusate for a distance equal to about 1-2 body-widths and more-or-less well-defined. Apex of forewing with a fairly well-defined, narrow, infusate band, occupying most of the area beyond the closed cells, with a variable patch in the radial cell. Hind-wing similarly infusate. S.4 with a broad, transverse band of hairs, the outer ones rather denser, long, slightly curved inwards and backwards and forming a “brush”; shorter, thinner, sparser and more upright towards the centre; all hairs with a small, apical hook. S.5 with a very sparse arc of hairs, strongest in the centre, where they are about as long as the shortest on S.4. SGP long, narrow, weakly expanded apicad; with a slightly flattened, weakly 3-keeled sub-basal area; the apex rounded and slightly thickened. Paramere rounded apically, about half as long again as the rest of the genitalia. Apical projection of digitus slender, slightly bent distad.

♀ (figs 579, 580). BL (14-)16-27. AE index 70-91. Colour as in male, except body more blue-violet and wings with narrower and well-defined apical band, occupying half or less of the area beyond the cells and not entering the radial cell; antenna sometimes becoming faintly brown apicad and/or segments with narrow, brown apical rings. Head in dorsal view moderately swollen. MT weak to moderate. MPN equal to or slightly shorter than PST, its furrow broad and often more-or-less strongly expanded apicad; carinae fine, sometimes 1 or 2 slightly stronger. Propodeum: MG sometimes very weakly indicated anteriorly and posteriorly, otherwise replaced by broadly rounded ridge. APT and PPT weak to moderate. DTC fairly strong and a little distant anteriorly, often becoming slightly stronger posterad; propodeal hair not very dense, slightly shorter to slightly longer than PST length. PTC weak or absent. Posterior face: VR at most very weak near PTC; PFC usually similar above to DTC, then more-or-less rapidly weakening posterad, sometimes entirely fine; usually present in a more-or-less broad midline, and wherever weak, giving way to a fine, matt sculpture; slightly shining near petiole socket. Lateral extension of S.2 groove distinct though often shallow (occasionally rather short). Hind tibia: teeth of usual size, subtending spines 2.0-2.5 times as long; inner spur reaching to about 0.25-0.3 basitarsus length (about equal to tarsal segment 3) and about 1.25-1.3 times as long as outer spur.

Variation.— Only as given above.

Distinctions.— The male is not likely to be confused with that of any other Central American species, by virtue of its sternal hair formation. The female strongly resembles that of *P. montezuma* which is sympatric in the northern part of its range; see the following table.

Table to distinguish between females of *Pepsis basifusca* and *P. montezuma*.

<i>P. basifusca</i>	<i>P. montezuma</i>
Smaller species, BL 14-25.	Larger, BL 18-33.
Head in dorsal view moderately swollen.	Rather strongly swollen.
AS3 shorter, AE index 70-91.	AS3 longer, AE index 81-107.
MT weak to moderate.	MT strong and sharp.
SMC3 longer, anterior vein usually longer than posterodistal veinlet; cell rounded apico-posteriorly, M-a spur-vein short or absent.	SMC3 shorter, anterior vein usually shorter than posterodistal veinlet; cell angulate apico-posteriorly, M-a spur-vein fairly strong.
Apical band of forewing occupying at most half the width of area beyond cells, well clear of them except sometimes near costa; sometimes extreme apex pale.	Apical band of forewing occupying more than half the width of area beyond cells and closer to them; extending right to wing apex.
Propodeal hair at most about as long as PST.	Propodeal hair distinctly longer than PST.
Tergite 1 rather swollen.	Tergite 1 evenly, shallowly rounded.
Femora with sparse hairs below.	Femora with dense hairs below.
Inner spur of hind tibia shorter, reaching to about 0.25-0.3 basitarsus length.	Inner spur longer, reaching to about 0.35-0.4 basitarsus length.

Distribution.— Found from the southern USA to western Panamá; ascending to 2,500 m in Mexico. Map fig. 657.

Material depositories.— 241 ♂♂, 143 ♀♀; AEIG, AMNH, ANSP, BMNH, BRIO, CAS, CUNY, EMMSU, INBIO, LACM, MCZ, MHNGV, MICR, MNHNPS, MNHU, NMV, OSUC, RMNH, SEMKU, TMB, TEXAMU, UCALD, USNM, USU, WASBAUER.

Pepsis boharti spec. nov.
(figs 398-403, 623, 656)

Type-material.— Holotype ♂, **Brazil**: Santo An[tonio?], 1921 (Zikan) (CUNY). Note. The label on the holotype is printed on 4 lines: "Brazil; S. Leopoldo; 1898; Dutra" but lines 2-4 are over-written very indistinctly: "Santo An; 1921; Zikan." I am confident that date and collector are as interpreted, but some doubt remains about the locality; however, "Santo Antonio" seems likely, especially since it is close to São Leopoldo. I am grateful to Dr Danilo Calazans, of the Fundação Universidade do Rio Grande, Brazil, for help with this problem. Despite the locality query, this male is designated holotype because the only other available male is in poor condition. Paratypes. Brazil: 1 ♂, Bahia (UZMC); 1 ♀, Bahia (Winthem) (NMV); 1 ♀, Lagoa Santa (MACN); 2 ♀♀, Brazil [N.F.L.], 1 ♀ Rio de Janeiro (all MHNGV); 1 ♀, E[stado] do Rio [de Janeiro], Tinguá, 21.i.1948 (MNRJ); 1 ♀, Goiaz, Annapolis, 2.i.[19]37, Col. Campos Seabra (MNRJ); 1 ♀, [Minas Gerais] Barbacena, 1.ii.[19]25 (BMNH).

Etymology.— Named after Professor R.M. Bohart.

Description.— ♂ (figs 398-403). BL 26-28. Body and legs black with dull blue-green metallic sheen. Antenna black with 1-2 apical segments orange. Wings fairly strongly infuscate. S.4 with a narrow, semicircular band of hairs, the outermost long, strongly



Fig. 657. Collection localities of *Pepsis basifusca*.

curved inwards and backwards, the apexes hooked, those of opposite sides just touching; antero-centrad becoming abruptly much shorter and straighter, and very sparse. S.5 apparently without modified hairs (both males seen are slightly abraded). SGP elongate, with a distinct but not sharp median keel, and fairly strongly expanded at the rounded apex; any apical hairs which may have been present are abraded. Paramere about half as long again as the rest of the genitalia, bluntly pointed; with apical hairs rather shorter than minimum paramere width. Inner projection of the digitus apex bluntly pointed.

♀ (fig. 623). BL 24-32. AE index 77-100. Colour as in male but antennal orange beginning irregularly anywhere between segments 5 to 9, and forewing sometimes more-or-less pale apically. Head in dorsal view with temple quite strongly swollen. MT large, sharply-pointed. Forewing with PPV rather short and transverse; 1r-m strongly sloping anterodistad, weakly curved (thus anterior veinlet of SMC3 short); stigmal fenestra curved, sometimes equally broad throughout, but more often tapering rapidly anterad,

thus appearing almost comma-shaped. MPN equal to or slightly shorter than PST, its furrow usually broad throughout, sometimes obsolescent anteriorly and strongly expanded posteriorly; carinae usually very fine with a few stronger ones, sometimes a single one markedly stronger. Propodeum: MG markedly deep and narrow over at least part of its length, set in a broad ridge. APT and PPT moderate to strong; DTC moderate to strong, sometimes irregular posteriorly. PTC rather narrow but very strong, flat-topped (sometimes duplicated immediately in front, then smaller). Propodeal hair equal to or shorter than MPN. Posterior face: VR weak; PFC fairly strong above, sometimes interrupted in mid-line, obsolescent below. Lateral extension of S.2 groove usually long but narrow, occasionally very short. Underside of front femur with fairly dense, coarse hair of very uneven length. Hind tibia: teeth moderately strong; sometimes rather narrow, upright, distant and blunt-tipped; subtended by spines 1.5-3.0 times as high; on the inner side of the teeth is a row of variably alternating spines and bristles, some of the latter (especially towards the tibial apex) very long and curved backwards. Inner spur reaching to about 0.3-0.4 basitarsus length (about equal to tarsal segment 2 or slightly less) and 1.2-1.4 times as long as outer spur. Spurs of mid and hind tibiae more-or-less strongly hooked apically, the outer ones most strongly.

Variation.— Only as noted above.

Distinctions.— The male is distinguished by the configuration of its S.4 hairs; although it somewhat resembles those of a few other species, it is much larger and allopatric from them (but see *P. convexa*). The female is very distinct on the basis of its very strong propodeal dorsal groove and PTC, reminiscent of *P. chrysoptera* but much larger, head more strongly swollen, strongly sloping 1 r-m, anterior tibial spurs not broadly spatulate (although sometimes blunt-tipped), hair below front femur, and with the MPN shorter and its furrow much broader than in that species.

Distribution.— Known only from low-altitude eastern and south-eastern Brazil. Map fig. 656.

Material depositories.— 2 ♂♂, 8 ♀♀; BMNH, CUNY, MACN, MHNGV, MNRJ, NMV, UZMC.

Pepsis chrysoptera Burmeister, 1872
(figs 289-295, 618, 658)

Pepsis chrysoptera Burmeister, 1872: 233, no. 8. Lectotype ♂ (MACN), here designated [examined].

Pepsis exigua Lucas, 1895: 599, no. 61. Lectotype ♂ (MNHU), here designated [examined]. **Syn. nov.**

Pepsis smaragdina Lucas, 1895: 672, no. 96. Lectotype ♂ (MNHU), here designated [examined]. **Syn. nov.**

Pepsis nebulosa Lucas, 1895: 673, no. 98. Lectotype ♂ (MNHU), here designated [examined]. **Syn. nov.**

Pepsis karschi Lucas, 1895: 706, no. 122. Lectotype ♀ (MNHU), here designated [examined]. **Syn. nov.**

Pepsis anisitsii Brèthes, 1908: 234. Holotype ♀ (MNHU) [examined]. **Syn. nov.**

Pepsis indistincta Brèthes, 1908: 234. Holotype ♀ (MLP) [examined]. **Syn. nov.**

Pepsis dimidiatipennis Brèthes, 1908: 235. ♂, Brazil, Manaus (lost). **Syn. nov.**

Pepsis chloroptera Brèthes, 1908: 236. Lectotype ♂ (MACN), here designated [examined]. **Syn. nov.**

Pepsis culta Brèthes, 1908: 237. Holotype ♂ (MLP) [examined]. **Syn. nov.**

Pepsis recta Brèthes, 1908: 238. Lectotype ♀ (MNHU), here designated [examined]. **Syn. nov.**

Pepsis tornowii Brèthes, 1908: 238. Holotype ♂ (MACN) [examined]. **Syn. nov.**

Pepsis schrottkyi Brèthes, 1908: 239. Lectotype ♂ (MACN), here designated [examined]. **Syn. nov.**

Pepsis itinerata Brèthes, 1908: 241. Lectotype ♀ (MACN), here designated [examined]. **Syn. nov.**

- Pepsis miniata* Brèthes, 1908: 241. Holotype ♀ (MACN) [examined]. **Syn. nov.**
Pepsis spagazzinii Brèthes, 1908: 241. Holotype ♂ (MACN) [examined]. **Syn. nov.**
Pepsis paulistana Brèthes, 1914: 307, no. 81. Holotype ♂ (MZUSP) [examined]. **Syn. nov.**
Pepsis chloe Brèthes, 1914: 313, no. 90. Lectotype ♂ (MACN), here designated [examined]. **Syn. nov.**
Pepsis coronaria Brèthes, 1914: 313, no. 91. Holotype ♂ (MZUSP) [examined]. **Syn. nov.**
Pepsis semilucana Haupt, 1952: 355, no. 7. Holotype ♀ (MLU) [examined]. **Syn. nov.**
Pepsis bruneipes Haupt, 1952: 384, no. 13. Holotype ♀ (MLU) [examined]. **Syn. nov.**
Pepsis brachynotus Haupt, 1952: 392. Lectotype ♂ (MLU), here designated [examined]. **Syn. nov.**
Pepsis diagonalis Haupt, 1952: 394. Lectotype ♂ (MLU), here designated [examined]. **Syn. nov.**
Pepsis discrepans Haupt, 1952: 395. Lectotype ♂ (MLU), here designated [examined]. **Syn. nov.**

Type-material.— *P. chrysoptera*: I have seen both of the syntype ♂♂, and have labelled the one from Tucumán as lectotype; the name appears on the original label as “*chrysoptera*”. The paralectotype is not conspecific: it is the holotype of Brèthes’ species *P. burmeisteri* (itself a synonym of *P. seladonica*). *P. exigua*: I have seen only a single syntype ♂ with locality “Matto Grosso” [= Mato Grosso] and labelled it lectotype; it lacks the genitalia. *P. smaragdina*: I have seen a single type-material ♂ and labelled it lectotype. *P. nebulosa*. I have seen only a single ♂ syntype and labelled it lectotype. This specimen bears no locality label, but Lucas gives “Brazil, Porto Allegre”, which locality is consistent with the antennal colour of the specimen. *P. karschi*. I have seen a single type-material ♀ and labelled it lectotype. *P. chloroptera*. I have seen 2 syntypes, a ♂ and a ♀, both in MACN; and have labelled the ♂ as lectotype. The ♀ paralectotype is a specimen of *P. festiva* F. Of 6 further ♀♀ in MZUSP and identified by Brèthes, 4 belong to *P. festiva*, 1 to *P. xanthocera* and only 1 to *P. chrysoptera*; none have type status as *P. chloroptera*. *P. recta*. I have seen 2 of the 4 ♀ syntypes, both from Asunción, and have labelled the larger one as lectotype. The other specimen (also in MNHU) is a conspecific paralectotype, but a third ♀ in MACN, although conspecific, has no type status. *P. culta*. In addition to the holotype, there is in MZUSP the ♂ mentioned later by Brèthes (1914: 298); it has no type status but is conspecific. *P. schrottkyi*. I have seen only 1 of the 2 ♂ syntypes; it is from Misiones, and I have labelled it lectotype. A ♂ in MLP has no type status but is conspecific. *P. itinerata*. I have seen both ♀ syntypes and labelled the larger one as lectotype. The other specimen is a conspecific paralectotype. *P. chloe*. I have seen 3 of the 4 ♂ syntypes and labelled as lectotype the one with an old, handwritten label “*chloe*”. The other 2 are conspecific paralectotypes. *P. brachynotus*. I have seen a single type-material ♂ and labelled it lectotype. *P. diagonalis*. I have seen a single type-material ♂ and labelled it lectotype. *P. discrepans*. I have seen a single type-material ♂ and labelled it lectotype.

Description.— ♂ (figs 289-295). BL 15-25. Body and legs black with dark blue or green sheen. Antenna with 0-11 apical segments orange. Wings black, with weak blue-violet reflections, to almost entirely orange; apexes sometimes slightly paler. The anterior tibial spur is remarkable in being **weakly spathulate** rather than tapered and pointed. S.4 with a thin line of coarse hairs, swept inwards basally then backwards, laterally dense and long with small apical hooks, then sparser, thinner, straighter and shorter inwards, at the centre nearly reaching the height (not length) of the outer ones. S.5 with only a sparse patch of thin hairs on each side (rarely denser, forming a loose tuft). SGP parallel-sided or weakly expanded apicad, with a **characteristic, small but distinct, pre-apical, transverse impression** (view from various angles). The apex is roughly square when the SGP is parallel-sided; when the latter is expanded, the apex is rounded and occasionally slightly

emarginate centrally. Paramere rather broad, about 1.5 times as long as rest of genitalia, bluntly pointed, with apical hair-fringe almost as long as maximum paramere width. Inner projection of digitus apex rather broadly and bluntly pointed.

♀ (fig. 618). BL 21-30. AE index 83-98. Colours as in male, except that the antennal orange reaches proximad at most to the mid-point of AS3, where the junction with the black is diffuse. Head in dorsal view with temple slightly to moderately swollen. MT often quite sharp. MPN usually about equal to PST, **its centre section depressed** below the level of both PST and propodeum, **its furrow narrow, almost suture-like**, abruptly obsolescent (sometimes obsolete) before reaching the anterior margin, occasionally expanded into a shining triangle, slightly expanded posteriorly; **carinae fine to very fine**, oblique. Propodeum: MG replaced by a **ridge which becomes sharper apicad**, ending in a more-or-less strong (size-related), toothlike (or wider) PTC; APT weak to moderate, PPT weak to strong (both size-related), often sharp in larger specimens; DTC fairly strong and regular throughout. Propodeal hair about 1/2-2/3 PST length. Posterior face: VR weakly indicated in large specimens, usually absent; PFC as DTC, gradually weaker apicad, usually interrupted in median line. Lateral extension of S.2 groove well-developed. Femora, especially anterior, with some short, fairly strong hairs below. Spur of anterior tibia **strongly flattened and spatulate**. Hind tibia: teeth usually sharp, backward-sloping (occasionally small, distant and almost upright), the spines 1.5-2.0 times as high; inner spur usually very long, reaching to 0.35-0.45 basitarsus length (about equal to tarsal segment 2); inner spur 1.2-1.3 times as long as outer.

Variation.— The number of antennal segments which are orange varies without obvious regional pattern, except that most of the specimens from any particular minor locality tend to resemble each other. Wing-colour, however, does display distinct regional variation. Throughout most of the range of this species the wings are entirely black; but in specimens of both sexes from Colombia: Magdalena valley the basal halves of the wings (with slight variations) are pale yellow-orange; likewise, specimens of both sexes from Brazil: Manaus; Rio Arapiuns (off the Rio Tapajos near Santarém) and Obidos. Two females from Santarém both have entirely black wings. Again in southern South America, there is a region where partly pale-winged forms occur; however, these are less well defined than their northern counterparts. Here also is found a complete range of intermediate colour forms, varying from entirely black-winged to orange-amber with a dark apical border. The region appears to be divided into two zones: one in Argentina: Salta; Jujuy; Catamarca; La Rioja and Tucumán where the wings are mainly pale; the other in Paraguay: Caaguazu; Cororo, Rio Ypané; Asunción; Hohenau; and Argentina: Corrientes where the wings are mainly dark and the pale colour is deeper orange, and varies from a sub-basal smudge on the forewing to distinct areas extending up to half the bases of the wings. One female from Caaguazú has the basal half of the forewing smoky orange and a smaller, less distinct patch subapically (rather like the sympatric form of *P. auriguttata*). A female from Corrientes is very similar in appearance to the above-mentioned female from the Rio Arapiuns, in that the orange is the same shade and likewise extends about halfway from the wing-base. A ♂ from Brazil: Mato Grosso (MNHNS) has the body covered with fine, dense, yellowish pubescence).

Distinctions.— Both sexes are well distinguished by the unique shape and sculpture of the MPN, the unusual propodeal median ridge and the spatulate anterior tibial spur; the male further by its S.4 hairs (these latter similar to those of other species in the



Fig. 658. Collection localities of *Pepsis chrysoptera* and *P. taschenbergi*.

same group) and pre-apical depression of the SGP (look carefully while varying the angle of incident light); the female further by the long inner spur of the hind tibia.

Biology.— Many specimens of both sexes belong to the *atripennis* mimicry-group; rarely, females belong to the *completa* mimicry-group (e.g. the paralectotype of *P. completa* (labelled only “Brazil”) is a specimen of *P. chrysoptera* and is such a specimen.

Distribution.— Found throughout South America from northern Colombia and the Guianas (although apparently absent from the Upper Amazon; and a record from Suriname (1 ♀ RMNH) while likely to be correct, needs confirmation), south to central Argentina (Entre Ríos and La Rioja - records from San Juan (8 ♀ ♀, MACN) and Río de La Plata (1 ♀, UZMC) are also probably correct but need confirmation; mostly at low altitudes, but reaching 1,200 m in Colombia (Magdalena) and Argentina (Salta). Map fig. 658.

Material depositories.— 375 ♂♂, 261 ♀♀; AEIG, AMNH, ANSP, BMNH, BONELLI, CAS, CMNH, CUNY, EMMSU, FRITZ, IMLT, INPA, MACN, MCZ, MHNGV, MIZAM, MLP, MLU, MNHNPS, MNHNPG, MNHU, MNRJ, MNS, MPEG, MZUSP, NHMBAS, NRS, OLLD, OSUC, RMNH, SMF, TMB, UBRAS, UCALB, UCALD, UMOX, UNPBOG, USNM, USPRIB, UZMC, WAHIS, WASBAUER, WILLIAMS, ZMHEL, ZMMICH, ZM-MOSC, ZSM.

Pepsis taschenbergi Lucas, 1895
(figs 27-32, 615, 658)

Pepsis taschenbergi Lucas, 1895: 675, no. 99. Lectotype ♂ (MLU), here designated [examined].

Type-material.— *P. taschenbergi*: I have seen a single type-material ♂ and labelled it lectotype.

Description.— ♂ (figs 27-32). BL 18-24. Body and legs black with dark blue-green metallic sheen. Antenna black with the apical segment partly dirty yellowish (see Variation). Wings moderately to strongly infuscate, with quite strong blue-violet reflections. **S.3 with long hairs forming** a rather extensive but only moderately dense **lateral brush**; the apexes are curved strongly backwards and inwards, sometimes touching those of the opposite side; on the inner side of the brushes are a few slightly shorter and straighter hairs, but these still leave a large gap in the centre. **S.4 with a similar but smaller hair brush**. S.5 essentially without modified hairs. SGP elongate, strongly expanded apically, with a weak median keel obsolescent pre-apically; the apex rounded, sometimes slightly emarginate centrally, with hairs at most about half as long as maximum SGP width. Paramere almost twice as long as rest of genitalia, rather narrow, bluntly pointed apically. Inner projection of digitus apex rather sharply pointed but not turned distad.

♀ (fig 615). BL 34-36. AE index 101-104. Colour as in male but AS3-11 with narrow, dull brown apical rings and AS12 with apical orange spot; body sheen dark blue-violet. Head in dorsal view with temple and vertex quite strongly swollen. Forewing with junction of radial vein and costa very shallow (as in the *rubra*-group); PPV almost axial; anterior half of 1r-m transverse, posterior half directed proximally, so that the vein is more-or-less strongly bent in middle; 2r-m increasingly strongly curved posterad and anterior vein of SMC3 short, so that the cell is very strongly bulging postero-distally. MT rather small but quite sharply-pointed. MPN as long as PST, its furrow narrow anteriorly, more-or-less strongly expanded apically, and abruptly so

apically; carinae fine. Propodeum: MG weakly indicated anteriorly. APT weak to moderate, PPT quite strong and transversely sharp, PTC very strong, sharp, and rounded. DTC weak, somewhat irregular. Propodeal hair slightly longer than PST. Posterior face: VR absent, PFC weak above, and so weak below that they are obscured by fine, transverse, almost matt sculpture. Lateral extension of S.2 groove well-developed. The front femur has some short, thin hairs below. Hind tibia: teeth small, almost upright, distant, rather sharp; the subtending spines scarcely higher. Inner spur reaching to 0.25-0.3 basitarsus length (about equal to tarsal segment 3 or slightly longer) and 1.1-1.2 times as long as outer spur.

Variation.— The male antenna has the dirty-yellow colour on the apical segment varying from a small apical spot to covering about half the segment.

Distinctions.— The male bears some resemblance to that of *P. purpureipes*, but that species is much smaller, has a brilliant green body, and has the hair-brushes much thinner; it is also distantly allopatric. The female has similar venation to that of *P. assimilis* in the *rubra*-group, but that species has a less sharp MT, stronger DTC, and the PTC more-or-less emarginate centrally; the two are also distantly allopatric.

Distribution.— Known only from eastern Brazil, at low altitudes. Map fig. 658.

Material depositories.— 41 ♂♂, 2 ♀♀; AEIG, BMNH, FDA, MLU, MZUSP, UFPVIC, USPRIB, ZSM.

The *Pepsis elongata*-group

Description.— Both species of the pair forming this group are small and rather slender (the females less so), BL males 16-23, females 18-33. The body is black, sometimes dirty brown. The antenna is black or partly orange; the wing colour variable, pale or dark, the forewing sometimes with a pale apex. The male sternal hairs are variable; the SGP is keeled at least basally, and is transversely convex apically; the paramere is narrow and longer than the rest of the genitalia. The female head is strongly transverse, the AS3 short to medium; MPN short; propodeum with the MG narrow but distinct; the gaster is strongly dorsoventrally compressed, highly polished, with tergites 2-5 apically emarginate; teeth of hind tibia tiny, the bristles directed strongly backwards.

Internal relationships.— The two species forming this group are strongly united by the unique characters of the female gaster.

External relationships.— This is regarded as the sister-group of the *P. menechma*-group; however, it was difficult to decide whether this or *P. nitida* was the sister-group of the *P. menechma*-group, because they both have some characters in common with both the *P. menechma* and *lampas*-groups.

Biology.— Some specimens of both sexes of *P. australis* belong to the *discolor* mimicry-group.

Biogeography.— The group is found from Panamá southwards, everywhere east of the Andes reaching to the latitude of northern Argentina. Both species are found mainly at lower altitudes but there is an exceptional record for *P. elongata* at 1,500 m in Lara state of Venezuela. The two species exhibit the same distribution patterns as the species-pairs in Part 2.

Pepsis elongata Lepeletier, 1845
(figs 81-86, 524, 659)

Pepsis elongata Lepeletier, 1845: 482, no. 21, pl. 33, f. 3. Lectotype ♀ (MIZSU), here designated [examined].

Pepsis purpurascens Smith, 1855: 194. Lectotype ♀ (BMNH), here designated [examined]. **Syn. nov.**

Pepsis fuscipennis Smith, 1873: 50. Lectotype ♀ (BMNH), here designated [examined]. **Syn. nov.**

Pepsis longula Banks, 1946: 367. Lectotype ♀ (MCZ), here designated [examined]. **Syn. nov.**

Pepsis accipitrinus Hurd, 1952: 132. [Replacement name for *P. fuscipennis* Smith, 1873, not Fabricius, 1804].

Type-material.— *P. elongata*: I have seen a single type-material ♀ and labelled it lectotype. *P. purpurascens*. I have seen a single type-material ♀ and labelled it lectotype. *P. fuscipennis*. I have seen 3 ♀ syntypes, 2 in BMNH and 1 in UMOX. I have labelled as lectotype the larger of the 2 ♀♀ in BMNH, which bears the locality “Ega” [= Teffé]. The remaining 2 ♀♀ are paralectotypes, and all 3 are conspecific. *P. longula*: I have seen both of the syntype ♀♀ mentioned by Banks, and have labelled the one from Cayenne as lectotype. The paralectotype from Guyana: St. Laurent is conspecific.

Description.— ♂ (figs 81-86). BL 16-21. Body and legs usually black, sometimes the gaster and legs partly red-brown, when the body has brassy hair; antenna black, sometimes partly yellow or orange; wings slightly to heavily infuscate, forewing sometimes with poorly-defined pale apex. Gastral tergites 5-6 slightly emarginate posteriorly. S.4 with a short, oval, lateral patch of coarse hairs, apexes of those of opposite sides touching, but with large central gap; the hairs curved inwards and backwards, gradually shorter centrad; S.5 with small, lateral tufts of much weaker hairs; most of surface of both sternites shining. SGP slightly expanded apicad, rounded apically, strongly transversely convex, with an apical fringe of long but thin hairs, at most as long as minimum SGP width. Paramere about 1.5 times as long as rest of genitalia, with an apical fringe of hairs about as long as maximum paramere width. Inner projection of digitus apex with a strongly obtuse point.

♀ (fig. 524). BL 18-33. AE index 87-107. Colour as in male except body (including pubescence) always entirely dark; wings sometimes fairly bright orange, antenna never with paler colour mainly near base. Head in dorsal view with temple strongly constricted, head strongly transverse. MT weak to moderate, sometimes strong (size-related). MPN as long as or slightly shorter than PST, its furrow variable but usually very narrow; carinae few, coarse and transverse, occasionally finer and slightly oblique, especially in larger specimens, and often hidden by pubescence. Propodeum: MG deep, narrow; both MG and DTC often hidden by pubescence. APT weak to moderate (sometimes strong), PPT weak to strong (both also size-related). DTC coarse, regular. PTC usually absent, sometimes weakly present. Propodeal hair extremely short and fine, apparently soon abraded, about 1/4-1/3 as long as PST. Posterior face: VR usually absent, sometimes weakly indicated near PTC. PFC coarser than DTC, evenly strong over whole surface except sometimes in median line, where replaced by fine, matt sculpture; often sinuate in middle of face. Gaster dorsoventrally compressed, shining (including pygidium); tergites 2-5 increasingly (arcuately) emarginate posteriorly. Lateral extension of S.2 groove absent. Hind tibia: with tiny, distant teeth and backward-curved hairs; inner spur very long, reaching to 0.3-0.45 basitarsus length (about equal to tarsal segment 2) and 1.2-1.5 times as long as outer spur.

Variation.— In males, the body pubescence varies from dull ochraceous in speci-

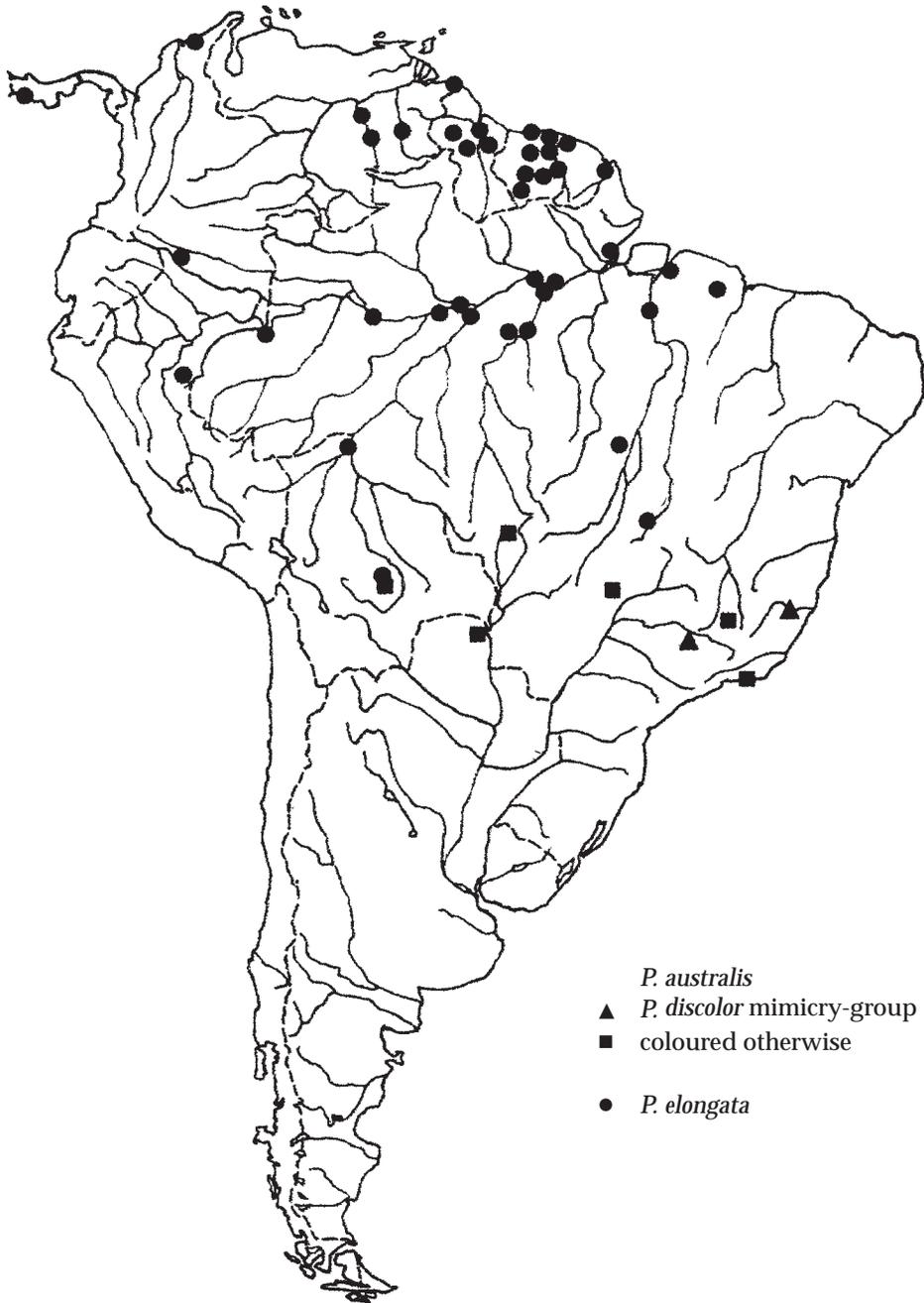


Fig. 659. Collection localities of *Pepsis australis* and *P. elongata*.

mens with dark integument (and a variable number of apical antennal segments bright yellow), to brassy yellow in specimens with gastral tergites, some proximal antenna segments (usually also the tibiae and tarsi partly) reddish-brown. The wings vary from orange-amber, sometimes with a weak, dark, apical border, to heavily infusate; often the extreme apex of the forewing is pale in both forms. Despite some variation, no real intermediates have been seen, thus some males belong to the *plutus* mimicry-group, some not; both forms occur almost anywhere in the species' range, often together. In females, the wings of paler specimens often have a rather bright orange tone, unlike any males seen, but there is no clear dimorphism in body and pubescence colour such as there is in males.

Distinctions.— The male needs carefully distinguishing from small specimens of *P. luteicornis*, which have shorter lateral S.4 hairs with many shorter hairs between them; *P. luteicornis* also has a virtually flat SGP. The female is at once distinguished from those of other species except *P. australis* by the strongly shining, posteriorly emarginate gastral tergites; and from *P. australis* by the latter's more swollen head, much shorter AS3, distinct PTC, sharply-defined pale forewing apex, and the forewing being distinctly darker than the hindwing.

Distribution.— Found along the Amazon mainstream northwards, including the Guianas; south of the Amazon to Bolivia in the west and Bananal Island, Araguaya River in the east; a record from Panamá, Chiriquí (1 ♀, MNHNPS) is probably correct but needs confirmation. Mostly at low altitudes, but reaching 1,500 m in Venezuela, Lara. Map fig. 659.

Material depositories.— 46 ♂♂, 96 ♀♀; AMNH, BMNH, CARPENTER, CAS, CMNH, CUNY, FDA, FRITZ, INPA, LACM, MCZ, MHNGV, MIZAM, MIZSU, MNHNPS, MNRI, MZUSP, NHMV, NMV, NRS, RMNH, RSM, TMB, UMOX, UNPBOG, USNM, UZMC, WAHIS.

Pepsis australis de Saussure, 1868

(figs 21-26, 525, 526, 659)

Pepsis australis de Saussure, 1868: 65, ♀, "Nova Hollandia" [= Australia] (lost). [This highly distinctive species was well illustrated by de Saussure, but the locality he gave is incorrect. The frigate Novara, during whose voyage the specimen was collected, called also at Rio de Janeiro, within the species' known range].

Pepsis centaurus Lucas, 1897: 295, no. 5. Lectotype ♂ (CMNH) [examined]. **Syn. nov.**

Type-material.— *P. centaurus*: I have seen a single type-material ♂ and labelled it lectotype.

Description.— ♂ (figs 21-26). BL 20-23. Body and legs black with dark blue-green sheen, sometimes tending to violet. Antenna black. Wings dirty-amber to quite strongly infusate; in the former case with a rather narrow, dark border; in the pale forms, the hind wing is particularly pale near the base; always with the extreme apex of the forewing more-or-less white. **S.2-5 with fairly dense, rather long hair patches**; on S.2 the posterior ones are apically curved backwards; S.3 hairs similar; on S.4 the posterior central ones are missing, so that the hairs form a more-or-less crescent-shape; these hairs are curved forwards at their base, then abruptly backwards for the rest of their length; between them (inside the crescent) are fairly dense, shorter hairs which are

curved forward; the hairs of S.5 are similar to those of S.4 but the longer hairs are fewer and slightly shorter, while the shorter hairs are more numerous; on S.6 are only lateral tufts of straight, short hair, as are commonly found on S.5 in other species; but in both cases, it is the segment following the one bearing the main modified hairs. SGP semicircular (convex) in cross-section, but the midline not keeled; apically strongly rounded and slightly upturned. Paramere elongate, about half as long again as the rest of the genitalia, apically pointed and with hairs as long as the maximum width of the paramere. Inner projection of digitus apex abruptly, bluntly pointed.

♀ (figs 525, 526). BL 23-27. AE index 81-89. Colour similar to that of the male, but in the pale form the white forewing apex is more distinct and the hindwing especially pale near the base. Head in dorsal view with temple and vertex slightly swollen. AS3 short. MT strong to very strong. MPN slightly shorter than PST, its furrow narrow, often expanded posteriorly, sometimes obsolescent and flatted-out anteriorly; carinae fine to very fine, at a slight angle to those of opposite side (V-shape pointing backwards). Propodeum: MG more-or-less distinct in anterior half, otherwise a ridge narrowing strongly posterad. APT strong, PPT and PTC moderate. DTC moderate to fine. Propodeal hair about half PST length. Posterior face: VR absent or weakly indicated near PTC; a few PFC in upper half but whole of posterior face obscured by hair. S.2 groove without lateral extensions. Hind tibia: teeth tiny, distant, the subtending spines 3-4 times as high; inner spur reaching to about 0.45 basitarsus length (about as long as tarsal segments 3+4 together) and 1.2-1.5 times length of outer spur.

Variation.— Only as given above.

Distinctions.— The male modified sternal hairs are highly distinctive, and combined with the general habitus of the insect are unique. The female is structurally similar only to that of *P. elongata*, which see.

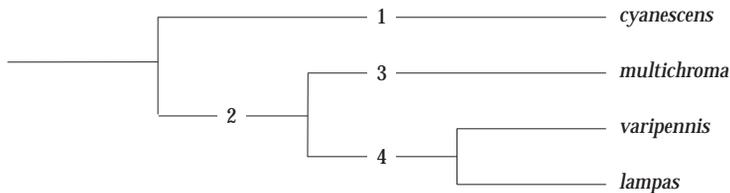
Biology.— Many specimens of both sexes belong to the *discolor* mimicry-group.

Distribution.— Known only from low altitudes in south-eastern Brazil, Paraguay and Bolivia, ascending to 350 m in Paraguay. Map fig. 659.

Material depositories.— 9 ♂♂, 8 ♀♀; AEIG, BMNH, CMNH, COOPER, CUNY, MHNGV, MNRJ, MZUSP, UFPCUR, USNM.

The *Pepsis lampas*-group

Description.— The four species comprising this group are rather small but very robust (BL males 19-23, females 17-35). The mesopleural tubercles are extremely strong in males, and very strong in females. The body is dark blue-black. Only one species in this group has much orange on the antenna, the rest rarely have any, being entirely black. The wings are entirely black, or partly so with silvery-white, sandy, orange or red markings; the hindwing most often has a narrow, white apical band. The male S.4 has a pair of short, rather dense, lateral hair brushes, their tips quite strongly hooked, not meeting to form an arc but occasionally with shorter hairs between. The SGP is elongate, the sides bent down, more-or-less expanded apicad and the apical margin often narrowly reflexed. The female gaster is dorsoventrally compressed and strongly polished dorsally after very little wear. The lateral extension of S.2 groove is variable. T.6 always has a highly polished, impunctate longitudinal area of species-specific shape. The mid and hind tibial spurs are strongly hooked.

Cladogram for the *P. lampas*-group

Characters:

1. S.4 hair brushes with shorter hairs between; apex of digitus sharply pointed; forewing entirely black.
2. Forewing with bright markings.
3. Apex of digitus bluntly pointed.
4. Apex of digitus bluntly pointed with tooth below point.

Internal relationships.— An extremely uniform group; *lampas* and *varipennis* are very closely related compared with the other species of the group.

External relationships.— This is the sister-group of *nitida*, with which the robust build and hooked tibial spurs indicate a close relationship.

Biology.— None known.

Biogeography.— This group is found from Panamá and the southern West Indies southwards: west of the Andes to north Perú; east of the Andes to Argentine Patagonia; but is absent from Chile. This is a basically lowland group; however, a population of *lampas* itself (usually with reduced red markings on the forewing) reaches 1,900 m in southern Perú. The species all have their centres of distribution outside of the Amazonian basin proper. In view of their extremely close relationship, the two very closely-related austral species may have been produced by secondary speciation after their ancestor became isolated from Amazonia. The small size of this group, its great uniformity, and distinctiveness of structure suggests that it did not speciate much, but adapted early to a specialized niche which enabled it to occupy a considerable peripheral distributional range extending to the southern West Indies.

Pepsis cyanescens Lepeletier, 1845
(figs 63-68, 527, 528, 660)

Pepsis cyanescens Lepeletier, 1845: 485, no. 26. Lectotype ♂ (MIZSU), here designated [examined].

Pepsis micans Mocsáry, 1885: 249, no. 16. Lectotype ♀ (MHNNEU), here designated [examined]. **Syn. nov.**

Pepsis jucunda Mocsáry, 1885: 249, no. 15. Lectotype ♀ (TMB), here designated [examined]. **Syn. nov.**

Pepsis balloui Banks, 1946: 391. Lectotype ♂ (MCZ), here designated [examined]. **Syn. nov.**

Pepsis diversa Haupt, 1952: 394. Lectotype ♂ (MLU), here designated [examined]. **Syn. nov.**

Type-material.— *P. cyanescens*: I have seen a single type-material ♂ and labelled it lectotype. *P. micans*: I have seen a single type-material ♀ and labelled it lectotype. *P. jucunda*: I have seen two conspecific syntype ♀ ♀ and labelled as lectotype the one from Venezuela, Merida. The one from Brazil, Massanary [= Maçauary] is a paralectotype. *P. balloui*: I have seen a single type-material ♂ and labelled it lectotype. *P. diversa*: I have seen a single type-material ♂ and labelled it lectotype.

Description.— ♂ (figs 63-68). BL 13-20. Body and legs black with deep, blue-green

sheen. Antenna black with a minute off-white apical spot; antenna rarely partly orange. Wings black with strong blue-violet reflections, hindwing with more-or-less distinct apical white band. S.4 with many short, thin hairs more-or-less completely filling in the gap between the main, lateral brushes. SGP slightly constricted basally, then parallel to the strongly rounded apex; strongly transversely convex; an apical fringe of rather short and sparse hairs. Paramere narrow, about 1.5 times as long as rest of genitalia, with apical hairs longer than its maximum width. Inner, apical projection of digitus pointed, right-angled or obtuse.

♀ (figs 527, 528). BL 15-26. AE index 60-75. Colour as in male, except antenna usually lacking apical pale spot. Head in dorsal view with temple slightly swollen. MT extremely strong and sharp. MPN slightly to much shorter than PST, its furrow rather broad, sometimes expanded anteriorly; carinae fine, those of opposite sides usually at an angle to each other. Propodeum: APT weak or absent, PPT weak to strong. DTC coarse, usually visible over whole of dorsum; PTC strong, usually single. Propodeal hair about as long as PST. Posterior face: VR strong near PTC, more-or-less strongly divergent apicad. PFC fairly strong in upper part although weaker between VR, obsolescent apicad and usually obsolete by mid-face; giving way to a slightly shiny surface obscured by fine pilosity. Lateral extensions of S.2 groove very short, sometimes absent. Last visible tergite with a slightly raised, virtually straight-sided, shining median area (pygidium), beginning with an acute point anteriorly, gradually broader apicad, then abruptly much broader just before the apex. Hind tibia: teeth sometimes rather small and distant, the subtending spines 1.5-2.0 times as high; between the teeth are numerous, fine hairs up to about half their height; on the inner side of the teeth is a row of long bristles very strongly bent backwards. Inner spur reaching to 0.3-0.45 basitarsus length (about equal to tarsal segment 2) and 1.2-1.3 times as long as outer spur.

Variation.— The white hindwing tip in the male is lacking or almost so in some specimens from Venezuela and Trinidad. A single male from Venezuela: Zulia, Tucuco (AEIG) has the antennal segments in dorsal view with an increasing amount of orange from AS6 onwards, till AS9 is totally orange, then the last segments again increasingly dark. The hind wing has only the slightest trace of pale apex.

Distinctions.— The white hindwing apex causes both sexes to resemble those of *P. seladonica* Dahlbom. The males are distinguished as given under that species, while the group-characters of *P. cyanescens* render the female abundantly distinct. Among the species of the *lampas*-group, the present species is quite distinct on the basis of colour, although differences also exist in the male S.4 hairs; and in the female propodeal posterior face sculpture, hind tibial hairs, and form of the pygidial area.

Distribution.— Ranges from Panamá, and Grenada in the West Indies, southwards over the whole of the northern part of South America (except west of the Andes); apparently rare south of the Amazon, reaching southern Perú and central Brazil; mostly found at low to moderate altitudes, but reaches 2,300 m in Colombia, Santander. Map fig. 660.

Material depositories.— 149 ♂♂, 126 ♀♀; AEIG, AMNH, BMNH, BRIO, CARRASCO, CAS, CMNH, COOPER, CUNY, FRITZ, IMLT, INPA, LACM, MCZ, MHNGV, MHNNEU, MIZAM, MIZSU, MLU, MNHNPS, MNRJ, MPEG, MZUSP, NHMBAS, NMW, NRS, OSUC, PAGLIANO, PMA, RMNH, SMF, TMB, UCALB, UMOX, UNALM, UNPBOG, UPAN, USNM, USPRIB, USU, UZMC, ZMPUCEQ, ZSM.

Pepsis multichroma spec. nov.
(figs 69-74, 529-531, 660)

Type-material.— Holotype ♂, **Perú**: Cajamarca, Jaen-Chamaya Road, 900 m, 10.iv.1984 (Cooper) (BMNH). Paratypes. **Ecuador**: Azuay, Km.100 via Cuenga 205A, 1♂, iv.1985 (Onore) (ZMPUCEQ); Posorja, 3 ♀♀ (Campos) (2 USNM, 1 BMNH); Oro, Arenillas (sea l.), 27.ii.1979, 1♂, 1♀; 28.ii.1979, 1♂, 2♀♀, all (Cooper) (BMNH). **Perú**: Cajamarca, Jaen, 900 m, 11.iv.1984, 4♂♂, 6♀♀; 12.iv.1984, 5♂♂; 24.iv.1984, 1♀; 26.iv.1984, 2♀♀; all (Cooper) (BMNH); Jaen, 700 m, iii.1947, 1♀ (Weyrauch) (IMLT) Amazonas, Bagua Grande, 500 m, 3.vi.1982, 1♀; 14.iv.1984, 1♂, both (Cooper) (BMNH); Piura, 12.iv.1969, 1♂ (Aguilar) (UNALM); Mal Paso, 45k e Chiclayo, 12.v.1983, 1♂ (Vardy) (BMNH).

Etymology.— This species is named after its many-coloured wings.

Description.— ♂ (figs 69-74). BL 14-19. Body and legs black with weak blue-violet metallic sheen. Antenna bright orange except the two basal segments black. Wing-colour variable: forewing always with a brownish-sandy patch near the black base and usually a broad, dark border; the hindwing dark with a broad, white apex. MPN furrow broad, sometimes very broad; carinae fine, often with a few stronger ones, usually transverse. Propodeum with the long, black hair denser than in other species of the group. S.4 with the lateral brushes separated by a clear gap, i.e. without any other hairs across the centre of the segment. SGP strongly constricted basally, then parallel to the rounded-truncate apex; transversely convex, more strongly laterally, and with rather short, sparse hairs apically. Paramere about 1.5 times as long as rest of genitalia, apex rounded, with hairs about as long as minimum paramere width. Inner projection of digitus apex forming an approximate right angle, blunt.

♀ (figs 529-531). BL 18-23. AE index 63-69. Colour as in male but even more variable, wings sometimes totally lacking dark colour in the apical part. Head in dorsal view with temple and vertex quite strongly swollen. MT strong to very strong, sharp. MPN as long as PST or slightly shorter, its furrow broad, often still further expanded posteriorly; carinae fine, sometimes a few coarser, often mainly anteriorly. Propodeum: MG sometimes weakly indicated anteriorly, otherwise replaced by a flat-topped ridge. APT weak or absent, PPT moderate. DTC moderate, usually only clearly visible in median line, becoming much finer and mixed with irregular sculpture laterad; PTC weak to moderate, often double or triple. Propodeal hair a little longer than PST. Posterior face: PFC strong only in centre and outer corners of uppermost part, elsewhere giving way to fine, almost matt, reticulate sculpture. Lateral extensions of S.2 groove fairly long and distinct. Last visible tergite with a median, shining area (pygidium) gradually broadened apicad throughout, not raised, its borders defined very irregularly by coarse punctures. Femora with denser hairs than in other species of the group. Hind tibia: tips of teeth not very sharply pointed, the subtending spines 1.5-2.0 times as high; between the teeth are very dense, fine hairs slightly lower to slightly higher than the teeth and partly obscuring their shape; on the inner side of the teeth is a row of very strong bristles curved strongly backwards. Inner spur reaching to 0.3-0.45 basitarsus length (about equal to tarsal segment 2) and 1.1-1.2 times as long as outer spur.

Variation.— Structural variation is slight, as detailed above; however, this species displays considerable variation in wing colour. In the coastal areas which comprise most of this species' range, the male forewing has a sub-basal silvery-sandy patch of very variable size, with the rest of the wing lightly infuscate except for a rather narrow,

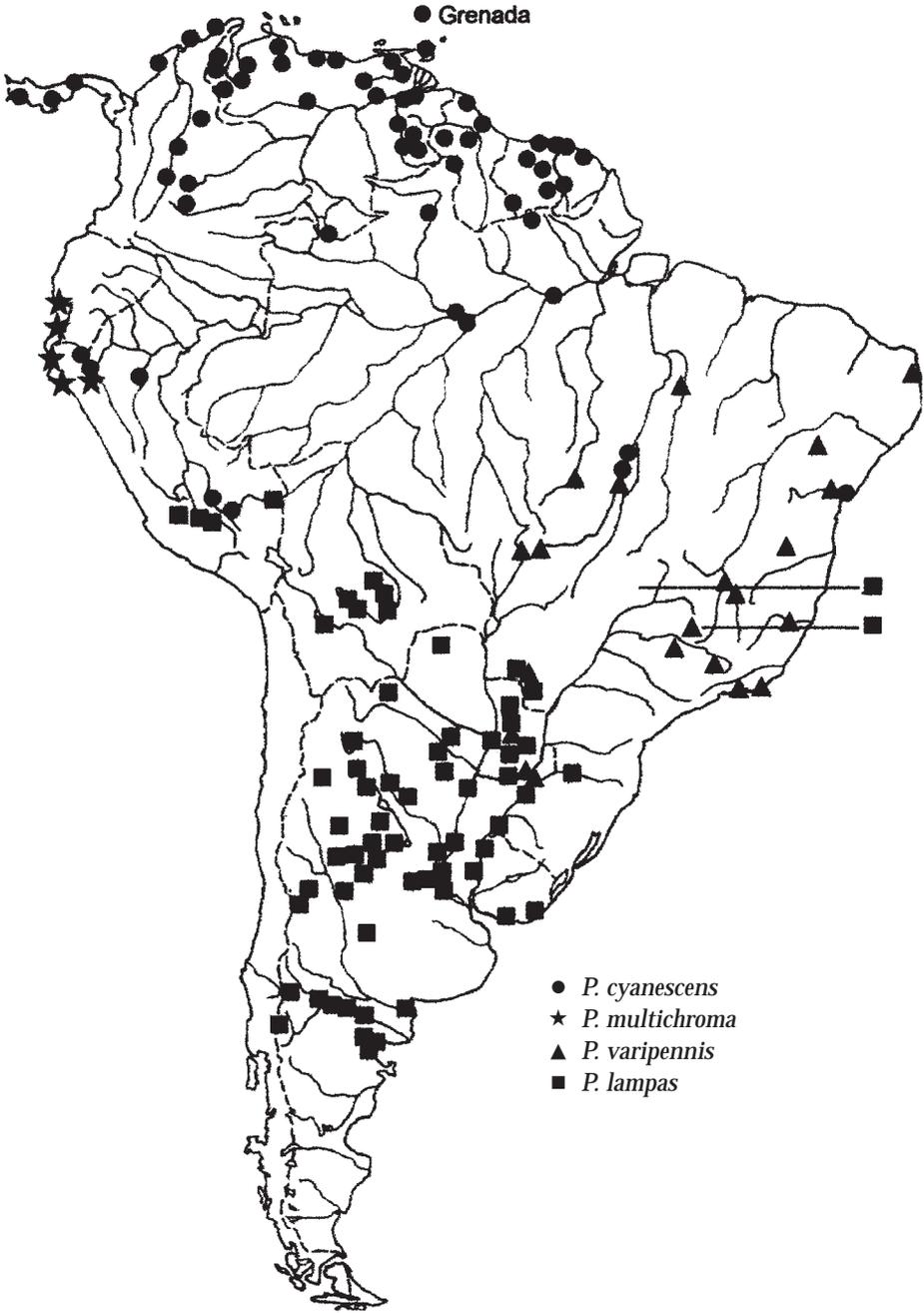


Fig. 660. Collection localities of *Pepsis cyanescens*, *P. multichroma*, *P. varipennis* and *P. lampas*.

white apical band; the hind-wing is entirely infusate (often more heavily than the forewing) except for a broader apical white band than on the forewing, and sometimes a small anteromedian extension of the forewing pale patch where this is very large. The female forewing is similar except that the pale patch covers most of its area, leaving at most an indistinct remnant of the infuscation as a narrow, pre-apical border before the apical white band; in this sex the pale area also extends to most of the middle part of the hindwing.

The population which occurs at higher altitude in northern Perú, however, is not only very different in appearance but shows little sexual dimorphism in colour: the pale area takes on a bright orange-amber tone, extending a little onto the middle of the hindwing when large, while the infuscation is much darker, with blue-violet reflections, and covers most of the apical half of the forewing; its junction with the pale area is very irregular but well-defined.

Distinctions.— The species is abundantly distinct from others of its group by its wing-colours alone; it also differs structurally in its lack of hairs in the middle of S.4 and details of genitalia in the male; and in the female by the details of propodeal posterior face, pygidium and hind tibial hairs. This species resembles *P. petiti* in colour.

Distribution.— Restricted mainly to the coastal lowlands from Guayaquil in Ecuador to Chiclayo in northern Perú, but a distinct population occurs above, in the low Andean pass at 900 m in which runs part of the upper Marañon river. Map fig. 660.

Material depositories.— 16 ♂♂, 18 ♀♀; BMNH, IMLT, UNALM, ZMPUCEQ, USNM.

Pepsis varipennis Lepeletier, 1845
(figs 75-77, 532, 533, 660)

Pepsis varipennis Lepeletier, 1845: 488. Lectotype ♂ (MIZSU), here designated [examined].

Type-material.— *P. varipennis*: I have seen a single type-material ♂ and labelled it lectotype.

Description.— ♂ (figs 75-77). BL 18-22. Body and legs black with dark blue-green sheen. Antenna black. Wings black; forewing with rather narrow, sub-basal silvery-ochre, transverse band, extended narrowly along costal margin and slightly expanded at its distal end around the stigma; hindwing with rather broad white apex. Anterior femur with fairly dense, short, curved hairs below, mid femur with fewer, mainly in basal half. Hairs on S.2 and 3 strong and fairly dense but not otherwise modified. S.4 with very dense, rather broad but mainly lateral brush; its hairs rather long, directed backwards and strongly curved inwards, with small apical hooks, but not touching the brush of the opposite side. S.5 with lateral patches of mainly short hair. SGP gradually expanded towards the strongly-rounded apex, whose margin is narrowly upturned and has rather short, sparse hairs; SGP transversely convex, especially laterally. Paramere about 1.5 times as long as rest of genitalia, round-ended, with apical hairs longer than its maximum width. Inner projection of digitus apex obtusely angulate, often with a shallow notch.

♀ (figs 532, 533). BL 20-35. AE index 66-78. Colour as in male except posterior part of sub-basal band of forewing sometimes extended a little distad; hindwing entirely

black. Head in dorsal view with temple and vertex moderately to quite strongly swollen. MT strong, moderately sharp. MPN often with the posterior margin highly polished, its furrow deep, sometimes more-or-less expanded posteriorly; carinae variable, usually coarse, sometimes fewer and very coarse, especially anteriorly. Propodeum: MG absent or weakly indicated anteriorly. APT very weak, PPT and PTC weak to moderate. DTC rather coarse, irregular. Propodeal hair very short, only about 1/2 PST length [but no really fresh specimens seen - possibly hairs abraded in all]. Posterior face: VR weak to strong, near PTC only, usually very strongly divergent apicad; PFC strong above except between VR, shining; weak or absent in other areas, where replaced by fine, matt sculpture. Gastral tergites dorsoventrally flattened, highly polished, pygidium with polished median line which is wider distad. Mid and hind tibial spurs strongly curved apically, extending to about half basitarsus length. Hind tibia: teeth of usual size or sometimes very small and distant, with strong, backwardly-curved hairs overlying them and short, extremely dense hair between; the subtending spines 1.5-2.0 times as high as teeth. Inner spur reaching to 0.4-0.45 basitarsus length (about equal to tarsal segment 2 or slightly longer); 1.0-1.2 times as long as outer spur.

Variation.— Only as noted above.

Distinctions.— Both sexes are well distinguished by the combination of their group-characters and wing pattern; however, the colours are similar to those of *P. nitida* where the two species are sympatric in the Mato Grosso, and careful attention must be paid to the group-characters to distinguish them. A few females are very similar to those of *P. lampas*; see Distinctions under that species.

Distribution.— Known from eastern and central Brazil, south to Paraguay and north-eastern Argentina; inhabits low altitudes. Map fig. 660.

Material depositories.— 73 ♂♂, 71 ♀♀; ANSP, BMNH, CMNH, CUNY, EMMSU, IMLT, MACN, MCZ, MHNGV, MIZSU, MLP, MNHNPA, MNRJ, MZUSP, OSUC, SME, UCALB, UFPCUR, UZMC, ZSM.

Pepsis lampas Lucas, 1895, stat. rev.
(figs 78-80, 534-537, 660)

Pepsis lampas Lucas, 1895: 752, no. 146. Lectotype ♂ (MNHU), here designated [examined].

Pepsis venturii Schrottky, 1902: 313 [not 309 as in Hurd, 1952: 323], no. 7. ♂, Argentina, Santa Fé, Ceres (lost). **Syn. nov.**

[*Pepsis nitida* Lepeletier; Brèthes, 1914: 326. Wrongly synonymized].

Type material.— *P. lampas*: I have seen 2 ♂♂ and 1 ♀ syntypes, and have labelled the ♂ in MNHU as lectotype. It bears the locality “Matto Grosso” [= Mato Grosso], but the collector’s name is spelt “Rohde” (not “Rhode” as in Lucas). The ♀ paralectotype in MNHU agrees with Lucas’ account, but the date on the ♂ paralectotype in NMV is 1853 (not 1873 as in Lucas). All 3 specimens are conspecific.

Description.— ♂ (figs 78-80). BL 15-23. Body and legs black with dark blue-green sheen. Antenna black. Wings usually amber to bright orange-red with very broad black border, irregular but well-defined (see Variation); hind wing with narrow, white extreme apical border beyond the black one. Sternal hairs, SGP and genitalia not distinguishable from those of *P. varipennis*.

♀ (figs 534-537). BL 19-29. AE index 66-75. Colour as in male, except that the hind wing is not white apically. Head in dorsal view with temple and vertex moderately to strongly swollen. MT strong to very strong, sharp. MPN a little shorter than PST, its furrow rather broad (sometimes narrow, and expanded posteriorly); carinae moderate, sometimes a few stronger anteriorly. Propodeum: MG sometimes weakly indicated anteriorly, otherwise replaced by a more-or-less broad, flat-topped ridge. APT absent or weak, PPT weak to moderate. DTC fine to rather coarse, sometimes very irregular, i.e. varying from the transverse, punctate between. PTC weak to moderate. Propodeal hair about 2/3 PST length. Posterior face: VR strong near PTC, strongly divergent posterad; PFC strong above, weaker medially and posterad, where replaced by fine but not matt sculpture. Lateral extension of S.2 groove well-developed, sometimes a little shorter than usual. The last gastral tergite has the median area with sparser punctures and hair than usual at the base; apicad, the punctures and hairs soon disappear and the polished area thus remaining gradually increases in width. Hind tibia: teeth rather small, with very short, dense hair between them, similar in height; the subtending spines 2.0 times as high as the teeth; on the inner side of the teeth is a line of very long, very strongly backwardly-curved hairs. Inner spur reaching to 0.3-0.4 basitarsus length (about equal to tarsal segment 2 or slightly longer); 1.0-1.1 times as long as outer spur. All spurs of middle and hind tibiae strongly curved at apex.

Variation.— In both sexes, the pale part of the forewing is occasionally reduced to a stripe (sometimes pale) along the costa; in these specimens the hind wing almost entirely loses the orange colour. This phenomenon occurs most commonly in northern specimens.

Distinctions.— The usual bright orange wing-colour of this species is distinctive, resembling only some specimens of the (largely sympatric) *P. nitida* Lep., which is totally distinct structurally; however, specimens in which the markings are both reduced and pale resemble *P. varipennis* Lep. (especially where the two species are sympatric), but in that species the costal stripe is very narrow and expanded abruptly near the stigma, while in *P. lampas* it is wide throughout. Specimens with amber wings somewhat resemble *P. multichroma* but the antenna is always partly orange in that species; the two are also distantly allopatric.

A male from Brazil: MT, Naviraí (USPRIB) has the wing-pattern similar to that of *P. varipennis*; however, the colour is strongly orange. It is tentatively assigned to *P. lampas* but may be a hybrid between it and *P. varipennis*.

Distribution.— A mainly Argentine species, but extending to the Andes of southern Perú and to central Brazil; there are records from Minas [Gerais] and the Mato Grosso without further locality, which are the most north-easterly records. Ascending to 1,900 m in Perú. Map fig. 660.

Material depositories.— 359 ♂♂, 278 ♀♀; AEIG, AMNH, BMNH, BONELLI, CARRASCO, CAS, CUNY, EMMSU, ETHZ, FDA, FRITZ, IMLT, INTAC, MACN, MCZ, MHNGV, MLP, MLU, MNCN, MNHNPS, MNHU, MNRJ, MNS, MZUSP, NMV, OCHOA, OSUC, RMNH, TMB, UCALB, UFPCUR, UMBREM, UMOX, UNCUS, USNM, USPRIB, USU, UZMC, WAHIS, WASBAUER, ZSM.

The *Pepsis nitida*-group

Description.— See species account.

Internal relationships.— Although this group is based on only a single species, the female gastral characters (and perhaps the coxal character of both sexes) may have group value (cf. *elongata*-group).

External relationships.— This species is the sister-group of *lampas* (but see comments under the *elongata*-group).

Biology.— None known, except that its considerable range of colour variation causes it to resemble many other sympatric species.

Biogeography.— The highly unusual characters of this species, its phylogenetic position, and its distributional range all suggest that it may be the southern survivor of a former species-pair. Certainly its phylogenetic position parallels that of the *elongata*-group.

Pepsis nitida Lepeletier, 1845 (figs 87-92, 522, 523, 661)

- Pepsis nitida* Lepeletier, 1845: 476. Lectotype ♀ (MIZSU), here designated [examined].
Pepsis lucidula Smith, 1855: 193. Lectotype ♂ (BMNH), here designated [examined]. **Syn. nov.**
Pepsis vaualba Smith, 1855: 195. Lectotype ♀ (UMOX), here designated [examined]. **Syn. nov.**
Pepsis pruinosa Mocsáry, 1894: 5. Lectotype ♀ (TMB), here designated [examined]. **Syn. nov.**
Pepsis cylindrica Lucas, 1895: 696, no. 117. Lectotype ♀ (MNHU), here designated [examined]. **Syn. nov.**
 [*Pepsis reaumuri* Dahlbom; Lucas, 1895: 749. Misidentification].
Pepsis andina Brèthes, 1908: 234. Lectotype ♂ (MACN), here designated [examined]. **Syn. nov.**
Pepsis andina dilatata Brèthes, 1908: 234. Lectotype ♂ (MACN), here designated [examined]. **Syn. nov.**
Pepsis holmbergi Brèthes, 1908: 234. Lectotype ♂ (MACN), here designated [examined]. **Syn. nov.**
Pepsis concava Brèthes, 1908: 239. Lectotype ♀ (MACN), here designated. **Syn. nov.**
Pepsis ephebus Brèthes, 1908: 242. Holotype ♂ (MACN) [examined]. **Syn. nov.**
Pepsis vaga Brèthes, 1908: 242. Holotype ♂ (MACN) [examined]. **Syn. nov.**
Pepsis fuscobasalis Brèthes, 1908: 242. Holotype ♂ (MACN) [examined]. **Syn. nov.**
Pepsis cordata Brèthes, 1914: 272, no. 13. Holotype ♀ (MACN) [examined]. **Syn. nov.**
Pepsis impatiens Brèthes, 1914: 273, no. 16. Holotype ♂ (MZUSP) [examined]. **Syn. nov.**
Pepsis tricolor Brèthes, 1914: 276, no. 22. Holotype ♂ (MACN) [examined]. **Syn. nov.**
Pepsis concava joergenseni Brèthes, 1914: 326, no. 112. Holotype ♀ (MACN) [examined]. **Syn. nov.**
 [*Pepsis lampas* Lucas; Brèthes, 1914: 326. Misidentification].
Pepsis cleone Brèthes, 1914: 327, no. 115. Holotype ♂ (MACN) [examined]. **Syn. nov.**
Pepsis dorsata Brèthes, 1914: 329, no. 117. Holotype ♀ (MACN) [examined]. **Syn. nov.**
Pepsis aretheas Brèthes, 1914: 331, no. 121. Lectotype ♀ (MACN), here designated [examined]. **Syn. nov.**
Pepsis lassonis Lucas, 1919: 121. ♂, ♀, Argentina (lost). **Syn. nov.**
Pepsis consors Banks, 1946: 352. Lectotype ♀ (MCZ), here designated [examined]. **Syn. nov.**
Pepsis interrupta Banks, 1946: 353. Lectotype ♀ (MCZ), here designated [examined]. **Syn. nov.**
Pepsis analis Haupt, 1952: 328. Holotype ♀ (MLU) [examined]. **Syn. nov.**

Type-material.— *P. nitida*: I have seen 2 ♀ syntypes from MIZSU, and labelled the larger one lectotype. The other is a conspecific paralectotype. *P. lucidula*: I have seen 2 syntypes in BMNH, one of each sex, and have labelled the ♂ as lectotype. The ♀ paralectotype is not conspecific, but is a specimen of *P. dimidiata* F. *P. vaualba*: I have seen 3 ♀ specimens with “Smith” labels, 2 in BMNH and 1 in UMOX. Since Smith did not in-

dicating that the species was present in BMNH at the time of description, only the UMOX specimen can be regarded as type-material, and I have labelled it lectotype. However, all 3 specimens are conspecific. *P. pruinosa*: I have seen a single type-material ♀, which bears a label "Brasilia. Tianhy [= Piauhy] dep.". I have labelled it lectotype. *P. cylindrica*: I have seen only one of the multiple syntype ♀ indicated in the description, and labelled it lectotype. *P. andina*: I have seen a single type-material ♂ and labelled it lectotype. *P. andina dilatata*: I have seen a single type-material ♂ and labelled it lectotype. *P. holmbergi*: I have seen all the four ♂♂ in MACN mentioned in Brèthes' later (1914) account; it is difficult to know which of these are syntypes, because although Brèthes' (1908) description implies multiple specimens (size variation is noted), no further details are given. Since Brèthes gave the identical range of size variation in 1914, and there is nothing in the 1908 description to exclude any of the four, I regard all as syntypes. I have labelled as lectotype the specimen from Misiones (the only one with locality label). The remaining three are paralectotypes conspecific with the lectotype. A further conspecific ♂ in MLP has no type status, despite bearing Brèthes' identification label and having been collected in the same locality as the lectotype, only two days later. *P. concava*: I have seen a single type-material ♀ and labelled it lectotype. *P. ephesus*: In addition to the holotype ♂ in MACN, there are 2 other ♂♂ in MACN and 1 in MLP. One of those in MACN (from Catamarca) is a specimen of *P. thoreyi* Dahlbom; the remaining two are conspecific with the holotype. *P. cordata*: 2 further ♀♀, conspecific with the holotype, are in MZUSP but have no type-status. *P. cleone*: In addition to the holotype ♂ in MACN, there is in MLP a ♂ labelled by Brèthes; it is odd that he did not mention this specimen since it bears a collection date just over a year earlier than that of the holotype, and has otherwise identical collecting data. *P. aretheas*: I have seen all 4 syntype ♀♀ mentioned by Brèthes, 2 in MACN and 2 in MLP. They each bear a different collecting date; all of them are different from the one given by Brèthes, but otherwise agree with the description. I have labelled as lectotype the one in MACN with slightly abraded wings and bearing the date "3.I.10". The remaining 3 specimens are paralectotypes and all 4 are conspecific. *P. consors*: I have seen both ♀ syntypes, and have labelled the one in MCZ as lectotype; the conspecific paralectotype is in CUNY. *P. interrupta*: I have seen 2 syntype ♀♀ and labelled one of them lectotype. The other is a conspecific paralectotype.

Description.— ♂ (figs 87-92). BL 15-23(-27). Body and legs black with a dark blue-green or sometimes slightly violaceous sheen. Antenna black. Wing-colour extremely variable (see Variation). Hind coxa with carina, as in female (which see) but less sharp. S.4 with short, weakly curved lateral hairbrushes, with sparser, shorter hairs between them anteriorly; between the brushes is a patch of dense, short hair which is often repeated (especially in larger specimens) on S.5 but without the lateral brushes. SGP slightly expanded towards the rounded-truncate apex, which is slightly reflexed. Paramere narrow, pointed, about 1/3 longer than the rest of the genitalia and with long apical hairs; apex of digitus strongly rounded.

♀ (figs 522, 523). BL 20-27. AE index 81-97(-100). Colour as in male. Head in dorsal view quite strongly transverse, scarcely swollen behind eyes, vertex a little more so. MT moderate to strong. MPN equal to or shorter than PST, its furrow usually broad, more-or-less expanded posterad; carinae usually few, coarse, often concentrated anteriorly, more-or-less hidden by pubescence. Propodeum: rounded in profile, MG usu-

ally sharply-incised centrally and present in at least anterior half of dorsum. APT moderate to strong, but rounded, not sharp. PPT and PTC absent or weak, obscured by the usually very coarse DTC. Propodeal hair extremely short and sparse, scarcely as long as the width of a DTC. Posterior face: VR moderately strong near PTC, absent below; PFC similar to DTC above, slightly weaker below and sometimes strongly obsolescent in median line, where they are replaced by fine, matt sculpture. Gaster slightly dorsoventrally compressed, soon polished through abrasion; T.2-5 shallowly, arcuately emarginate posteriorly; pygidium semiconical, punctate only towards the apex; the opposing sternite slightly concave, **the whole segment more-or-less down-pointing**. Pygidial hairs only dense apically. Lateral extension of S.2 groove absent (rarely, very weak). Hind coxa at junction of dorsal and outer surfaces with a **very sharp, sinuate carina**, part of which stands up like a knife-edge. All femora with all surfaces except the inner, covered with short, quite dense, coarse hair. Hind tibia: teeth very small, the subtending spines 3-5 times as high; on the inner side of the teeth is a sparse line of fairly long, often backwardly-directed hairs. Inner spur long, reaching to 0.4-0.45 basitarsus length (about equal to tarsal segment 2 + half of 3); 1.1-1.3 times as long as outer spur.

Variation.— Structurally there is little variation, except for an aberrant male (a paralectotype of *P. holmbergi*) with strongly longitudinal DTC; but the species varies enormously in wing colour, thus resembling most sympatric species [this, together with an evident total disregard of the very strong, unique structural characters is the reason for the inordinate number of synonyms for this species]. Both sexes follow much the same patterns in a distinct cline. In most of northern Argentina the wings are amber-orange (deeper in females) with a rather broad infusate border (broadest in females); in Brazil the wings are black with an irregularly-shaped pale or silvery central mark on the forewing; this mark sometimes disappears completely in specimens from the northern part of the species' range. Intermediate forms are found in Paraguay and Argentina: Misiones, Corrientes, Entre Rios and Córdoba; this transition zone coincides almost exactly with the natural region of Argentina called Mesopotamia. Thus those forms found in the north of the species' range, or on higher ground in the south, are dark or mainly so; while those found on low ground in the south are pale. The situation is roughly paralleled in the west: males from the Andes of north-west Argentina (Jujuy and Salta) and Bolivia (Cochabamba) are very dark; however, in this area the females are not so dark compared with those in the east. A remarkable colour aberration is found in the male holotype of *P. tricolor* from Misiones, Bonpland; in this specimen the wings are dark with an orange mark in mid-forewing, but its apex is broadly white.

Distinctions.— Both sexes, in their various colour forms, are easily mistaken for other species at first sight; in particular, the form most common in Argentina has almost always been confused with *P. lampas* Lucas. Yet structurally the species is one of the most distinctive: the sharp, hind coxal carina of *P. nitida* is unique in the genus. In addition, the male lacks the extremely strong MT of *P. lampas*. The shape and orientation of the last gastral segment in female *P. nitida* is diagnostic. The male is further separated from those of other species by the configuration of its modified sternal hairs.

Distribution.— This species is found in eastern Brazil from the Amazon southwards

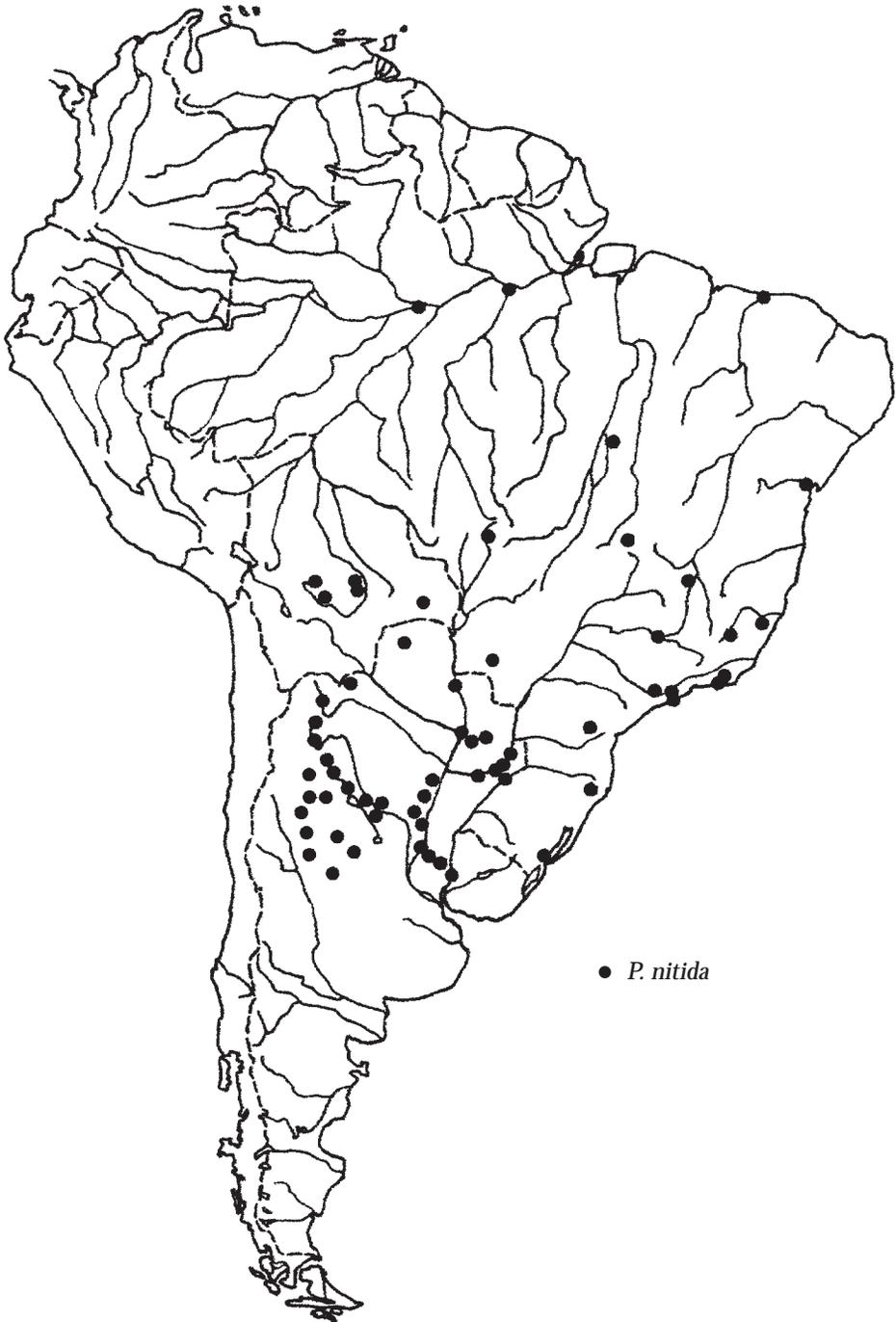


Fig. 661. Collection localities of *Pepsis nitida*.

to Paraguay, and in Argentina south to Córdoba, reaching northwest as far as central Bolivia. It apparently does not occur in the western Amazon basin proper. Ascends to 1,200 m in Salta, Argentina. Map fig. 661.

Material depositories.— 329 ♂♂, 441 ♀♀; AEIG, AMNH, BMNH, BONELLI, CMNH, CUNY, EMMSU, FRITZ, IMLT, INPA, MACN, MCZ, MHNGV, MIZSU, MLP, MLU, MNCN, MNHNPS, MNHU, MNRI, MNS, MZUSP, NHMBAS, NMV, NRS, OLLD, OSUC, RMNH, SMF, TMB, UBRAS, UCALB, UFPCUR, UFPVIC, UMOX, USNM, USU, UZMC, WASBAUER, WAHIS, ZSM.

The *Pepsis seladonica*-group

Description.— See species account.

Discussion.— The sole species of this group displays a combination of characters which are all found, often separately, in the four species-groups most closely related to it; however, *P. seladonica* cannot be placed in any of these because they are all so strongly distinguished by their own group-characters as positively to exclude it. Since this species therefore possesses no unique characters, it must therefore be placed in a group of its own; however, at the same time this means that it is not possible to assign group-status to any of its characters.

External relationships.— The characters shared with other groups are as follows:

Both sexes: the hindwings exhibit a narrow, white apico-posterior band (*lampas*-group: all males, some females) (note that this character is otherwise present in the genus only in *P. inbio*, of the distantly related *rubra*-group, as a character reversal); SMC3 with basal and apical veins strongly bowed-out (several species of *menechma*-group, especially *P. basifusca*); MT strong (*australis*, *lampas* and *menechma*-groups).

Males: S.2 & 3 with abundant (but not modified) hair (all four of the other groups in this complex); S.4 hair-brushes short, dense, strongly incurved but with apexes far apart (*nitida* & *lampas*-groups); between these brushes are many shorter hairs near the apical margin of the segment (*P. nitida*; *P. australis* (*elongata*-group), *P. basifusca* (*menechma*-group)); the hairs of S.5 are rather long and dense (about half the height of those of S.4) and form an arc together with the usual short, lateral tufts (*P. nitida*, extremely dense in *P. australis* (*elongata*-group) but of different form, probably not homologous); the SGP is weakly expanded apicad, and has a poorly defined median keel near the base (most closely resembling those of *nitida* & *lampas*-groups); the paramere is slender, rather long (about one-third longer than the digitus), bluntly pointed, and is a little thinner in the basal half (*nitida* & *lampas*-groups); the digitus weakly resembles those of *P. minarum* and *P. basifusca* (both of the *menechma*-group).

Females: propodeum with sharp MG set in a central ridge, the latter ending in a strong PTC (*P. chrysoptera* and *P. boharti* in the *menechma*-group).

Biology.— None known.

Biogeography.— This species may be close to the ancestor of all four groups to which it is most closely related (see main cladogram), i.e. a relic. The greatest concentration of records is from the Amazon mainstream southwards, which would be consistent with a south-eastern origin for the species, and in accord with the strong southern distributional bias of the most closely related species-groups. Also like them, it inhabits mainly lowland.

Pepsis seladonica Dahlbom, 1843
(figs 203-208, 585, 586, 662)

Pepsis seladonica Dahlbom, 1843: 120, no. 4. Lectotype ♂ (MZEL), here designated [examined].

Pepsis deuteroleuca Smith, 1855: 196, no. 28. Lectotype ♂ (BMNH), here designated [examined]. **Syn. nov.**

Pepsis kohli Lucas, 1895: 690, no. 111. Lectotype ♀ (NMV), here designated [examined]. **Syn. nov.**

Pepsis postica Lucas, 1895: 840. [Name given in error for *deuteroleuca*].

Pepsis deuteroleuca var. *venezolana* Brèthes, 1908: 235. ♂. Venezuela, Caracas. (Lost). **Syn. nov.**

Pepsis burmeisteri Brèthes, 1908: 242. Holotype ♂ [= paralectotype of *chrysoptera* Burmeister] (MACN) [examined]. **Syn. nov.**

Type-material.— *P. seladonica*: I have seen a single type-material ♂, labelled “Cap. b. s., Thunberg, *P. seladonica* Dlbm.” Despite this alleged South African provenance, the specimen agrees well with the original description, which gives the feasible locality “Brasilia” (see also the lectotype discussion of *P. thunbergi*). *P. deuteroleuca*: I have seen four conspecific ♂ syntypes; one, labelled “Braz.,” which is in BMNH, I have labelled as lectotype; the others are all in UMOX. One of the latter is labelled “Amaz.,” the other two “Braz.”; all are paralectotypes. None of the specimens bears the more exact locality “Santarem” given in the original description. *P. kohli*: I have seen three conspecific syntype ♀♀ in NMV, and labelled the one in the best condition as lectotype; one paralectotype has the right forewing damaged, the other has the thorax extensively glued together. The ♀ type-material in MNHU mentioned by Lucas is apparently lost.

Description.— ♂ (figs 203-208). BL 16-26. Body and legs black with a deep blue, metallic sheen, tending to violet (less commonly, to green). Antenna usually black, occasionally partly orange. Wings usually black with fairly strong blue-violet reflections; sometimes partly amber, hindwing almost always with a white apical patch. S.1-3 with rather dense hair of moderate length, only posteriorly on S.3 where the apices, especially of the more lateral hairs, are curved backwards; on S.4 the hairs form an approximate semicircle; antero-centrally they are directed forwards at the base, then curved gradually backwards, so that they are more-or-less perpendicular to the surface; towards the sides they become much denser, strongly backwardly-directed basally, and much more strongly curved inwards and backwards apicad; the extreme postero-laterals are more like the antero-central ones. The gap within the semicircle is filled with numerous but not very dense, short, weak hairs. S.5 has a rather wide band in the form of a shallow arc of moderately dense, virtually straight hairs, shorter and denser towards the sides. SGP almost flat, weakly expanded apicad, the apex truncate with rounded corners, its margin usually narrowly reflexed and slightly brown-translucent, sometimes slightly emarginate centrally; with a sparse fringe of hairs only about as long as 1/3 maximum SGP width. Paramere of normal length, about 1.5 times as long as rest of genitalia; with only short hair.

♀ (figs 585, 586). BL 21-34. AE index 82-94 (AS3 usually markedly short). Colour as in male, except white patch at apex of hindwing usually narrower. Head with vertex and temples moderately swollen. MT weak to strong. Forewing with stigmal fenestra usually broad and distinct, PPV very short, and 1r-m strongly rounded. MPN equal to or shorter than PST, its furrow usually narrow, shining; carinae fine. Propo-

deum: MG replaced by a strong, broad ridge, flatter anteriorly and sometimes with a trace of an MG; APT moderate to strong, PPT and PTC weak to strong. DTC usually moderate and fine mixed, often irregular, diffuse and difficult to distinguish; occasionally surface partly punctate. Propodeal hair shorter than PST. Posterior face: VR absent to moderately strong in upper half, fairly strongly divergent from PTC apicad; PFC moderately strong above, gradually obsolescent apicad, stronger on VR but much weaker between them, leaving an area of very finely rugose, matt sculpture; lowest PFC sometimes forming semicircles around the petiole socket. Anterior femur in fresh specimens with some sparse, fairly fine hair below; other femora with less. Lateral extension of S.2 groove well-developed. Hind tibia: teeth rather small, sharp and distant, with very dense, extremely short pubescence between; the subtending spines 2.0-2.5 times as high. A varying number of the weak bristles on their inner side are moderately strongly curved backwards. Inner spur reaching to 0.35-0.4 basitarsus length, about equal to tarsal segment 3 or slightly less, and 1.1-1.5 times as long as outer spur.

Variation.— Northwards from the Amazon, an increasing number of specimens of both sexes have the antenna more-or-less orange; in some from Venezuela the orange is bright and extends from AS3 onwards. In such specimens the hindwing white patch is sometimes reduced or (rarely) absent altogether. A single male from Bolivia: Santa Cruz, Buenavista, 1,300' (BMNH) has the antenna dull orange (but retains a normal hindwing white patch). In the south of the species' range, in both sexes, variations occur in which an amber patch develops in the middle of both fore and hind wings; these can enlarge to the point where most of the wings are amber. In the most extreme specimen seen (a female from Argentina: La Rioja (CUNY)), the base has narrow, strong infuscation, whose junction with the amber is sharp; the apex has rather broad infuscation, very gradually diffusing into the amber. A female from Brazil, Mato Grosso, Río Tapirapé (AMNH) has the entire body covered with fine, dense, yellowish pubescence.

Distinctions.— Both sexes are well distinguished by the usually constant and distinct white hindwing apex; however, the male of *P. cyanescens* also has this character; it is best distinguished from that of *P. seladonica* by its following characters (more important ones in bold): smaller size, **SMC3 much narrower anteriorly, stigmal fenestra narrow, junction of white hindwing apex with dark colour well-defined**; MPN usually distinctly longer than PST; propodeum more tapered, and DTC coarser; **fewer and shorter hairs on S.1-3, antero-central hairs of S.4 much shorter than others, laterals more evenly curved, and area within semicircle polished instead of infilled with short hairs**; SGP more-or-less strongly expanded from the base for 1/3 of its length apicad, then parallel-sided to the rounded-truncate apex, which is fringed with hairs about as long as 3/4 maximum width of SGP (in fresh specimens!), **strongly convex from side to side; paramere of normal length but apically fringed with very long hairs, longer than its maximum width**. The two species are also partly allopatric. The female of *P. seladonica*, especially if the white hindwing apex is absent, abraded or just overlooked, is very like that of *P. crassicornis*; the latter is distinguished by its forewing 1 r-m sloping strongly anterodistally, much stronger propodeal sculpture (especially PPT, PTC, DTC and VR), usually the presence of some orange antennal

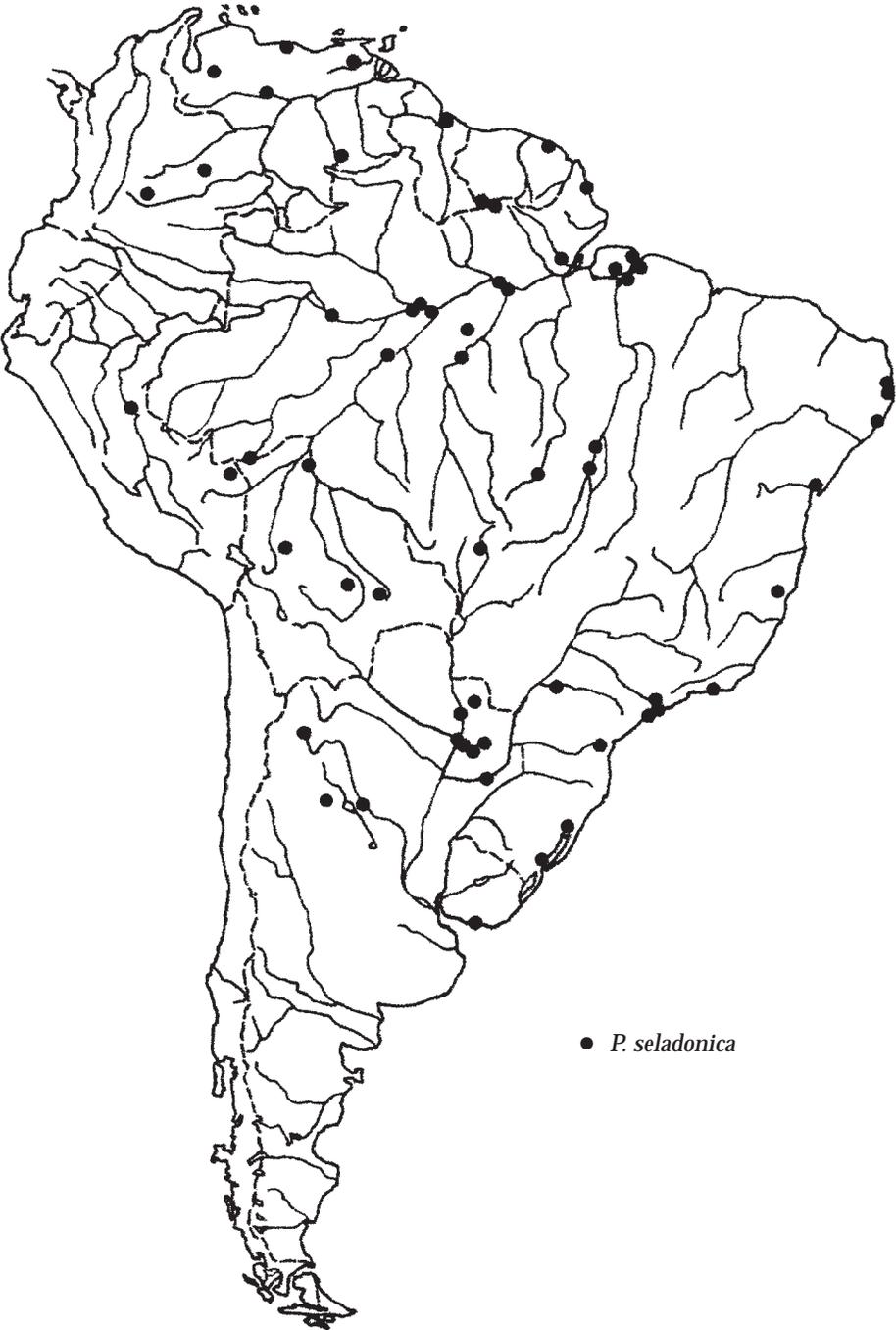


Fig. 662. Collection localities of *Pepsis seladonica*.

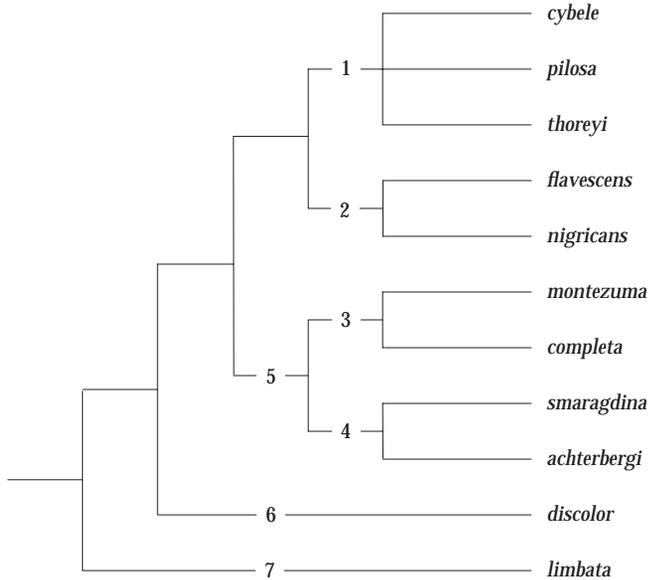
segments (only present in *P. seladonica* north of the Amazon, outside the range of *P. crassicornis*); and the last hind tarsal segment of *P. seladonica* is virtually straight, whereas that of *P. crassicornis* is distinctly curved. The Argentine amber-winged form of *P. seladonica* retains the usual white hindwing tips, but close observation is needed with abraded specimens to distinguish these. Dark-winged forms of *P. discolor* in western Argentina sometimes have a clear patch in the hindwing, so that the female somewhat resembles that of *P. seladonica*, but the patch in *P. discolor* differs in being small and sub-apical, not touching the wing apex.

Distribution.— Widespread everywhere east of the Andes; present in the Maracaibo basin, but not otherwise known from north or west of the Andes; southwards to Uruguay: Montevideo, and there are several records from Argentina: La Rioja, without further locality; ascending to 1,300 m in Bolivia, and 1,630 m in Venezuela: Maracaibo. Map fig. 662.

Material depositories.— 337 ♂♂, 124 ♀♀; AEIG, AMNH, ANSP, BMNH, BONELLI, BRIO, CAS, CMNH, CUNY, EMMSU, FDA, FRITZ, FSAG, IMLT, INPA, INTAC, LACM, MACN, MCZ, MHNNEU, MHNGV, MIZAM, MLU, MNHNPG, MNHNPS, MNRJ, MNS, MPEG, MZEL, MZLAU, MZUSP, NMV, NRS, OLLD, OSUC, RMNH, RSM, SEMKU, SMF, TMB, UCALB, UMOX, UNPBOG, USNM, USPRIB, USU, UZMC, WASBAUER, WILLIAMS, ZSM.

The *Pepsis montezuma*-group

Description.— This group includes eleven small to medium-sized, fairly robust species (BL males 12-28, females 14-37). The body is black with dark blue, green or violet sheen, in some males brilliant green; it is sometimes covered with dense, dark hair, especially in the montane species. The antennae are black; unlike most closely-related species-groups, only a minority have a few apical segments orange (cream in one male). The wings of most species are orange-amber with a dark, apical border; some are entirely dark, some with an off-white to yellow transverse band (*atripennis* or *completa* mimicry-groups); a few males have very pale amber (almost clear) wings with dark apex, while in one species the female usually has the hindwing markedly paler than the forewing. The male S.4 hairs usually form more-or-less dense, lateral brushes of long, gradually curved hairs whose apexes meet (or nearly meet) those of the opposite side, forming a tall, almost perfect arc; between these are none to many hairs of very varied configuration. S.5 occasionally has a few, rather long central hairs but is otherwise without modified hairs. The SGP is usually strongly expanded apically, the apex with a more-or-less distinct central emargination. The paramere is fairly broad, and longer than the rest of the genitalia. The inner, apical projection of the digitus is well developed and is usually long and slender, finger-like. The females are without distinctive group-characters.

Cladogram for the *P. montezuma*-group

Characters:

1. Male S.4 with outer hairs curved, and with some shorter, straighter, central hairs; SGP strongly expanded apicad, truncate; paramere short, broad, bluntly pointed; inner, apical projection of digitus thick.
Female head quadrate; AS3 short; PST short, with furrow abruptly expanded apicad. Semi-montane species.
2. Apical border of forewing narrow, indistinct; male S.4 with many dense hairs, forming complete semicircle, central hairs curved.
3. Male S.4 lateral hair-brushes with no hairs between.
4. Male S.4 lateral hair-brushes with a few, weak hairs between.
5. Male S.4 lateral hair-brushes without strong hairs between.
6. Male S.4 hairs sparse and evenly distributed over most of segment; digitus without inner projection.
7. Body large; male S.2 & 3 with long, dense hair; paramere convex before mid-point.

Internal relationships.— Like the *ruficornis* sub-group of the *ruficornis*-group, and the *viridis*-group, to which it is related, this group includes species-pairs whose status appears comparable to the ones in those groups.

External relationships.— This group's closest ally is the *ruficornis*-group, but is less numerous and widespread.

Biology.— Some forms belong to the *atripennis* or *completa* mimicry-groups.

Biogeography.— Apart from a few isolated records, this group does not occur in the USA; it is also absent from the West Indies. Otherwise, it occurs everywhere southwards to the limits of the genus in Patagonia. The montane species commonly reach high altitudes in the Andes, up to 4,500 m. One species (*P. montezuma* itself) displays an interesting geographically-based colour inversion: everywhere in the Andes the wings are orange-amber (paler in the extreme south of its range, in Bolivia and Argentina) and

the antenna black, but on the Peruvian desert coast, the wings are black and the antenna mainly orange. The population of the semi-desert region of northern Perú exhibits a complete range of intermediates.

Pepsis cybele Banks, 1945
(figs 221-226, 614, 663)

Pepsis cybele Banks, 1945: 85. Holotype ♀ (MCZ) [examined].

Pepsis weberi Banks, 1946: 394. Holotype ♂ (MCZ) [examined]. **Syn. nov.**

Description.— ♂ (figs 221-226). BL 14-19. Body and legs black with dark green or blue-green metallic sheen. Antenna with from 1.0-6.5 apical segments creamy-white or pale orange. Wings usually with basal half pale and apical half infusate - but see Variation. S.4 with a wide, transverse, rather sparse patch of virtually erect hairs, weakly curved inwards, the outer ones slightly longer. S.5 with a few weak hairs on the apical half. SGP quite strongly expanded towards the apex, which is truncate with rounded corners, and usually a narrowly brown-translucent margin. Paramere broadest pre-apically, blunt, and about 1.5 times as long as rest of genitalia. Apex of digitus with inner projection bluntly pointed and slightly turned distad.

♀ (fig. 614). BL 16-25. AS3 short and thick, AE index 72-97. Colour as in male except with a greater tendency for the basal pale part of the wing to be reduced; however, this does not apply to individuals where the pale colour is more yellow. Head in dorsal view with the temple slightly swollen. MT moderate to strong. MPN equal to or shorter than PST, its furrow broad, the carinae moderate to fine. Propodeum: MG replaced by a very broad, rounded ridge. APT, PPT and PTC all weak to moderate, sometimes the last absent. DTC moderately coarse (finer in small specimens), even, regular. Propodeal hair about half PST length. Posterior face: VR absent or very weak, near PTC only, almost parallel to very strongly divergent. PFC similar to DTC continued, weaker medially and gradually distad, where replaced by slightly shiny, finely-sculptured area. S.2 with lateral extension of S.2 groove quite strong. Front femur with short hair below, especially near base. Hind tibia: teeth of usual size (sometimes rather narrow), the subtending spines about 2.0-2.5 times as high; inner spur long, reaching to about 0.30-0.45 basitarsus length (about equal to tarsal segment 2 or slightly less) and 1.2-1.3 times as long as outer spur.

Variation.— In both sexes, sometimes the wings are infusate, commonly with variable pale patches near the base; most often they are entirely pale in the basal half, the boundary variably sharp. However, in Venezuela and parts of eastern Colombia, these pale patches take the form of a well-defined yellow band, sub-basal on the forewing, basal on the hind, i.e. the individuals are members of the *atripennis* mimicry-group.

Distinctions.— The male is distinguished by its sparse but long and widespread hairs on S.4; it thus resembles *P. discolor* but is much smaller and widely allopatric from it. The female differs from those of other species as follows (all occur in entirely black-winged or yellow-banded forms): *P. atripennis* has a distinct PTC and scarcely any sub-femoral hair; *P. pilosa* has a shorter AS3 and a more transverse head, the SMC3 is very narrow anteriorly, and the femora (and body generally) are more densely hairy; *P. dimidiata* has shorter hind tibial spurs with curved apices, lacks a PTC and its MG runs

right through, its MPN furrow is shorter and broader, and its AS3 is slightly longer and more slender.

Biology.— Some specimens of both sexes belong to the *atripennis* mimicry-group.

Distribution.— Transandean in Colombia, also found in Venezuela and Trinidad; ascending to 500 m; probably under-collected, due partly to its being small and inconspicuously coloured. Map fig. 663.

Material depositories.— 19 ♂♂, 8 ♀♀; BMNH, FRITZ, LACM, MACN, MCZ, MIZAM, OEHLKE, PMA, UCALB, UNPBOG, WAHIS.

Pepsis pilosa Banks, 1946
(figs 233-238, 601, 602, 663)

Pepsis pilosus Banks, 1946: 393. Lectotype ♂ (AMNH), here designated [examined].

Type material.— *P. pilosus*: I have seen a single type-material ♂ and labelled it lectotype.

Description.— ♂ (figs 233-238). BL 12-20. Body and legs black with dark blue to blue-green metallic sheen. Antenna black. Wings black with rather weak blue-violet metallic reflections, sometimes with pale patches or yellow-orange sub-basal band (see Variation). S.1-3 usually with some long hair, least on S.3; S.4 with fairly broad, transverse, apical band of rather dense, long hairs, about as long as 2.5-3 times SGP width; the outer (lateral) hairs weakly curved inwards, gradually replaced centrad by shorter, straighter ones, those in centre about half as long as the outer. S.5 with a single line of very weak hairs, slightly denser and longer laterally. SGP rather short, fairly strongly expanded towards the truncate apex. Paramere broad, short, only as long as the rest of the genitalia, with a bluntly-pointed apex. Apical projection of digitus with a blunt point.

♀ (figs 601, 602). BL 26. AE index 76. Colour as in male but no specimens with variegated wings so far seen. Head fairly strongly swollen and quite broad in dorsal view. MT moderately strong. SMC3 of forewing very narrow anteriorly, strongly bulging postero-distally. MPN distinctly shorter than PST, its furrow strongly expanded apicad, shining; carinae fine, scarcely shining. Propodeum: rather strongly tapering apicad. MG totally replaced by a very broad, rounded ridge. APT moderate, PPT weak; DTC rather strong, weaker anteriorly and posteriorly. Propodeal hair about as long as PST + 1/2 MPN. PTC absent. Posterior face: VR absent, PFC continued straight on from DTC but rapidly weaker apicad, giving way medially to fine, dense sculpture. Lateral extension of S.2 groove well-developed. All femora with some rather short (shorter than width of femur) but fairly dense hairs below, least on posterior femur. Hind tibia: teeth of usual size, subtending spines about twice their height; with line of mixed setae and spines on inner side, all directed backwards; inner spur reaching to about 0.4 basitarsus length (about equal to tarsal segment 3) and about 1.5 times as long as outer spur (which is more blunt than usual).

Variation.— The wings (at least in males) frequently display paler patches of very variable size and position (sometimes very extensive); some specimens have a strong, yellow-orange sub-basal band, i.e. belong to the *completa* mimicry-group.

Distinctions.— Both sexes are extremely pilose; the male is distinguished by its very

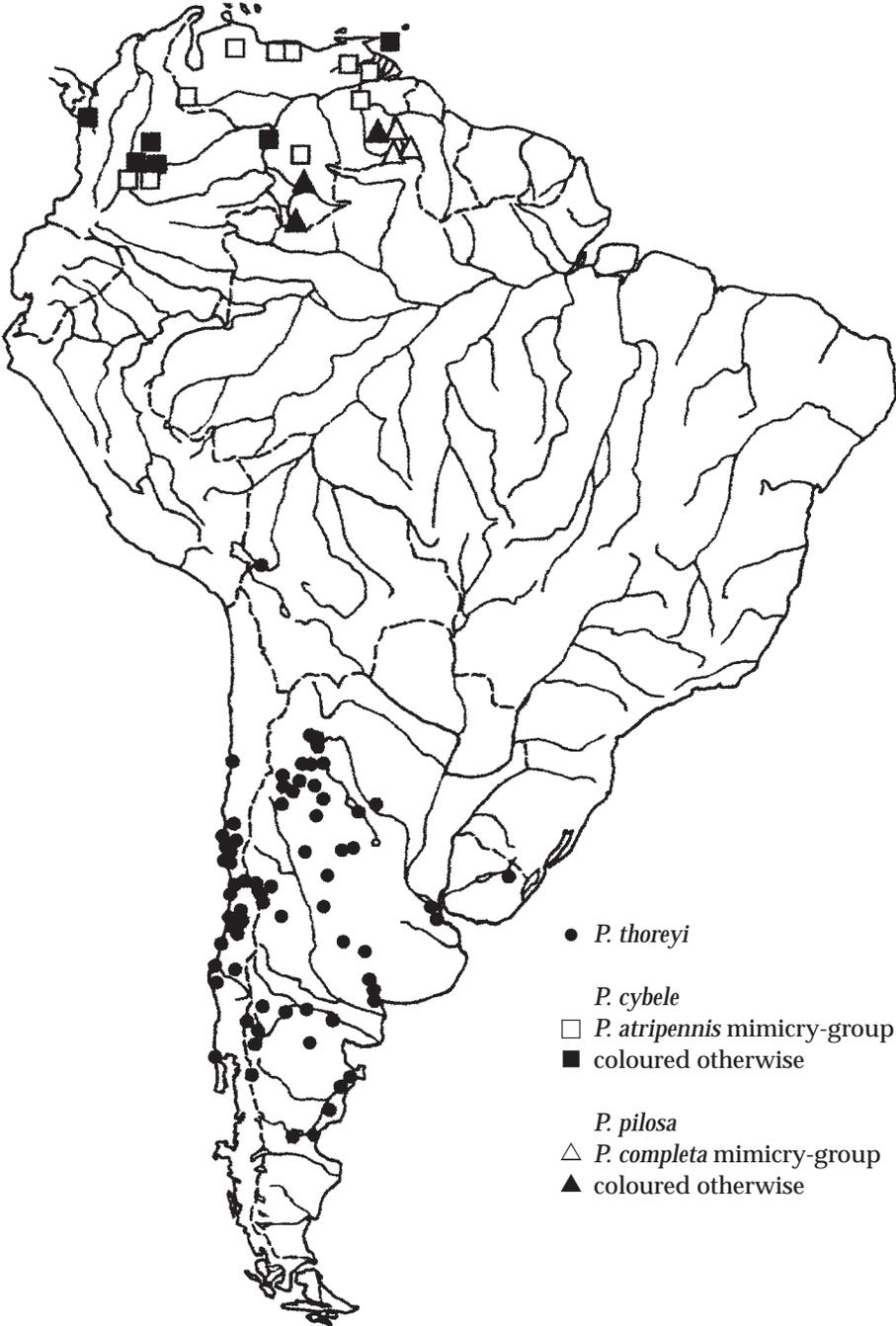


Fig. 663. Collection localities of *Pepsis thoreyi*, *P. cybele* and *P. pilosa*.

long S.4 hairs arranged in a band (like an exaggerated *P. ianthina*). The female is distinguished by its head-shape, short AS3, anteriorly very narrow SMC3, short MPN, tapering propodeum with PTC, and very long propodeal hair. The species' distribution is also very restricted.

Biology.— Some males belong to the *completa* mimicry-group (the only known female does not).

Distribution.— Apparently restricted to the Tepui region of Venezuela, at altitudes between 1,800-2,100 m. Map fig. 663.

Material depositories.— 18 ♂♂, 1 ♀; AMNH, BMNH, MIZAM, USNM [incl. ♀].

Pepsis thoreyi Dahlbom, 1845, spec. rev.
(figs. 441-446, 596, 663)

Pepsis thoreyi Dahlbom, 1845: 465. Lectotype ♀ (MZEL), here designated [examined]. Sp. rev. [Note.— A ♀ standing under *P. nigrocincta* in MNHU may be a further syntype of *P. thoreyi*; it has a label handwritten in Gothic German script: "Probably type of *P. thoreyi*." Another label says "Valparaiso".] Hurd (1952: 323) gives *P. thoreyi* Dahlbom, 1845 as a synonym of *P. limbata* Guérin, 1831, but without attribution. Mocsáry (1887: 18) was apparently the first to give this synonymy; although he attributes it to Smith (without date), I have not been able to find mention of *P. thoreyi* in any of that author's four papers on *Pepsis*. Lucas (1895: 801) gives this synonymy tentatively. Brèthes (1914: 360) gives *P. thoreyi* as a synonym of *P. circe* [Mocsáry, 1885], but only in the index; he does not otherwise mention the name in any of his papers - surprisingly, not even in "*Pepsis* in Chile" (1909). [I regard *P. circe* as a synonym of *P. montezuma* Smith, 1855]. It seems that Hurd may have accepted Mocsáry's assertion, and considered Brèthes' later synonymy of *P. thoreyi* under *P. circe* as unreliable.

Pepsis lurida Lucas, 1895: 804, no. 180. Lectotype ♂ (MNHU), here designated [examined]. **Syn. nov.**

Pepsis euterpe Brèthes, 1908: 242. Lectotype ♂ (MACN), here designated [examined]. **Syn. nov.**

Type material.— *P. thoreyi*: I have seen two syntypes, one of each sex, and have labelled the ♀ as lectotype; the ♂ paralectotype is a specimen of *P. limbata* Guérin. A ♀ standing under *P. nigrocincta* in MNHU is a specimen of *P. thoreyi* and may be a further syntype of this species (see in synonymy of *P. menechma* Lepeletier). *P. lurida*: I have seen a ♂ and three ♀ syntypes in MNHU, and have labelled the ♂ (which lacks the genitalia) as lectotype; all the ♀♀ are paralectotypes. One of the ♀♀ ("Chile, Pass von Uspallata") is conspecific with the ♂, the other two (both "Brasil") are specimens of *P. flavescens* Lucas. Another ♀ in TMB bears an original Lucas identification label; however, it cannot have any type-status as *P. lurida* because it is also labelled "Argentina, Est. Crespo", a locality not mentioned in the original description. The specimen belongs to the amber-winged form of *P. viridis* Lep. *P. euterpe*: I have seen 3 of the 4 ♂ syntypes: 1 from Patagonia, Santa Cruz; and 2 from Pampa Central. I have labelled as lectotype the first-mentioned specimen which is in the best condition of all; the other 2 specimens are paralectotypes and are conspecific with the lectotype.

Description.— ♂ (figs 441-446). BL 14-22. Body and legs black with blue-green sheen. Antenna black. Wings orange-amber; infuscation of forewing basally strong, narrow; apically fairly strong, broad (about a quarter of wing-length) but poorly-defined; hindwing as forewing but infuscation less distinct. S.1-3 with a few fairly long hairs. S.4 hairs: the extreme laterals long, forming a dense, narrow "brush", curved inwards, those of opposite sides forming an arc; the insertion points of the remaining hairs between them together forming a shallow arc; these hairs are mostly straight and

almost all reaching to about two-thirds the height (not length) of the larger ones; **there are very few if any hairs intermediate between the two sizes or shapes**. SGP quite strongly expanded towards the usually strongly truncate apex. Paramere apically rather blunt, about 1.5 times as long the rest of the genitalia, its apical hairs markedly longer than the others.

♀ (fig. 596). BL 18-25(-33). AE index 67-83(-87). Colour as in male, but apical infuscate wing-bands are narrower (occupying only the area beyond the closed cells) and better-defined. Head in dorsal view strongly swollen. MT moderate to strong. MPN equal to or slightly shorter than PST, its furrow usually deep, strongly expanded apicad; carinae usually moderately strong, sometimes mixed with fine ones, or entirely fine, shining. Propodeum: MG at most weakly indicated over part of the propodeal dorsum (occasionally deceptively simulated by a line of denser hair), mostly replaced by a very broad, shallow ridge. APT and PPT weak to moderate. DTC moderate to fine, often slightly stronger posteriorly, fairly regular but appearing less so because of numerous, shallow punctures as wide as the interstices, partly obscured by hair at least as long as PST + 1/2 MPN. PTC weak to moderate, sometimes shallowly emarginate centrally. Posterior face: VR at most weakly indicated above, when strongly divergent apicad. PFC strong near PTC, becoming weaker below, usually abruptly but sometimes gradually, giving way to a finely sculptured, matt area of variable extent. Lateral extension of S.2 groove well-developed. Hind tibia: teeth sometimes a little distant, subtending spines 2.0-2.5 times as high; inner spur rather short, reaching to 0.2-0.25 basitarsus length (about equal to tarsal segment 3 or slightly shorter), and 1.2-1.4 times as long as outer spur.

Variation.— Only as noted above.

Distinctions.— The male S.4 hairs are very similar to those of *P. flavescens*, which see for distinctions; the male of *P. limbata* is also similar: see under that species for distinctions. The female of *P. thoreyi* is very like a small one of *P. limbata*; the best distinctions are that *P. thoreyi* female has the MPN furrow strongly expanded apicad and its carinae shining, and the DTC are partly obscured by hair at least as long as PST + half MPN length. However, since these characters are variable, the following table is provided to assist in doubtful cases; *P. flavescens* is also included in view of its propodeal hair being of similar length.

A table is also given under *P. limbata* to distinguish the females of *P. aciculata*, *P. thoreyi*, *P. limbata* and *P. montezuma*.

Distribution.— The most southerly-distributed species in the genus; apart from a record from Bolivia, Coroico (1 ♀, CUNY, probably correct but needing confirmation) and one from northeastern Uruguay, it is known only from Chile and Argentina; in the latter, it is not recorded in the northeast; extending southwards at least to Comodoro Rivadavia, but if an old record for Santa Cruz (♂ lectotype of *P. euterge*) is confirmed, it will be the most southerly record for the genus (when this specimen was collected, the northern boundary of this province did not extend as far north as it does today). The species ascends to 3,300 m in Catamarca. Map fig. 663.

Material depositories.— 294 ♂♂, 380 ♀♀; AEIG, AMNH, BMNH, CAS, CMNH, CUNY, EMMSU, ETHZ, FDA, FRITZ, IMLT, INTAC, LACM, MACN, MCZ, MHNGV, MLP, MLU, MNHNPS, MNHNSA, MNHU, MNRJ, MNS, MZEL, MZUSP, NMV, NRS, OLLD, OSUC, PAGLIANO, PORTER, RMNH, SMF, TMB, UCALB, UCALD, UCV, UMCE, UMOX, USNM, USU, UZMC, WAHIS, WASBAUER, ZSM.

Table for distinguishing between *Pepsis thoreyi*, *P. limbata* and *P. flavescens* females.

<i>P. thoreyi</i>	<i>P. limbata</i>	<i>P. flavescens</i>
AE index 67-83(-87).	AE index (76-)81-95.	AE index 70-82.
MPN scarcely shorter than PST.	MPN equal to, to distinctly shorter than PST.	Equal or slightly shorter.
MPN furrow broad, strongly expanded posterad (more-or-less V-shaped).	Variable; of even width, to moderately expanded posterad or only posteriorly.	Rather broad, parallel-sided; occasionally slightly expanded posteriorly.
MPN carinae regular, somewhat shining (especially towards median groove) contrasting with propodeal dorsum.	Fine to very fine, almost always matt.	Very fine, matt.
Propodeal dorsum slightly convex in profile, PTC difficult to see.	Flat or almost so, PTC usually rather broad but shallowly emarginate distally.	Slightly convex, rounded; PTC weak or absent.
DTC fine, usually very fine anteriorly, irregular, matt; partly obscured by pilosity.	DTC fine, irregular, almost matt; partly obscured by pilosity.	Moderately coarse and regular, slightly shining; scarcely obscured by pilosity, often distinctly punctate between.
PFC very irregular, rapidly obsolescent apicad, obscured by extensive, strong, micro-reticulation.	Rapidly becoming finer distad; sometimes (especially medially) becoming very fine and matt.	Regular, gradually finer distad, often obsolescent medially.
Forewing with apical infusate band quite well defined, markedly darker near costa, contrasting with its anterior part, not entering radial cell.	As <i>P. thoreyi</i> .	Fairly broad, junction very diffuse; anteriorly a little darker, stopping just short of radial cell.
SMC3 of forewing evenly rounded postero-distally	More-or-less rounded, often obtusely angulate distally.	Evenly rounded apically (slightly longer posteriorly).
Hind tibial spines less than twice the height of the teeth they subtend.	Hind tibial spines 2-3 times the height of the teeth.	Spines 2-3 times the height of the teeth.
Inner hind tibial spur reaching to about 0.4 basitarsus length.	0.2-0.3.	About 0.3.

Pepsis flavescens Lucas, 1895
(figs. 404-409, 595, 664)

Pepsis flavescens Lucas, 1895: 511, no. 19. Lectotype ♂ (MNHU), here designated [examined].

Pepsis periphetes Lucas, 1895: 806, no. 182. Lectotype ♂ (MNHU), here designated [examined]. **Syn. nov.** [*Pepsis limbata* Guérin; Lucas, 1895: 801. Misidentification].

Pepsis limbatella Brèthes, 1908: 242. Lectotype ♂ (MACN), here designated [examined]. **Syn. nov.**

Pepsis discoidalis Brèthes, 1914: 312, no. 88. Lectotype ♂ (MACN), here designated [examined]. **Syn. nov.**

Pepsis limbatica Brèthes, 1914: 342, no. 139. Holotype ♂ (MZUSP) [examined]. **Syn. nov.**

Pepsis militaris Brèthes, 1914: 343, no. 140. Lectotype ♀ (MZUSP), here designated [examined]. **Syn. nov.**

Pepsis cavillatrix Haupt, 1952: 341, no. 3. Lectotype ♂ (MLU), here designated [examined]. **Syn. nov.**

Pepsis arcuata Haupt, 1952: 342, no. 5. Lectotype ♀ (MLU), here designated [examined]. **Syn. nov.**

Pepsis recterugosa Haupt, 1952: 342, no. 6. Holotype ♀ (MLU) [examined]. **Syn. nov.**

Pepsis adversatrix Haupt, 1952: 373, no. 24. Lectotype ♂ (MLU), here designated [examined]. **Syn. nov.**

Type material.— *P. flavescens*: I have seen only a single syntype ♂ with the data “Montevid. Sello”, and labelled it lectotype. The specimen also bears an old green label “*bonariensis* N.”. Possibly this label was added by Lucas, who later realized that the name was preoccupied. *P. periphetes*: I have seen a single ♂ syntype from Allegrette [= Alegrete, 430k w Porto Alegre, Brazil], and labelled it lectotype. *P. limbatella*: I have seen both ♂ syntypes and labelled the one in better condition as lectotype. The paralectotype is conspecific. *P. discoidalis*: I have seen 2 ♂♂ with identical collecting data, and a ♀, all in MACN; although Brèthes mentions only one of each sex, I regard all 3 specimens as syntypes. I have labelled the slightly larger ♂ as lectotype; the other ♂ and the ♀ are paralectotypes. All 3 specimens are conspecific. *P. militaris*: I have seen all 3 syntypes (♀♀) mentioned in the original description and have labelled the least worn specimen as lectotype. The 2 paralectotypes are conspecific. *P. cavillatrix*: I have seen the ♂ and the ♀ mentioned by Haupt and have labelled the ♂ as lectotype. I regard both specimens as syntypes; although Haupt mentioned a holotype, it is not clear which specimen he was referring to. The ♀ paralectotype is conspecific. *P. arcuata*: I have seen both ♀ syntypes and labelled one of them lectotype; the paralectotype is conspecific. *P. adversatrix*: I have seen both ♂ syntypes from Brazil: Santa Catharina, and all 3 ♀ ones from Uruguay: San José. I have labelled a ♂ as lectotype; all the remaining specimens are conspecific paralectotypes. A further 4 ♂♂ (3 Santa Catharina, 1 Sierra da Mar) have no type-status, although they too are conspecific.

Description.— ♂ (figs 404-409). BL 13-25. Body and legs black with dark green-blue sheen. Antenna black. Wings usually mainly pale amber, both with narrowly infuscate base; forewing apex with fairly strong, usually narrow and well-defined infuscate band; hindwing usually paler apically, sometimes with very faint, narrow infuscation. Occasionally all wings partly or entirely very dark (see Variation). S.4 with a semicircle of hairs, virtually erect basally, evenly dense, the extreme laterals long and curved inwards and those of opposite sides meeting to form an arc; towards the anterior, central part of the segment the hairs gradually reduce in thickness, length and degree of curvature such that finally in the centre they are about half the height (not length) of the longest; behind these short hairs are additional, similar ones which thicken the semicircle in that area. S.5 with only a few, weak hairs at most, mainly in small, lateral tufts. SGP quite strongly expanded towards the truncate-rounded apex; covered with short hair. Paramere blunt at apex but still about half as long again as the rest of the genitalia.

♀ (fig. 595). BL 19-32. AE index 70-84. Colour as in male except that the wings are darker on average, a dull orange-amber, and the apical infuscation less well-defined. Head in dorsal view moderately swollen. MT moderate to strong. MPN slightly shorter than PST, its furrow usually rather broad and parallel-sided, occasionally weakly expanded posterad; carinae fine or, more commonly, very fine, matt. Propodeum: MG replaced by a broad, rounded ridge. APT weak to moderate (occasionally strong), PPT weak to moderate. DTC usually fine, increasing to moderate posterad, rather irregular; in large specimens more even in size and more regular. PTC absent to weak (occasionally moderate). Hairs about as long as PST and half MPN together. Posterior face: VR absent or (mainly in larger specimens) very weak in upper half, when strongly divergent apicad. Upper PFC as strong as DTC, rapidly weakening apicad and weaker at least in mid-line or sometimes abruptly obsolete, leaving a finely-sculptured, matt median area

of very variable size and definition. Lateral extension of S.2 groove well-developed. Usually abundant hair below anterior and middle femora, but variable and soon abraded. Hind tibia: teeth normal except sometimes rather sharply pointed, the subtending spines 2.0-2.5 times as high. Inner spur reaching 0.3-0.4 basitarsus length (about equal to tarsal segment 3 or slightly shorter) and 1.2-1.5 times as long as outer spur.

Variation.— Occasional specimens of both sexes from Brazil: Santa Catharina, Argentina: Misiones and Bolivia: Santa Cruz have the wings more-or-less heavily infuscate; specimens from Patagonia (Rio Negro; Neuquen) have the wings more orange and the infuscation of the forewing apex broader and less well-defined. Two males from Brazil: Chapada [dos Güimaraes] (CMNH) and Goias, Vianopolis (MZUSP) has yellow-banded wings and belongs to the *completa* mimicry-group.

Distinctions.— Males are distinguished from those of similar, sympatric species as follows: males of *P. smaragdina* frequently exhibit some hairs between the lateral brushes; although these hairs are usually thin and sparse, they are occasionally sufficiently numerous to resemble those of *P. flavescens*. The two species can be distinguished as follows (*P. smaragdina* characters in parentheses): antenna always entirely black (with variable amount of orange-yellow apically, sometimes only a tiny, apical spot visible only from end-on); forewing with infuscation usually confined to a narrow, well-defined, apical band, only occasionally invading the cells (infusate area usually much broader, its inner margin diffuse and spreading well into the cells); the S.4 hairs form a perfectly uniform reduction series from the brushes inwards and are evenly curved overall, their tips usually overlapping (their form changes more abruptly inwards; outer hairs less strongly curved in basal half, hence their tips scarcely touching); the insertion points of the hairs form a rather narrow, semicircular band (a wide, shallowly arcuate band). There are also small differences in the genitalia. Note that any apparent differences in the SGP are due only to individual variation, with wide overlap between species. In *P. nigricans* the male has a transverse band of quite strong hairs on S.5, easily overlooked when S.4 and S.5 are telescoped together. In male *P. thoreyi* the transition between long, lateral hairs and short, intervening ones is abrupt, with usually very few transitional hairs such as those in *P. flavescens*; however, variation can give rise to doubt. However, the apical band of the forewing in *P. thoreyi* is much broader and poorly-defined; and the paramere has apical hairs about twice as long as the remaining hairs (all equal in *P. flavescens*); furthermore, the two species are not entirely sympatric. The male of *P. flavescens* is also somewhat similar to that of *P. limbata*, which see for differences.

In females, the strongest combination of characters is formed by the short AS3 (= low AEI), the DTC being usually fine, increasing to moderate posterad; the PTC absent to weak (occasionally moderate); the propodeal hairs about as long as PST + half MPN together. However, the females of this species are also very variable, consequently often resembling those of several other species. The two extremes are large and rather dark, resembling *P. discolor* (see the table given under *P. discolor* to distinguish them); and small and pale, resembling *P. smaragdina* (however, the latter has shorter propodeal hair, almost no femoral hair, and usually partly orange antenna); but with a complete range of intermediates. The occasional entirely very dark specimens strongly resemble *P. filiola*, but again that species has shorter propodeal hair. The long propodeal hair and fairly abundant mid-femoral hair are the most constant and useful characters in *P. flavescens*. In respect of its long propodeal hair, *P. flavescens* is likely to be confused also

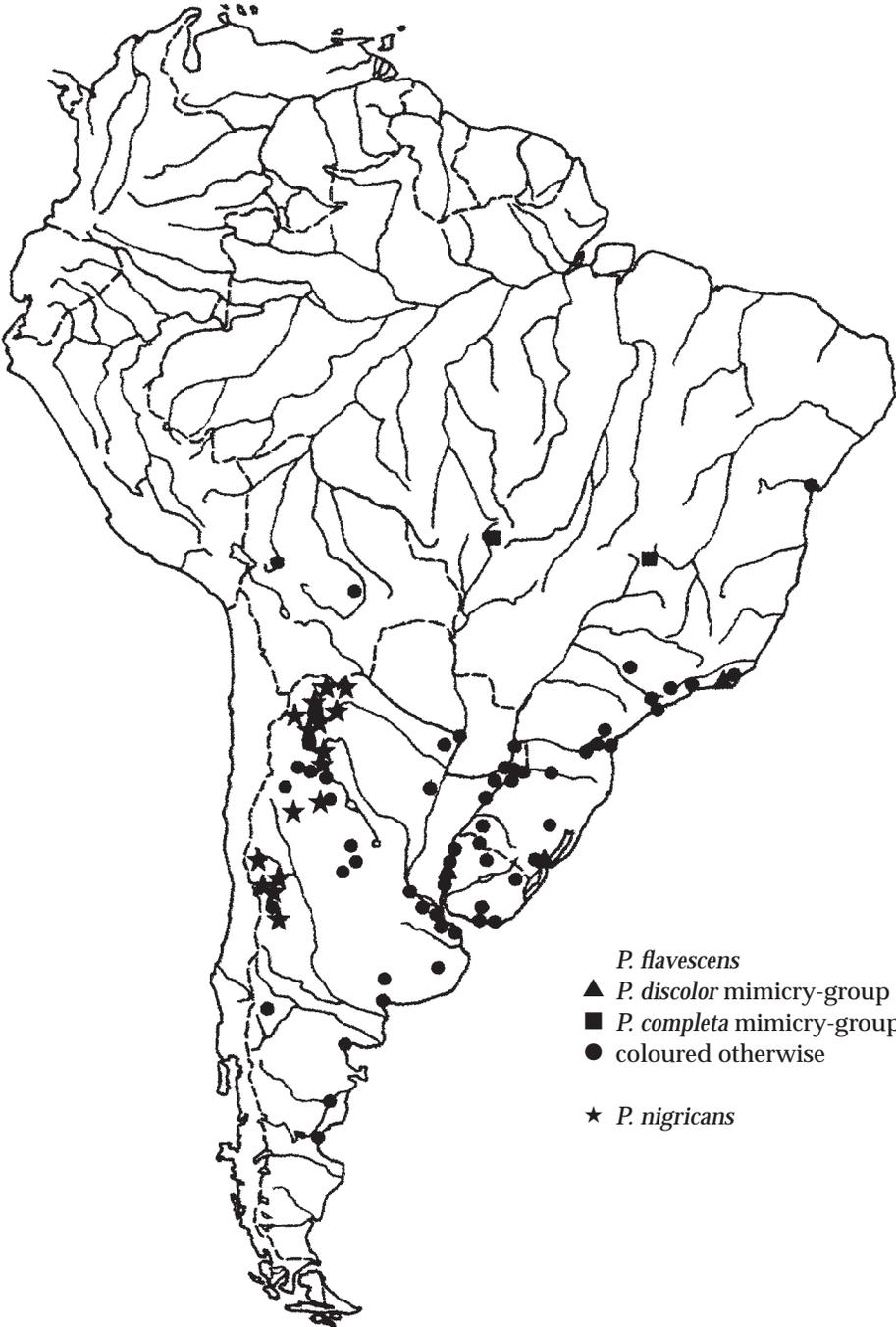


Fig. 664. Collection localities of *Pepsis flavescens* and *P. nigricans*.

with *P. thoreyi* and *P. limbata*; a table is given under *P. thoreyi* to distinguish them. This species may also be confused with *P. discolor* and *P. viridis*; see the table given under the first-named species to distinguish them.

Biology.— Two males belonging to the *completa* mimicry-group have been seen from Brazil: Mato Grosso, Chapada dos Guimarães (CMNH) and Goiás, Vianópolis (MZUSP). Females from south-eastern Brazil and Paraguay sometimes belong to the *discolor* mimicry-group.

Distribution.— A very wide-ranging southern species: found sparsely in Bolivia, central and eastern Brazil, becoming very common in southern Brazil and northern Argentina, then gradually sparser again to its southern limit in Comodoro Rivadavia (central Argentine Patagonia). A record from Chile (1 ♀, TMB) needs confirmation, while records from Mexico (1 ♀, MNHNPS) and from Jamaica, Port Antonio (1 ♂, MCZ) probably represent labelling errors; mostly at low altitudes but ascends to 1,200 m in Salta. Map fig. 664.

Material depositories.— 432 ♂♂, 151 ♀♀; AEIG, AMNH, BMNH, CMNH, CSU, CUNY, EMMSU, ETHZ, FRITZ, FSAG, IMLT, MACN, MCZ, MHNGV, MHNNEU, MLP, MLU, MNHNPG, MNHNPS, MNHNSA, MNHU, MNRJ, MNS, MZHEL, MZUSP, NMV, NRS, RMNH, SEMKU, SMF, TMB, UCALB, UFPCUR, UMOX, USNM, WAHIS, WASBAUER, ZMMOSC, ZSM.

Pepsis nigricans Lucas, 1895
(figs 435-440, 594, 664)

Pepsis nigricans Lucas, 1895: 806, no. 181. Lectotype ♀ (MNHU), here designated [examined].
Pepsis troglodytes. Brèthes, 1908: 243. Holotype ♂ (MACN) [examined]. **Syn. nov.**

Type material.— *P. nigricans*: I have seen 4 syntype ♀♀ and labelled one of them lectotype; the remaining 3 are paralectotypes and all 4 specimens are conspecific.

Description.— ♂ (figs 435-440). BL 13-23. Body and legs black with blue to green or violet metallic sheen. Antenna black. Wings orange-amber with the base usually more-or-less narrowly but strongly infuscate, the boundary usually diffuse; a rather weakly infuscate but well-defined apical band is more distinct on the forewing, where it occupies from about half to almost all of the area beyond the cells; almost disappearing in worn specimens. S.4 hairs long laterally, basally straight then strongly curved inwards, those of opposite sides not usually meeting apically; towards the front-centre the hairs are gradually shorter, straighter and sparser until centrally they reach about 2/3 the height (not length) of the outermost ones; along the posterior margin (between the longest hairs) are rather sparse shorter hairs; on S.5 is a fairly broad and wide band of moderately dense, straight hairs similar in height to those of anterior S.4. SGP weakly expanded apicad, with rounded apex. Paramere weakly pointed with apical hairs shorter than paramere width. Apical projection of digitus long and finger-like.

♀ (fig. 594). BL 25-36. AE index 90-107. Body with abundant black hair, especially on the propodeum. Anterior femur with a moderate amount of coarse hair below, successively less on following femora. Colour differs from male as follows: basal band of forewing very broad (equal to width of thorax including tegulae) but very diffuse distally; apical band less variable in extent than in male, usually narrow, sharply-defined, occupy-

ing just over half the area beyond the cells. Head with vertex and temple slightly swollen. Forewing: usually the apex of the radial cell meets the costa proximally to the point where it joins SMC3; the PPV is more transverse than usual; 1r-m is straight with a rather abrupt curve anteriorly; and 2r-m is angulate just behind its mid-point. MT moderate to strong, occasionally sharp. MPN equal to or slightly shorter than PST, its furrow broad, sometimes gradually expanded posterad, shining; carinae very fine, sometimes 1 or 2 fine in anterior half in larger specimens. Propodeum: MG usually indicated in at least anterior and posterior thirds, often quite deep, sometimes continued straight through on to posterior face. APT and PPT moderate, strong in very large specimens. DTC moderate to strong, becoming stronger posterad. Propodeal hair about 1.5 times MPN length. PTC weak or absent. Posterior face: VR weak, their distance apart very variable. PFC in upper part as strong as DTC, gradually weaker posterad, more-or-less rapidly obsolescent and replaced by matt microreticulation towards the mid-line; near the petiole socket, the surface with less microsculpture and more polished; here the PFC are fine but distinct, and semicircular (concentric around the socket). Lateral extension of S.2 groove well-developed. Hind tibia: more slender than usual, its teeth small, irregularly distant, the subtending spines 2.0-2.5 times as high; inner spur reaching about 0.25 basitarsus length (about as long as tarsal segment 3), and 1.2-1.5 as long as outer spur.

Variation.— Only as given above.

Distinctions.— The male is distinguished from those of similar species, especially *P. flavescens*, by the presence of a distinct band of hairs anteriorly on S.5 (look carefully when S.4 and 5 are telescoped together); also the S.4 lateral hairs usually have a distinct, straight basal part before the strong curve. The female is best characterized by the AE index, broad basal and narrow apical wing bands, the propodeal MG and PTC forms, and hair length. It most resembles female *P. montezuma*; see under that species for distinctions.

Distribution.— Restricted to the northwest Argentine provinces from Salta south to Mendoza and east to Tucumán in an altitude band from (680-)1,000-3,200 m. A ♂ and 6 ♀♀ (MLP) purporting to come from Misiones, San Ignacio are apparently mislabelled. Map fig. 664.

Material depositories.— 105 ♂♂, 44 ♀♀; BMNH, CUNY, EMMSU, FRITZ, IMLT, MACN, MCZ, MLP, MNHNPS, MNHU, MNS, PORTER, RMNH, SEMKU.

Pepsis montezuma Smith, 1855
(figs 313-318, 575, 576, 665)

Pepsis montezuma Smith, 1855: 199. Lectotype ♀ (BMNH), here designated [examined].

Pepsis quitonensis Packard, 1869: 61. Lectotype ♀ (MCZ), here designated [examined]. **Syn. nov.**

Pepsis sibylla Mocsary, 1885: 258, no. 32. Lectotype ♀ (MHNNEU), here designated [examined]. **Syn. nov.**

Pepsis circe Mocsary, 1885: 263, no. 41. Lectotype ♂ (TMB), here designated [examined]. **Syn. nov.**

Pepsis occidentalis Cameron, 1893: 218, no. 10. Lectotype ♂ (BMNH), here designated [examined]. [Synonymized by Meade-Waldo et al., 1915: 332].

Pepsis peruanus Lucas, 1895: 595, no. 59. [p. 840: name amended to *peruana*]. Lectotype ♀ (NMV), here designated [examined]. **Syn. nov.**

Pepsis fulva Lucas, 1895: 698, no. 118. Lectotype ♀ (MNHU), here designated [examined]. **Syn. nov.**

Pepsis nessus Lucas, 1895: 787, no. 167. Lectotype ♀ (TMB), here designated [examined]. **Syn. nov.**

Pepsis fusca Lucas, 1895: 788 (not Christ, 1791). Holotype ♀, South America (lost). **Syn. nov.**

- Pepsis andicola* Cameron, 1903: 226. Lectotype ♀ (BMNH), here designated [examined]. **Syn. nov.**
Pepsis chilloensis Cameron, 1903: 227. Lectotype ♀ (BMNH), here designated [examined]. **Syn. nov.**
Pepsis patagonica Brèthes, 1908: 241. Lectotype ♂ (MACN), here designated [examined]. **Syn. nov.**
Pepsis fasciculata Brèthes, 1908: 243. Lectotype ♂ (MACN), here designated [examined]. **Syn. nov.**
Pepsis pisoensis Strand, 1911: 145, no. 4 (part). 2 syntype ♂♂, Ecuador, Pinullar, 2,900 m. (lost). **Syn. nov.**
Pepsis pacifica Brèthes, 1914: 326, no. 113. Holotype ♀ (MZUSP) [examined]. **Syn. nov.**
Pepsis huascar Banks, 1946: 327. Lectotype ♂ (CUNY), here designated [examined]. **Syn. nov.**
Pepsis atricoma Hurd, 1950: 132. [Replacement name for *fusca* Lucas not Christ].

Type material.— *P. montezuma*: I have seen five conspecific ♀ syntypes, one in BMNH, the others in UMOX; I have labelled as lectotype the ♀ in BMNH. The four UMOX specimens are paralectotypes. Although Smith also described the ♂ I was not able to find any type-material of that sex. *P. quitonensis*: I have seen a single type-material ♀ and labelled it lectotype. *P. sibylla*: I have seen a single type-material ♀ and labelled it lectotype. *P. circe*: I have seen five ♂ and one ♀ syntypes, all conspecific, and labelled one of the ♂♂ as lectotype. *P. occidentalis*: I have seen 6 ♂ syntypes and labelled as lectotype the largest specimen; it has the darkest wings of all the syntypes, and already bears the usual BMNH “type” labels. The remaining 5 ♂♂ are conspecific paralectotypes. *P. peruana*: I have seen a single type-material ♀ and labelled it lectotype. *P. fulva*: I have seen a single type-material ♀ without locality label, and labelled it lectotype. The original description gives only “South America” as locality; the wing-colour of the specimen suggests a northern Andean or Mexican provenance. *P. nessus*: I have seen many specimens of both sexes from TMB, all purporting to be syntypes, but only a single ♀ (labelled “America merid.”) qualifies as type-material; I have labelled it lectotype. All the others mentioned in the original description, including those in MNHU, are apparently lost. *P. andicola*: I have seen 2 ♀ syntypes and labelled the one in better condition (from Pichincha) as lectotype. The other specimen is a conspecific paralectotype. *P. chilloensis*: I have seen a single type-material ♀ and labelled it lectotype. *P. patagonica*: I have seen a single type-material ♂ and labelled it lectotype. *P. fasciculata*: I have seen a single syntype ♂ (from Santa Maria) and labelled it lectotype. *P. huascar*: I have seen the first of the two syntypes mentioned by Banks, a ♂, and labelled it lectotype.

Description.— ♂ (figs 313-318). BL 12-25. Usually body and legs black with deep blue metallic reflections, antenna black (occasionally with a tiny, apical orange spot), and wings orange with dark base and apical border; sometimes antenna orange above and wings entirely black (coastal Peru & Chile); other colours occur in both sexes, but are less common (see Variation). S.4 hairs entirely lateral, forming a dense brush of about 4-36 hairs, evenly curved (occasionally slightly bent just beyond the middle) and meeting those of the opposite side in an arc. SGP more-or-less strongly expanded towards the truncate-rounded apex. Paramere 1.5 times as long as the rest of the genitalia, with a strongly-rounded apex.

♀ (figs 575, 576). BL 18-33. AE index 81-107. Colour as in male, except that the basal infuscation of the forewing extends just over a thorax-width (between tegulae), that of the hindwing about 2/3 as much; in most specimens the apical band of the forewing is sharply-defined, occupying about half the area beyond the cells, usually not quite touching the radial cell; frequently, however, this band occupies virtually all the space beyond the closed cells, rarely extending along the anterior part of the radial cell. Entire body covered

with long, dense hair, especially sides and underside, and below all femora, especially the anterior. Head in dorsal view moderately strongly swollen. MT very strong and sharp. Forewing with PPV rather transverse but still quite long; SMC3 strongly bulging posterodistally. MPN equal to or slightly shorter than PST, its furrow rather narrow, usually more-or-less expanded apicad or entirely broad; carinae rather fine, often somewhat irregular. Propodeum: MG virtually absent. All tubercles weak, PPT at most a low, blunt tooth; DTC usually fairly strong, occasionally fine, rather irregular, often stronger and more distant posteriorly, interstices usually dull with fine sculpture; PTC weak, occasionally strong and narrow. Propodeal hair length between PST + half MPN and PST + MPN, sometimes strongly obscuring surface. Posterior face: VR absent to moderately strong in upper half only; when present, parallel or slightly divergent apicad. PFC fairly strong above (similar to anterior DTC), gradually weaker below and in the centre-line, where they often give way to a finely-sculptured, matt area. T.1 with abundant hair. Lateral extension of S.2 groove well-developed. Hind tibia: teeth of usual size, sometimes irregularly rather distant, subtending spines 2.0-2.5 times as high; inner spur reaching to 0.35-0.4 basitarsus length (slightly shorter to slightly longer than tarsal segment 3), and 1.2-1.3 times as long as outer spur (but see Variation).

Variation.— This species, with its extremely wide distributional area and mainly montane habitat, is one of the most variable in the genus. Within the range of the usual colour-form of this species described above, occasional individuals (most commonly females) occur which differ in colour from the rest of the local population (most often by markedly darker wing-colour). Such females which sometimes simultaneously display structural variation can be very difficult to identify: this concerns the shape of the MPN furrow, the transverse carinae of both MPN and propodeum, strength of MT, and density of subfemoral pilosity. Especially in very large females, there is also a tendency for the row of hairs subtending the hind tibial teeth on their inner side to be curved backwards. A female from Venezuela: Colonia Tovar (MNH-NPS) has the hind tibial inner spur reaching only to 0.2 basitarsus length and slightly shorter than the outer spur.

In males, colour variation more-or-less parallels that in the females. In addition, the number of modified hairs on S.4 varies considerably (as given above). Aspects of this variation are that there is little relation to size of insect, it does not have any geographical basis, and opposite sides of S.4 do not always have equal numbers of hairs. Occasional specimens are encountered in which the overall pilosity is especially dense, e.g. in 1 of 4 males from PERU: Otusco, 2,600 m and in another from near Aricapampa, 2,300-2,500 m the hairs on S.2 in particular are distinctly longer and denser than usual. This tendency becomes common as the species approaches the southern limit of its distributional range in the Andes of Argentina and Chile.

Although the above forms are the commonest, three other distinct colour forms exist in both sexes:

1. At high altitudes in Peru (upwards of c.1,800 m.) all apical pigmentation disappears, leaving the wing-tips milky-translucent (but see variant 2).
2. In certain, apparently very restricted, areas of the western watershed of the Peruvian Andes there occurs a peculiar form in which the wings are entirely metallic silver-grey (somewhat resembling *Pepsis petiti*). Such specimens have been seen from northern Peru: Bagua, 550 m (1 ♀); central Peru, Ayacucho-Huancavelica area,

2,700-3,400 m (several ♂♂ & ♀♀) and Matucana, 2,400 m (1 ♀); see The Lygarochromy phenomenon (Part 1, p. 22).

3. The most extreme form, in which the usual colour pattern is reversed, producing entirely black wings, a violet body, dorsally orange antenna and extremely dense pilosity (*P. peruana*), occurs in the western watershed of the Andes in Perú and Chile (especially the desert coast, but also known from Arequipa, 2,300 m). A range of intermediates occurs in north coastal Peru, where climatic conditions are likewise intermediate, with a little rain in most years. Variably dark forms also occur in various parts of the area from Mexico to Venezuela and Ecuador, but they are never as dark as the desert form and the antenna always remains entirely black.

Distinctions.— This is one of the few species of the genus which occurs mainly at high altitudes; it occurs at low altitudes only in areas sharing some of the climatic conditions of high-altitude habitat, viz. the western desert coasts of South America, and the northern and southern extremities of its range (see variant 3 above).

The male resembles only two others in its S.4 hairs: *P. completa* has yellow (sometimes whitish) banded wings and lacks femoral hair; whereas *P. smaragdina* usually has at least a few hairs between the lateral “brushes” and has a deep green body; both of the latter species are allopatric from *P. montezuma*.

Although the female is characterized by the moderately swollen head, usually very sharp MT, and propodeal hair length, all of these, as well as the wing colours, can vary in individual specimens, which renders some females very difficult to identify. Furthermore, some females from very high altitudes (variant 1 above) strongly resemble those of *P. terminata* and *P. tolteca*, where they are sympatric. A table was given under *P. terminata* (Part 2, p. 70) to separate them. In the northern part of its range, the female strongly resembles that of *P. basifusca*; see under that species for distinctions.

In the southern part of this species' range (Bolivia, Chile, Argentina) both sexes often have the basic wing colour very pale; the female is distinguished from those of almost all sympatric species of similar appearance by the narrow, sharply-defined apical band of the forewing, the very long propodeal hair (equal or almost equal to PST + MPN together); the body hair is also denser than that of any other species (most noticeable on the sides and underside of the body, and below all the femora). The only other species virtually coinciding with this description is *P. nigricans*, partly sympatric in western Argentina; in that species the head is less strongly swollen; the basal infuscation of the forewing is more extensive and its boundary very diffuse; the MPN furrow is broader and its carinae finer; the propodeal hair shorter and less dense, the MG usually more evident and PTC less so; also the PPV is more transverse and the head less swollen. In the southern part of its range, female *P. montezuma* could possibly be confused with those of *P. thoreyi* and *P. limbata*, but *P. montezuma* has a much narrower apical wing-band, even denser and longer hair, and its basic wing colour is often very pale. A table to distinguish between females of *P. aciculata*, *P. thoreyi*, *P. limbata* and *P. montezuma* is given under *P. limbata*.

Biology.— A female from PERU: Machu Picchu (BMNH) was carrying a theraphosine spider, ?*Grammostola* spec., det. A. Smith, 1992; its habitat is terrestrial.

Distribution. This species is one of the most widely-distributed in the genus. It occurs in all neotropical mountain areas from Mexico and Venezuela to Argentina and Chile up to about 4,500 m, but is totally absent from the West Indies and eastern South America; it descends to sea level on the western desert coast of Perú (black form) and in

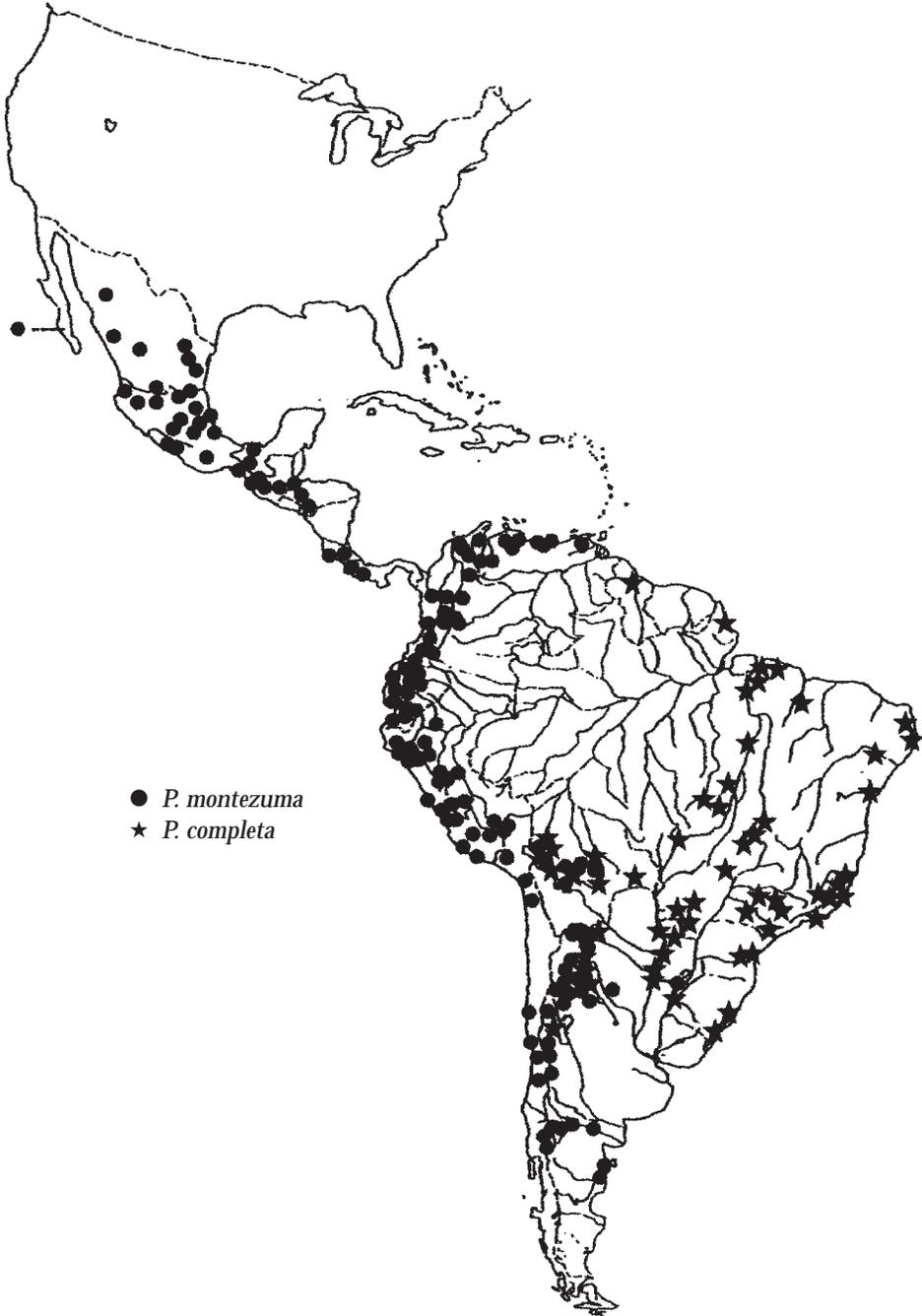


Fig. 665. Collection localities of *Pepsis montezuma* and *P. completa*.

Argentina extends east to Santiago del Estero, Añatuya (100 m) and south to Patagonia, Chubut, Gaimán (100 m). A single male from Misiones (MACN) is probably mislabelled. Map fig. 665.

Material depositories.— 1,189 ♂♂, 966 ♀♀; AEIG, AMNH, ANSP, BMNH, BONELLI, BRIO, CARRASCO, CAS, CMNH, CSU, CUNY, EMMSU, ETHZ, FDA, FRITZ, FSAG, HENSEN, IMLT, INBIO, LACM, MACN, MCSNGO, MCZ, MHNGV, MHNNEU, MHN-LIM, MICR, MIZAM, MIZSU, MLP, MLU, MNCN, MNHNPS, MNHNSA, MNHU, MNRJ, MNS, MZEL, MZFIR, MZUSP, NMV, NRS, OCHOA, OLLD, OSUC, PAGLIANO, PMA, PORTER, PUCEQ, RMNH, SEMKU, SMF, SMTD, TEXAM, TMB, UCALB, UCALD, UCVAL, UMB, UMCE, UMOX, UNALM, UNAN, UNCUS, UNLAMB, UNPBOG, UN-TRUJ, USNM, USU, UZMC, WAHIS, WASBAUER, ZMMICH, ZSM.

Pepsis completa Smith, 1855
(figs 17, 304-312, 642, 643, 665)

Pepsis completa Smith, 1855: 190. Lectotype ♀ (BMNH), here designated [examined].

Pepsis nuda Fox, 1899: 195. ♂, Brazil (lost). [Synonymized by Brèthes, 1914: 278].

Pepsis quichua Brèthes, 1908: 235. Lectotype ♂ (MACN), here designated [examined]. **Syn. nov.**

Pepsis comes Banks, 1946: 342. Lectotype ♀ (MCZ), here designated [examined]. **Syn. nov.**

Type material.— *P. completa*: I have seen 3 ♀ syntypes, 2 in BMNH and 1 in UMOX. One of the 2 in BMNH bears a handwritten Smith type label but no locality label: I have labelled this specimen as lectotype. The other specimen bears the locality "Braz." but no type label. The UMOX specimen bears no Smith labels. The 2 last-mentioned specimens are paralectotypes. The specimen in UMOX is conspecific with the lectotype, but the BMNH paralectotype is a specimen of *P. chrysoptera* Burmeister. *P. quichua*: I have seen 3 ♂ and 3 ♀ syntypes, and labelled as lectotype one of the two larger ♂♂. The other 5 specimens are conspecific paralectotypes. *P. comes*: Banks mentions 2 ♀♀ in his description, but I have seen only the specimen collected by Williams; this one, which I have labelled lectotype, bears the type labels of Banks and MCZ; presumably the other specimen (collected by Martorelli), contrary to Banks, does not.

Description.— ♂ (figs 304-312). BL 12-23. Body and legs black with fairly strong metallic blue-green sheen. Antenna black with 0.5-5.0 apical segments bright orange. Wings almost always black with an white to orange transverse band approximately its own width from base and occupying about a quarter of the wing-length (but see Variation). S.4 with a pair of very narrow brushes each of 4-8 coarse hairs (sometimes broken off at the base), usually evenly curved but sometimes slightly bent in the middle, those of the two sides together forming a complete arc. S.5 with only a patch of small, lateral hairs. SGP very weakly bent down at middle, sides slightly, gradually expanded towards the truncate apex, whose margin is narrowly reflexed. Paramere about 1.5 times as long as rest of genitalia.

♀ (figs 17, 642, 643). BL 17-28. AE index 82-98. Colour as in male, except up to 7 apical antennal segments orange. Head with temple and vertex slightly swollen, more-or-less size-related. MT moderate to strong. MPN about equal in length to PST, sometimes slightly shorter than PST in larger specimens, its furrow rather broad and shining,

sometimes expanded apicad; carinae moderate to very fine (often mixed). Propodeum: MG at most vestigial, replaced by a strong ridge. APT moderate to strong, PPT weak to moderate (both more-or-less size-related). DTC coarse to moderate, fairly regular, sometimes missing just before PTC. Propodeal hair 1/2-3/4 PST length. PTC weak to moderate. Posterior face: VR weak or vestigial, usually present in upper half of face only, slightly divergent from the PTC or parallel, then usually gradually convergent apicad but obsolete before merging. PFC beginning as strong as DTC, gradually weaker apicad, also in a median area wide above but narrowing below. Lateral extension of S.2 groove well-developed. Hind tibia: teeth often rather small for the size of insect, sharp and backward-pointing, the subtending spines 2.0-2.5 times as high; inner spur reaching to 2.5-3.5 length of basitarsus, (intermediate in length between tarsal segments 2 and 3); 1.2-1.3 times as long as outer spur.

Variation.— In the Mato Grosso (Brazil) a colour change occurs in both sexes: in specimens south and east of this area, the wing-bands are off-white instead of yellow (= *quichua* Brèthes); in these specimens, the number of orange antennal segments is fewer on average. Apart from this, the only colour variation consists of slight differences in the degree of definition of the transverse wing-band, which is sometimes a little further from or closer to the wing-base than its own width (but never as close as in the *atripenis* mimicry-group).

A single male from Brazil: Bahia (MNHNPS) has mainly amber wings, narrowly infuscate basally and broadly, but not strongly, from beyond the mid-point to the apex, the junction diffuse. It thus has the same colour as *P. schlinkei*, found in the same area, and as such is the only specimen of *P. completa* seen which does not belong to the mimicry-group; two other males from the same locality possess the normal colour pattern.

In many larger females, the lower PFC are coarser than usual and strongly curved, forming part-circles centred on the propodeal valve. In the absence of intermediate specimens, this phenomenon can give a deceptive impression of constituting a specific character.

Distinctions.— The S.4 hairs of the male resemble only those of *P. montezuma* in being exclusively lateral; the wing colour and allopatry distinguish these two species. Since the female of *P. completa* always has yellow (or off-white) banded wings, the keys to the mimicry-group bearing its name will separate it from species of similar appearance (but see also *P. viridis* Distinctions).

Biology.— The name of this species, with its virtually unvarying wing-pattern, has been chosen as that of a mimicry-group.

Distribution.— Found in the extreme Lower Amazon; as it extends southwards, it also expands westwards to include much of Bolivia and the whole of northern Argentina; records from Guyana: Bartica district, Kalacoon (1 ♂, AMNH) and Argentina, San Juan (5 ♂♂, 3 ♀♀, MACN) need confirmation; ascending to about 1,500 m in the Mato Grosso, Brazil and Salta, Argentina. Map fig. 665.

Material depositories.— 366 ♂♂, 201 ♀♀; AEIG, AMNH, ANSP, BMNH, BONELLI, BRIO, CAS, CMNH, COOPER, CUNY, EMMSU, ETHZ, FDA, FRITZ, IMLT, LACM, MACN, MCZ, MHNGV, MHNLM, MHNNEU, MLP, MLU, MNHNPG, MNHNPS, MNRJ, MNS, MPEG, MZUSP, NHMBAS, NRS, OSUC, RMNH, RSM, SMF, UBRAS, UCALB, UFPCUR, UFVIC, UMBREM, UMOX, USNM, USPRIB, USU, UZMC, WAHIS, WASBAUER, ZSM.

Pepsis smaragdina Dahlbom, 1843
(figs 410-416, 582, 666)

- Pepsis smaragdina* Dahlbom, 1843: 120, no. 3. Lectotype ♂ (MZEL), here designated [examined].
- Pepsis thunbergi* Dahlbom, 1843: 121, no. 9. Lectotype ♂ (MZEL), here designated [examined]. **Syn. nov.**
- Pepsis lara* Mocsáry, 1888: 162, no. 4. Lectotype ♀ (MNHU), here designated [examined]. **Syn. nov.**
[*Pepsis viridisetosa* Spinola; Lucas, 1895: 504. Misidentification].
- Pepsis infuscata* Lucas, 1895: 504. [MS name cited in synonymy].
- Pepsis satrapes* Lucas, 1895: 506, no. 15, ♂, Brazil (lost). **Syn. nov.**
[*Pepsis mutabilis* Lepeletier; Lucas, 1895: 663. Misidentification].
- Pepsis nupta* Lucas, 1895: 666, no. 92. Lectotype ♂ (NMV), here designated [examined]. **Syn. nov.**
- Pepsis erynnis* Lucas, 1895: 669, no. 94. Lectotype ♀ (TMB), here designated [examined]. **Syn. nov.**
- Pepsis fraterna* Lucas, 1895: 676, no. 101. Lectotype ♂ (MNHU), here designated [examined]. **Syn. nov.**
- Pepsis diabolus* Lucas, 1895: 679, no. 104. Lectotype ♀ (NMV), here designated [examined]. **Syn. nov.**
- Pepsis mystica* Lucas, 1895: 682, no. 106. Lectotype ♀ (MNHU), here designated [examined]. **Syn. nov.**
- Pepsis salamandra* Lucas, 1895: 773. [MS name cited in synonymy of *lara*].
- Pepsis thalia* Brèthes, 1908: 233. Lectotype ♂ (MACN), here designated [examined]. **Syn. nov.**
- Pepsis brasiliensis* Brèthes, 1908: 237. Holotype ♀ [not male as stated in original description] (MACN) [examined]. **Syn. nov.**
- Pepsis pallida* Brèthes, 1908: 238. Holotype ♀ (MLP) [examined]. **Syn. nov.**
- Pepsis iheringi* Brèthes, 1908: 238. Holotype ♀ (MZUSP) [examined]. **Syn. nov.**
- Pepsis dromeda* Brèthes, 1908: 238. Lectotype ♀ (MACN), here designated [examined]. **Syn. nov.**
- Pepsis sepultrix* Lucas, 1919: 86. ♀. [Brazil]: São Paulo. (Lost). **Syn. nov.**
- Pepsis strickeri* Lucas, 1919: 87. ♀. [Brazil]: São Paulo. (Lost). **Syn. nov.**

Type material.— *P. smaragdina*: Dahlbom described both sexes; in the ♀ description he ascribes the name *P. smaragdina* to Klug in MNHU, then gives the ♂ description in smaller print. It is not clear whether he saw a Klug ♀ with an MS name. Certainly the ♀ in MZEL does not correspond with Dahlbom's description (which may have been written by Klug). Although a ♂ bearing an old label "*atripennis* Fabr., *smaragdina* Kl." accords with Dahlbom's later action (1845: 464) of [wrongly] synonymizing *P. smaragdina*, this specimen also disagrees with the description of its sex. The ♂ which I have seen and labelled lectotype bears the label "*P. smaragdina* Kl., mus. Berol., Brasil., Drewsen 1844." The fact that "Mus. Berol." appears on the label may be only an indication that a Klug MS type was in MNHU. I do not believe it is necessarily evidence that the specimen so labelled was a gift from Klug, nor even that Dahlbom saw the Klug specimen. *P. thunbergi*: I have seen a single type-material ♂ and labelled it lectotype. It agrees well with the unusually detailed description except that it is larger than the measurement given. The specimen bears the data: "*P. thunbergi* H. E. 122, Brasilia". This is a feasible locality for the species, but neither of those given in the description are (Cape of Good Hope for the ♂; Valparaiso for the ♀). In his later work Dahlbom (1845: 463) mentions only the ♂, giving the locality Brazil, apparently having realized the earlier error in labelling. *P. lara*: I have seen a single type-material ♀ and labelled it lectotype. *P. nupta*: I have seen 2 syntypes: a ♂ in NMV without locality which I have labelled lectotype, and a ♀ in TMB. The ♂ lacks the sternal hairs, SGP and genitalia. The ♀ paralectotype is conspecific. *P. erynnis* I have seen a single type-material ♀ and labelled it lectotype. *P. fraterna*: I have seen a single type-material ♂ and labelled it lectotype. The specimen lacks the genitalia. *P. diabolus*: I have seen a single type-material ♀ and labelled it lectotype. *P. mystica*: I have seen only a single ♀ syntype and labelled it

lectotype. *P. thalia*: I have seen only one of the ♂ syntypes and labelled it lectotype. Another ♂ (from Espirito Santo, Brazil) standing under this name in MACN, but without type-status, is a specimen of *P. brunneicornis* Lucas. 6 ♀♀ standing under this name in MZUSP have no type-status (3 belong to *P. chrysoptera*, 1 to *P. amyntas*, 1 to *P. viridis*, and 1 to *P. auriguttata*). *P. dromeda*. I have seen 8 ♀♀ from various localities in MACN, MZUSP and MNHU all purporting to be type-material. In fact only one in MACN, which I have labelled as lectotype, and one in MNHU, a paralectotype, have type status; but all 8 are conspecific.

Description.— ♂ (figs 410-416). BL 15-22. Body and legs bright metallic green, tending to blue on the thorax and yellow-green on the gaster. Antenna black, with 0-10 apical segments orange or yellow, occasionally segments 4-11 dull brown. Forewing usually with apical 1/3 infusate, hindwing 1/4. Rest of wings clear to orange-amber, the junctions between the two colours sharp or diffuse. S.4 hairs forming a rather compact lateral brush, those of opposite sides together forming an arc; between them, scattered across the disc of the sternite, is a very variable number of hairs (occasionally none at all), but usually rather sparse and mostly about half the length (3/4 the height) of the brush-hairs, strongly curved basally, and directed inwards or backwards according to their position; the whole forming an approximate 1/4 sphere. S.5 with a few short, rather sparse hairs laterally. SGP more-or-less strongly expanded apicad, often slightly emarginate centrally. Paramere about 1.5 times as long as rest of genitalia. Apex of digitus with a slender inner projection directed distad.

♀ (fig. 582). BL (15-)18-29. AE index 75-107. Colour as in male but body generally darker, and antenna with 0-11 segments orange or yellow; wing colour variable (see Variation). MT moderate to strong, usually quite sharp. Forewing with 1r-m often strongly rounded and 2r-m strongly bulging postero-distally. MPN furrow of variable width, more or less expanded apicad; carinae fine to very fine. Propodeum: MG sometimes weakly indicated anteriorly, otherwise replaced by a broad, shallow ridge; APT, PPT & PTC very weak to moderate (the last sometimes absent; all more-or-less size-related); DTC moderate to fine, often stronger in posterior half. Propodeal hair almost as long as PST. Posterior face: VR at most indicated weakly near PTC; PFC usually interrupted in mid-line, often broadly (where the surface is usually matt), occasionally a few complete near PTC; gradually becoming weaker posterad, surface near apex more-or-less shining. Lateral extension of S.2 groove well-developed. Hind tibia: teeth sometimes rather small for the size of insect, subtending spines 1.5-2.5 times as high; inner spur reaching to about 0.3-0.4 basitarsus length (about equal to segment 3), and about 1.2-1.3 times as long as outer spur.

Variation.— ♂. Occasionally the wings are entirely infusate (*P. nupta*), when the hind wing can be paler than the fore. Males from Bahia often have the clear area of the wings tinted orange. The SGP varies in the degree of expansion apicad; when strongly expanded it usually also has a central notch in the apical margin. However, in those specimens in which the SGP is scarcely expanded, the intervening hairs between the S.4 brushes are often few or missing. These extremes of variation can easily give a false impression of specific differences.

♀. This sex displays interesting variation in wing colour; the majority of individuals have the wings moderately infusate, often with the hind wing slightly paler; at the other extreme, especially towards the northern limit of the species' range in Bahia, the

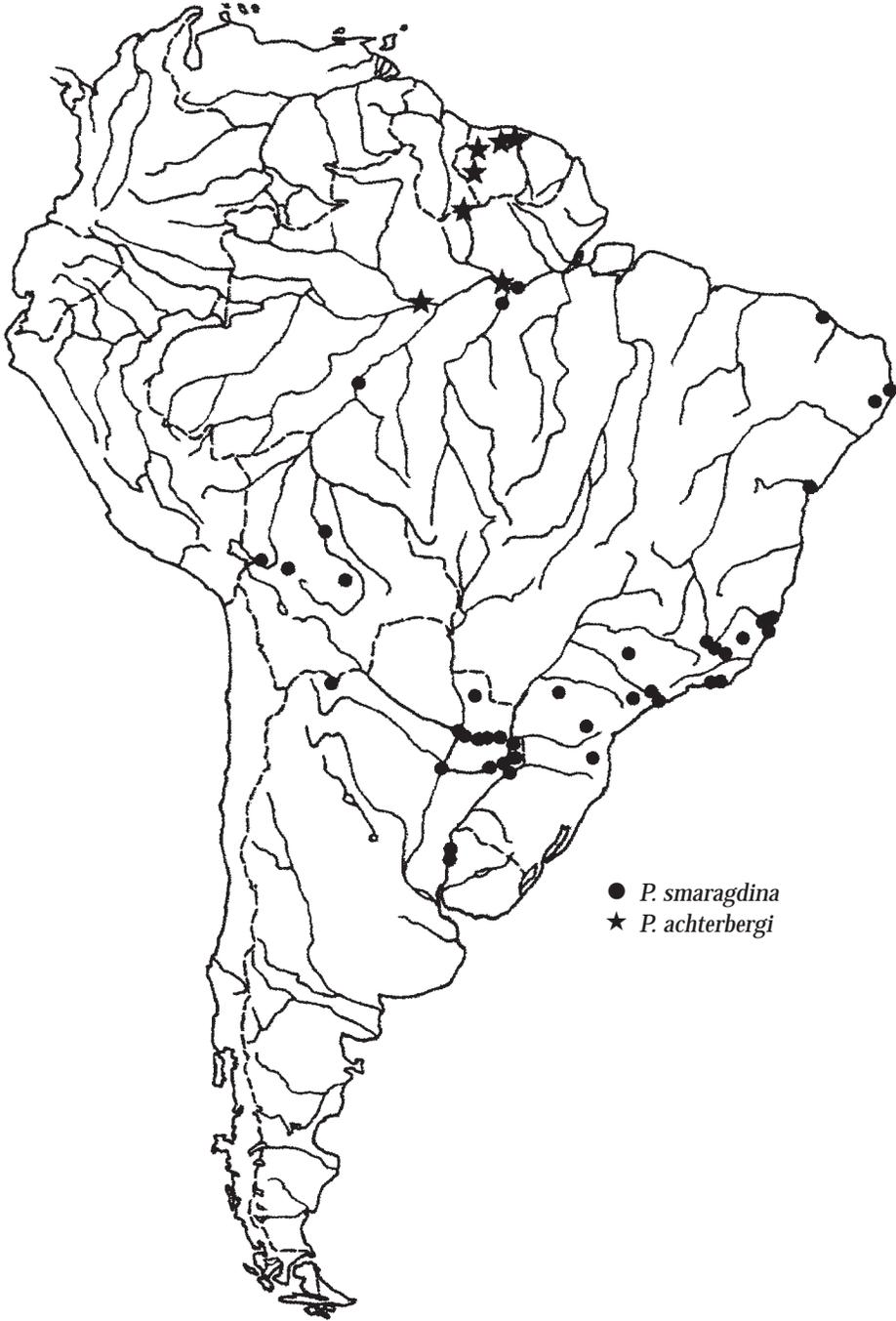


Fig. 666. Collection localities of *Pepsis smaragdina* and *P. achterbergi*.

wings are orange-amber with dark apical borders (sometimes more extensively dark on the hindwing). A few more-or-less transitional forms between these latter and the commonest form have been seen.

In both sexes, the antennal colour varies similarly: in most areas of the species' range, the number of coloured apical segments is variable but on or near the Amazon (Santarém; Rio Tapajos) the colour is pale yellow (occasionally bright orange) and extends almost to the base of AS3; whereas in specimens from Argentina: Entre Rios and Misiones the antenna lacks all trace of pale colour.

Biology.— Specimens of both sexes often belong to the *discolor* mimicry-group in Paraguay and southeastern Brazil.

A female from Brazil: Itatiaya, 700 m, 9.xii.26 (MLU) (as *P. festiva*) has associated with it a spider belonging to the genus *Idiops* (Idispidae - formerly Ctenizidae) (det. Andrew Smith). Although this family is within the Mygalomorpha, it is distant from Theraphosidae; it is unusual in that, while belonging to the taxonomic group of trap-door spiders, its burrow does not have a trap-door.

Distinctions.— One of the few small species in its distributional area, the SGP and sternal hair formation serve to distinguish most males; males with more than usually abundant hairs between the lateral brushes of S.4 resemble males of *P. flavescens* (which see); those without any such intermediate hairs are distinguished from those of *P. completa* by the totally different wing colour (black with a broad, yellow band in the latter). The female may be confused with small specimens of *P. flavescens*, which see for differences; this sex also resembles that of *P. discolor* (see *P. discolor* Distinctions).

Distribution.— A mainly southeastern species; found sparsely from the Lower Amazon to Bolivia, southwards only to Argentina: Salta, but to Entre Rios in the east, always at low altitudes; a record from "Venezuela" (1 ♀, MNHNPS) probably represents a labelling error. Map fig. 666.

Material depositories.— 171 ♂♂, 229 ♀♀; AEIG, AMNH, BMNH, BRIO, CMNH, CUNY, EMMSU, ETHZ, FRITZ, IMLT, MACN, MCZ, MHNGV, MHNNEU, MIZSU, MLP, MLU, MNCN, MNHNPS, MNHU, MNRI, MZEL, MZUSP, NMV, NMW, NRS, OSUC, RMNH, SMF, TMB, UCALB, UCALD, UFPCUR, UFFVIC, UMOX, USNM, US-PRIB, UZMC, WAHIS, WASBAUER, ZMMOSC, ZSM.

Pepsis achterbergi spec. nov.

(figs 453-458, 598, 666)

Type material.— Holotype ♂, [Brazil] Pará, Obidos (BMNH). Paratypes: [Brazil] 1 female, Amazon, Obidos [no further data]; 1 ♀, same locality but 1904 (Lecoite) (TMB, BMNH); 1 ♀, Pará, Obidos, iii.1976 (Kesselring) (WILLIAMS); Amazonas, Manaus, Ypiranga, Rio Negro 14 k from Manaus, 81 m, 1 ♀, xi-xii.1941 (Rabaut) (AMNH); Guyana: 1 ♀, Amazon-Courantyne divide, Head of Oronoque River, 1937 (Beddington) (BMNH); Suriname: 1 male, Carolinakr[eeek], 10.i.1965 (Broekhuizen); 3 ♂♂, Coppename Riv., Raleigh Falls, 13-15.vii.1963, Malaise trap 2 (Vecht); 2 ♀♀, same data but only one in Malaise trap, 16.vii.1963; 2 ♂♂, same data but only one in Malaise trap, 12.vii.1963; 2 ♂♂, same data, 16.vii.1963; 1 ♀, same data but 27.iii.1972, not Malaise trap (Mees); 1 ♀, same data but 16.vii.1963 (Geijskes); 1 ♀, Coppename River road, Raleigh Falls-Voltz Mt., km.4.6, 13.vii.1963 (van der Vecht); 1 ♀, Upper Corantijn River, Coeroeni, 19.vi.1963 (Wessels Boer); 1 ♂, Phedra, 8-16.xi.1964 (Geijskes); 1 ♂, same data but 14-20.xii.1964 1 ♂, 1 ♀, Phedra, 20.xii.1964 (Broekhuizen); 4 ♂♂, Exp. Wilh[elmina] Mts., three 16, one 17.vii.1963, open granite-rock, on *Hyptis atrorubens* Poir. 9 km from Luciekamp (Wessels Boer); 1 ♀, same data, 17.vii.1963; 4 ♂♂, Zanderij, 21-25.vii.1963, Malaise trap (van der Vecht); 3 ♀♀,

same data but 16.vi.1963, two 26.vii.1963, not Malaise trap (van der Vecht); 1 ♀, Exp. Wilhelminageb[iet], Kamp 2, km. 10 (Ligorie); 1 ♀, Environs of Voltz Mt., 15.vii.1963 (van der Vecht); (all RMNH, BMNH); 1 ♀, Raleigh, Vallen-Voltzberg Res., Voltzberg Camp, 90 m, 29.i-30.ii.1982 (Carpenter & Trail) (CARPENTER); 1 ♀ [no further data] (MNHNPS); 1 ♀ [no further locality], 1899 (Fruhstorfer) (NMV); 1 ♀ [no further locality], (Fruhstorfer) (TMB).

Etymology.— This species is named after Prof. Dr Ing. C. van Achterberg.

Description.— ♂ (figs 453-458). BL 13-20. Body and legs black with deep bright green metallic sheen; much of body, especially sides, covered with short, silvery hair. Antenna black with 0-2.5 apical segments ivory-white. Wings clear to yellowish-amber with apical 1/4-1/3 moderately infusate, the junction sharp to rather diffuse. S.3 sometimes with a small, lateral patch of hairs (a little longer, stronger and sparser than the essentially unmodified ones found on S.5 in many smaller species). S.4 with an arcuate patch of hairs, the outer ones long, forming a very loose brush, incurved and forming an arc with those of opposite side; between the brushes are a few shorter, sparser, straighter hairs. S.5 occasionally with a few of the usual lateral tuft of hairs long and strong. SGP weakly and evenly expanded (occasionally obscured by a slight expansion medially) towards the apex, which is truncate with rounded corners, has a very narrowly translucent margin, and a fringe of short hairs (about half minimum SGP width). Basal half of SGP with a very weak median keel. Paramere slightly longer than rest of genitalia, rather narrow, apically rounded; apical hairs shorter than maximum paramere width. Inner projection of digitus apex very slender, strongly turned distad.

♀ (fig. 598). BL 15-25. AE index 93-109. Body and legs black with deep blue-green metallic sheen. Antenna black, sometimes slightly brownish towards apex. Wings very narrowly infusate basally, mainly orange-amber becoming paler apicad; just before the apex becoming almost clear and shading immediately into a narrow, slightly infusate apical band. Head in dorsal view with temple slightly swollen. Antenna rather thick, AS3 appearing short. MT moderate to strong. Forewing with SMC3 rather long, somewhat bulging posterodistally. MPN slightly shorter than PST, its furrow rather narrow, sometimes attenuate just before reaching anterior margin, more-or-less strongly expanded apicad; carinae fine, a few slightly stronger. Propodeum: MG at most indicated weakly anteriorly, mostly replaced by a rather broad, flattened ridge. APT and PPT weak to moderate, PTC weak (sometimes double), usually narrow. DTC fairly strong, often more distant in apical 1/3. Propodeal hair a little shorter than MPN. Posterior face: VR weak to fairly strong, more-or-less divergent from PTC, present in upper half; PFC quite strong, covering whole face, slightly weaker in middle. Lateral extension of S.2 groove well-developed. Hind tibia: teeth rather small, subtended by spines 2.0-2.5 times as high, with a sparse row of backwardly-directed bristles on the inner side. Inner spur reaching to about 0.25 basitarsus length (about as long as tarsal segment 3 or slightly longer) and 1.2-1.5 times as long as outer spur.

Variation.— Only as given above.

Distinctions.— The S.4 hairs distinguish the male from those of all other species except *P. smaragdina*, but the two are parapatric, and in *P. smaragdina* the SGP is more strongly expanded apicad and often has the apex slightly emarginate. The female is very similar to the colour form of *P. smaragdina* from eastern Brazil (Bahia) but in that species the apical wing-band is broader and darker, and the antenna often stouter.

Distribution.— A low-altitude species, known only from Guyana, Suriname and the Lower Amazon (Obidos and Manaos). Map fig. 666.

Material depositories.— 20 ♂♂, 23 ♀♀; AMNH, BMNH, MNHNPS, MZUSP, NMV, RMNH, TMB, WILLIAMS.

Pepsis discolor Taschenberg, 1869
(figs 16, 245-250, 581, 667, 668)

- Pepsis discolor* Taschenberg, 1869: 28, no. 3. Lectotype ♂ (MLU), here designated [examined].
Pepsis diversipennis Mocsáry, 1885: 261, no. 38. Lectotype ♀ (MHNNEU), here designated [examined].
 [Synonymized by Lucas, 1895: 707].
Pepsis sinnis Lucas, 1895: 808, no. 183. Lectotype ♂ (MNHU), here designated [examined]. **Syn. nov.**
Pepsis jujuyensis Brèthes, 1908: 234. Lectotype ♂ (MACN), here designated [examined]. **Syn. nov.**
Pepsis modesta Brèthes, 1908: 237. Holotype ♂ (MACN) [examined]. **Syn. nov.**
Pepsis comparata Brèthes, 1908: 239. Lectotype ♂ (MACN), here designated [examined]. **Syn. nov.**
Pepsis neutra Brèthes, 1908: 243, male, Tucumán (lost). **Syn. nov.**
Pepsis terebrans Brèthes, 1908: 243. Lectotype ♂ (MACN), here designated [examined]. **Syn. nov.**
Pepsis procera Haupt, 1952: 342, no. 4. Holotype ♀ (MLU) [examined]. **Syn. nov.**
Pepsis plaumanni Haupt, 1952: 368, no. 17. Lectotype ♂ (MLU), here designated [examined]. **Syn. nov.**
Pepsis ogloblini Haupt, 1952: 369, no. 18. Lectotype ♂ (MLU), here designated [examined]. **Syn. nov.**
Pepsis deletrix Haupt, 1952: 369, no. 19. Holotype ♂ (MLU) [examined]. **Syn. nov.**

Type material.— *P. discolor*: I have seen the ♂ and both ♀ syntypes. The ♂ and one of the ♀♀ bear the locality “Congonh.” [= Congonhas, now São Paulo airport]. I have labelled the ♂ as lectotype; both ♀♀ are paralectotypes and all three specimens are conspecific. *P. diversipennis*: I have seen a single type-material ♀ and labelled it lectotype. *P. sinnis*: I have seen a single type material ♂ and labelled it lectotype. *P. jujuyensis*: I have seen 2 syntype ♂♂ and labelled as lectotype the slightly larger specimen. The paralectotype is conspecific. *P. comparata*: I have seen 2 ♂ syntypes and labelled the smaller specimen as lectotype. The paralectotype is conspecific. *P. neutra*: This name is here interpreted on the basis of a specimen in MACN labelled Tucumán and bearing Brèthes identification label, but collected after the description was published. Interestingly, the specimen agrees perfectly with the description. A further ♂ standing under the name in MACN but without locality, is conspecific but likewise without type-status. *P. terebrans*: I have seen a single type-material ♂ and labelled it lectotype. *P. plaumanni*: I have seen two syntypes, one of each sex, and labelled the ♂ as lectotype. The ♀ paralectotype is a specimen of *P. inclyta* Lep. *P. ogloblini*: I have seen all 3 ♂ and 10 ♀♀ syntypes, and labelled a ♂ as lectotype. All the other specimens are paralectotypes; both of the other ♂♂ and 8 of the ♀♀ are conspecific; the remaining 2 ♀♀ are specimens of *P. flavescens* Lucas.

Description.— ♂ (figs 245-250). BL 17-28. Body and legs black with dark blue-green metallic sheen. Antenna black. Wings orange-amber with narrowly infuscate basal and apical bands, the base more strongly. Frequently, especially in the north-west of Argentina, the wings are entirely black with a few small, obscure orange marks in mid fore-wing; intermediates between the two forms are rare. All sternites have some rather long and sparse hair below; S.4 has unusual modified hairs in that they are evenly distributed over the surface (i.e. not at all clustered laterally), forming a roughly oval patch. The more lateral hairs are slightly curved inwards, those to-

wards the centre shorter and straighter; the hairs in the central-posterior part are shorter and straighter still. The SGP is quite strongly expanded apicad, then slightly contracted pre-apically to form a rounded-truncate apex which is occasionally slightly emarginate centrally. Paramere about 1.5 times as long as rest of genitalia. Apical projection of digitus rounded-angulate.

♀ (figs 16, 581). BL 22-37. AE index 81-94. Body and legs black with blue-green or violet metallic sheen. Antenna black, segments often with obscure brown, apical rings. Wings orange-amber, infuscation on the forewing extending for about a thorax-width (measured between the tegulae) from the base, strong but poorly-defined; very little basal infuscation on the hindwing. Both wings with narrow, weak and poorly-defined dark apical bands, on the forewing taking up about half the width beyond the cells, almost touching about the anterior half of the apical abscissa of the radial vein (separated by 2-3 vein-widths), usually not darker near the costa. Hind-wing often much paler than fore; occasionally the wings are entirely dark. Head rather strongly swollen. MT weak to strong. Radius-costa junction forming a more-or-less shallow angle. Stigmal fenestra rather narrow, often very indistinct. PPV usually rather short and transverse. 1r-m quite strongly curved anteriorly, or shallowly overall; 2r-m either strongly curved in posterior half (thus SMC3 bulging postero-distally), or entirely strongly curved, or (uncommonly) angulate. MPN equal to or slightly shorter than PST, its furrow narrow, more-or-less strongly expanded apicad or apically, carinae very fine, sometimes a few stronger than the rest, matt. Propodeum: dorsal face longer than posterior. MG sometimes weakly indicated within a broad, median ridge. APT & PPT moderate to strong. PTC moderate to strong, most often narrow (sometimes very weak or absent, or weakly emarginate centrally). DTC rather fine but regular (occasionally coarser posterad; sometimes obsolescent, when PFC weaker in proportion), scarcely obscured by hair, which is equal to or slightly shorter than PST length. Posterior face: VR usually weak, present only in upper half at most. PFC fairly strong at top and sides (sometimes the uppermost more-or-less connecting the PPT and as strong as the PTC); weaker but still clear below, where they are shining and form shallow arcs concentric around the petiole socket; the central area is finely sculptured and matt. Lateral extension of S.2 groove well-developed. Anterior and mid femora with some rather short and sparse hair below (soon abraded). Hind tibia: teeth variable, usually quite strong, occasionally smaller and somewhat distant; spines 2.0-2.5 times their height; inner spur long, reaching to 0.3-0.45 basitarsus length (at least as long as tarsal segment 3, sometimes as long as 2) and 1.25-1.3 times outer spur length.

Variation.— In a male from Manaus (INPA) the entire forewing is fairly strongly infusate, the hind wing almost as much (the strong basal infuscation is still visible in the forewing however). A male from Argentina: Corrientes, Mercedes (MACN) has, in addition to the usual modified hairs on S.4, a sparse line of shorter ones on S.5. A male from Argentina: Salta, Orán, Ruta Nac. 57, km 33, “Angosta del Pescado” (IMLT) (with entirely infusate wings) has the hair on S.1-3 denser than usual and (in this respect only) thus somewhat resembles a male of *P. limbata*. A female from Brazil: Obidos (TMB) has more hair below the femora than usual (but comes from outside of the range of *P. flavescens*, with which it might otherwise be confused). A male from Brazil: Santa Catha-

rina, Nova Teutonia (ZSM) has the S.4 hairs a little shorter and sparser than usual, all slightly curved apicad; S.3 also has a few similar but less uniform hairs; the apical projection of the digitus is notched in unique fashion. I do not believe the noted differences constitute specific characters, but are merely indicative of a malformed specimen; in all other respects it is a normal *P. discolor*; furthermore, the locality is very well-collected and exhibits very low endemicity.

The dark-winged form of *P. discolor* in western Argentina sometimes has a small, clear sub-apical patch in the hindwing, somewhat resembling *P. seladonica*, but in that species the clear area always touches the wing apex, is usually larger, and the structural characters of the species differ.

Distinctions.— Dark-winged males are very similar to those of *P. seifferti*, which see for distinctions. Female *P. discolor* are very variable in size, structure and colour; they are generally best characterized by the long hind tibial inner spur; also by the forewing infuscation pattern and the SMC3 shape, but especially the last two characters are subject to much variation, leading to confusion with other species. Smaller females strongly resemble the form of *P. viridis*, which has black antenna and mainly amber wings; a table to separate them is given under that species.

See last paragraph of Variation above for resemblances to *P. seladonica*.

Certain small females of *P. discolor* resemble usual-sized females of *P. smaragdina*; in both species the hindwing colour is less dark than in the forewing, but whereas in *P. smaragdina* the actual colour is the same, in *P. discolor* there is a yellow-amber tint, giving additional contrast; also, female *P. smaragdina* usually have a few apical antennal segments orange, whereas all segments are black in *P. discolor* (although they may have obscure brown, apical rings).

Although the difference in propodeal hair length usually readily separates females of *P. discolor* and *P. flavescens*, the character does vary occasionally; *P. discolor* also resembles *P. viridis*, although in different ways. The following tables will help to distinguish them (note that the characters used in the two tables are often different):

Table to distinguish between females of *Pepsis flavescens* and *P. discolor*:

<i>P. flavescens</i>	<i>P. discolor</i>
AS3 shorter, AE index 70-82.	AS3 longer, AE index 81-94.
Fore and hind wing colours scarcely contrasting, if at all.	Fore wing frequently much darker than hind wing.
SMC3 evenly rounded apically, rather long posteriorly.	SMC3 more-or-less angulate about middle of distal vein, shorter posteriorly.
MPN furrow rather broad, parallel-sided; occasionally slightly expanded posteriorly.	Narrow; sometimes expanded posterad or posteriorly.
Propodeal profile rounded, PTC weak or absent.	Profile angulate, PTC variable - low and broad, or high and narrow.
Propodeum in dorsal view, gradually tapered.	Rather transverse.
DTC rather coarse, scarcely obscured by pilosity.	DTC rather fine, partly obscured by pilosity.
Propodeal hair equal to or slightly longer than PST.	Shorter than PST.
Inner spur of hind tibia reaching to about 0.3 basitarsus length.	Inner spur reaching to 0.3-0.4 basitarsus length.

Table for distinguishing between *P. flavescens*, *P. discolor* and *P. viridis* females where sympatric.

<i>P. flavescens</i>	<i>P. discolor</i>	<i>P. viridis</i>
BL 19-32.	22-37.	23-29.
AE index 70-82.	81-94.	76-108.
Temple moderately swollen.	As <i>P. flavescens</i> .	Scarcely swollen.
Hairs on temple equal to or slightly shorter than OOD.	As <i>P. flavescens</i> .	Equal or slightly longer.
MPN equal to or slightly shorter than PST.	As <i>P. flavescens</i> .	Equal or slightly shorter.
MPN furrow rather broad, parallel-sided; occasionally slightly expanded posteriorly.	Narrow; sometimes expanded posterad or posteriorly.	Narrow, slightly (occasionally markedly) wider posterad.
MPN carinae very fine, matt.	Fine to very fine, matt.	Medium to very fine, matt.
Propodeal hair equal to or slightly longer than PST.	Shorter.	Equal or slightly shorter.
Overall profile of propodeal dorsum convex, rounded.	Flat, angulate slightly behind.	Flat or slightly convex.
PTC weak or absent.	Variable: low and broad or high and narrow.	Angulate or slightly rounded; quite strong.
Outline of propodeum in dorsal view gradually tapered.	Transverse.	Broad, transverse.
DTC moderately coarse and regular, slightly shining; scarcely obscured by pilosity, often distinctly punctate between.	Moderately fine to fine, regular, slightly shining, partly obscured by pilosity, sometimes punctate between.	Rather coarse, fairly regular, matt; partly obscured by pilosity, without punctures between.
Carinae of propodeal posterior face regular, gradually finer distad, often obsolescent medially.	Finer on average than DTC, usually obsolescent medially.	Often weaker than DTC, often obsolescent medially.
Apical band of forewing fairly broad but junction very diffuse; anteriorly a little darker, stopping just short of radial cell.	Broad, junction diffuse (often entire forewing infuscate).	Wings entirely black.
SMC3 evenly rounded apically (slightly longer posteriorly).	Usually more-or-less angulate at or just behind middle of distal vein.	Rounded posterodistally, sometimes weakly angulate.
Hind tibial spines 2-3 times height of teeth.	2.0-2.5.	2.0-2.5.
Hind tibial inner spur reaching to about 0.3 metatarsus length.	0.3-0.4.	0.25-0.3.

Biology.— The name of this species has been chosen to represent a mimicry-group. Both sexes participate in the group in south-eastern South America. The degree to which individuals pertained to the mimicry-group was not recorded for all specimens; accordingly one map is given for all records of the species, and another for the mimicry-group records alone. Although the last is therefore incomplete, the general trends are clear. Map fig. 668.

Distribution.— A widespread southern species; it is extremely rare on the Amazon, gradually becoming more frequent southwards to southeastern Brazil and northern Argentina, where it is very common. It extends southwards only as far as mid Buenos Aires and Mendoza provinces, but ascends to 2,660 m in northwestern Argentina. Map fig. 667.

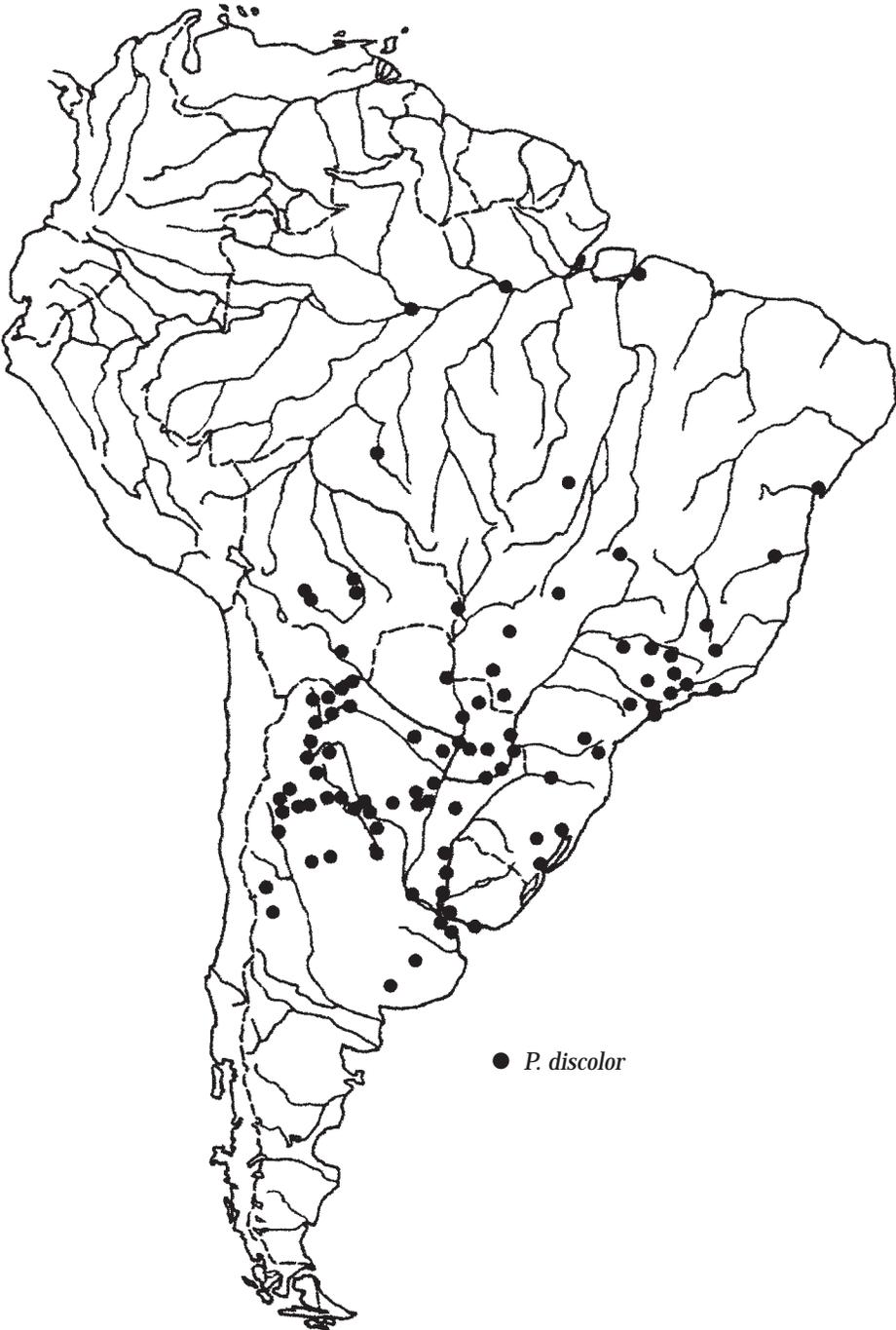


Fig. 667. Collection localities of *Pepsis discolor*.

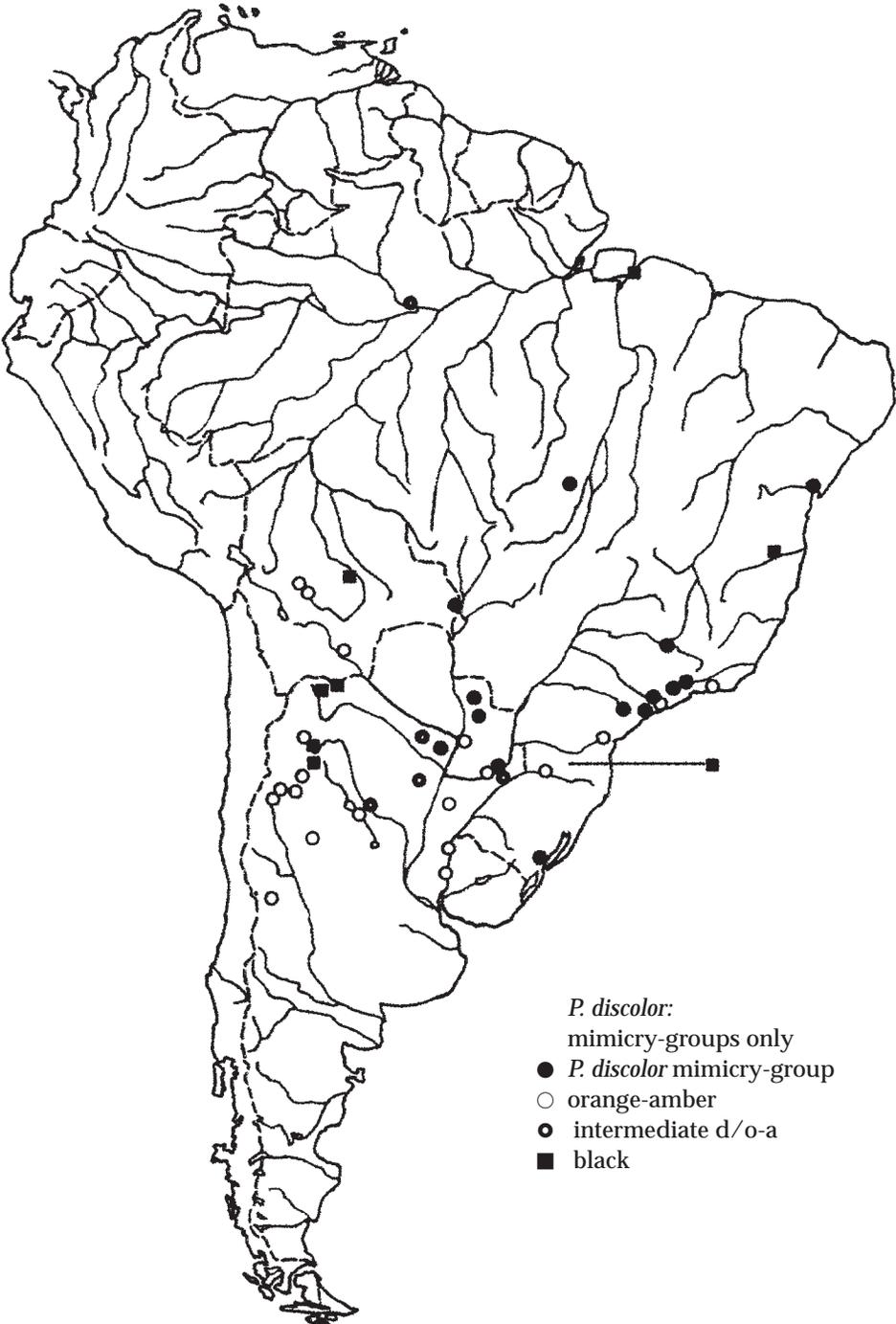


Fig. 668. Collection localities of *Pepsis discolor* (mimicry-groups).

Material depositories.— 952 ♂♂, 799 ♀♀; AEIG, AMNH, BMNH, BONELLI, CAS, CMNH, COOPER, CUNY, EMMSU, ETHZ, FDA, FRITZ, IMLT, INPA, MACN, MCZ, MHNGV, MHNNEU, MLP, MLU, MNCN, MNHNPS, MNHU, MNRJ, MNS, MZFIR, MZLAU, MZUSP, NMV, NRS, OLLD, OSUC, RMNH, SEMKU, SMF, SMTD, TMB, UBRAS, UCALB, UCALD, UFPCUR, UMBREM, UMOX, USNM, USPRIB, UZMC, WAHIS, WASBAUER, ZMMOSC, ZSM.

Pepsis limbata Guérin, 1831
(figs 447-452, 591, 669)

Pepsis limbata Guérin, 1831: 255, (♂, ♀). Lectotype ♂ (MCSNGO), here designated [examined].

Pepsis limbata Guérin, 1838: 260, pl. 471, f. 2. (♀ only). [Each of Guérin's two descriptions refers to the other.]

Pepsis fulvipennis LeGuillou, 1842: 319. Lectotype ♀ (MNHNPS), here designated [examined]. [Synonymized by Brèthes, 1914: 341].

[*Pepsis thoreyi* Dahlbom; Mocsáry, 1887: 18. Misidentification].

[*Pepsis aciculata* Taschenberg; Lucas, 1895: 801. Misidentification].

Pepsis intermedia Schrottky, 1902: 314, no. 8, ♂, Buenos Aires (lost). [Synonymized by Brèthes, 1914: 341].

Pepsis richteri Brèthes, 1908: 242. Holotype ♀ (MACN) [examined]. **Syn. nov.**

Pepsis polita Brèthes, 1908: 243. Lectotype ♂ (MACN), here designated [examined]. **Syn. nov.**

Pepsis limbella Haupt, 1952: 370, no. 20. Lectotype ♂ (MLU), here designated [examined]. **Syn. nov.**

Pepsis artemis Haupt, 1952: 370, no. 21. Holotype ♀ (MLU) [examined]. **Syn. nov.**

Type material.— *P. limbata*: I have seen a ♂ and 2 ♀ syntypes in MCSNGO. I have labelled the ♂ as lectotype; although it is in poor condition, it is still recognizable. A further ♀ syntype is in MNHNPS. All 3 ♀♀ are paralectotypes and conspecific with the ♂. *P. fulvipennis*: I have seen a single type-material ♀ and labelled it lectotype. *P. polita*: I have seen a single type-material ♂ from Catamarca, which I have labelled as lectotype. This specimen alone is mentioned later by Brèthes (1914: 350); however, both of his descriptions give size variation. *P. limbella*: I have seen the ♂ and both ♀ syntypes, and labelled the ♂ as lectotype. Haupt's mention of a ♀ holotype is ambiguous because it is not clear which of the two specimens was intended. Both ♀ paralectotypes are specimens of *P. thoreyi* Dahlbom.

Description.— ♂ (figs 447-452). BL 18-28. Body and legs black with dark blue-violet metallic sheen. Antenna black, often with a tiny, pale apical spot on the last segment. Wings orange-amber with a scarcely infuscate base and moderately broad apical band filling most of the space beyond the cells but touching only the radial (occasionally entering it slightly). Head, thorax and anterior half of tergite 1 with much dense, black hair. Sternite 2 after the transverse groove with variably dense and coarse, evenly distributed hair; S.3 with similar hair but more-or-less in a semicircle with the laterals a little longer and slightly incurved apically; S.4 with a virtually complete semicircle of hairs, the laterals dense, coarse and strongly incurved, meeting those of the opposite side or almost so, then gradually shorter, weaker and straighter towards the centre, where they are sparse. SGP more-or-less strongly expanded apicad; where strongly, often weakly emarginate centrally; with an apical hair-fringe rather shorter than maximum width of SGP. Paramere about half as long again as rest of genitalia and with apical fringe of rather long hair, digitus with the apical projection very slender and up-turned.

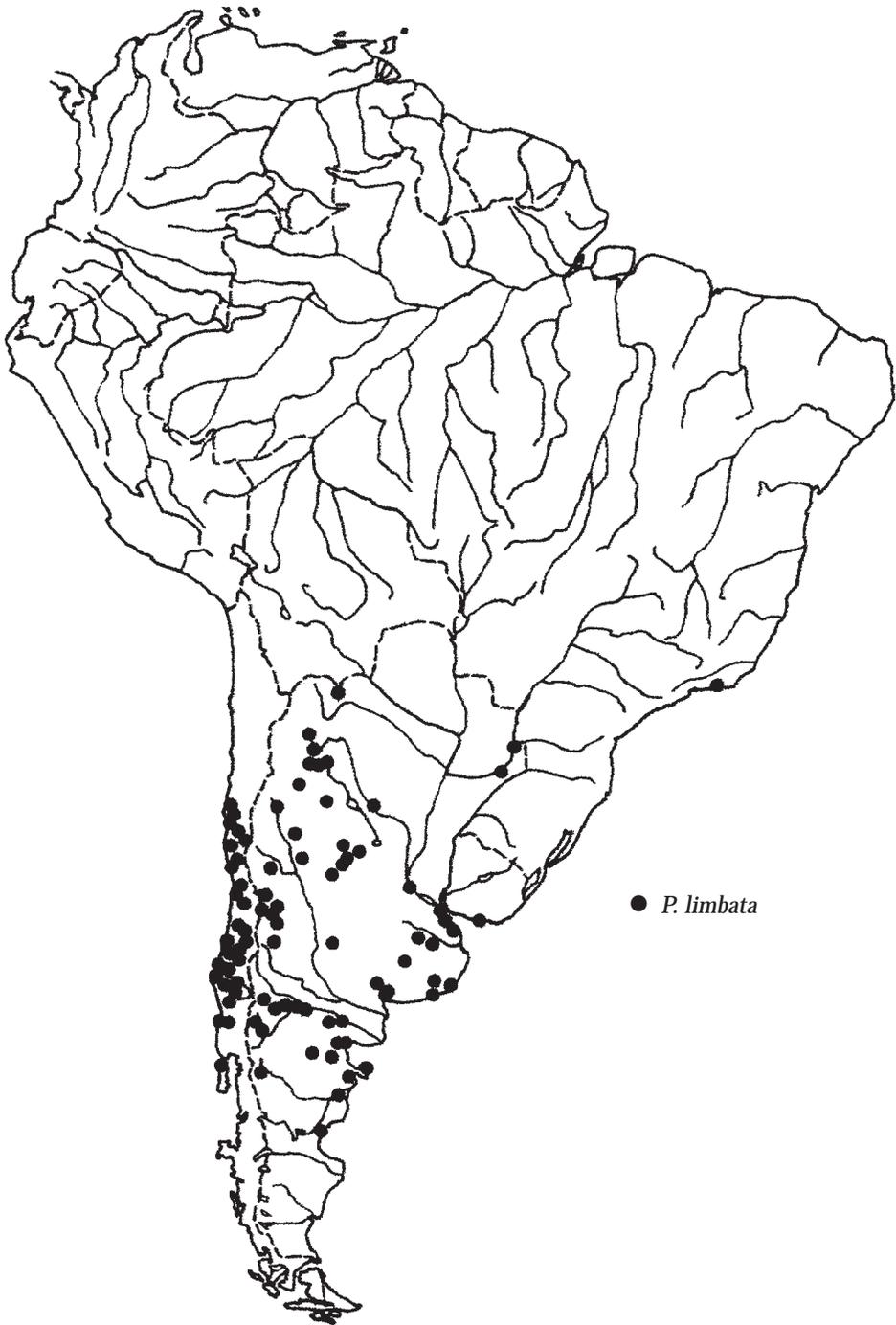


Fig. 669. Collection localities of *Pepsis limbata*.

♀ (fig. 591). BL 14-33. AE index (76-)81-95. Body and legs black with deep blue metallic sheen; antenna black, the segments often with dull brown apical rings. Wings orange-amber; on forewing, basal infuscation extends less than thorax width from wing-base, still less on hind-wing; very poorly-defined on both; with a moderately infuscate, usually poorly-defined, apical band, distinctly darker near the costa, almost touching the cells, often in contact with the anterior quarter of the apical abscissa of the radial cell (also often, whole of infuscation separated from radial cell by only a very narrow, clear area, about vein-wide; occasionally in contact with up to half the cell apex; rarely the infuscation enters the radial cell a little). Hind-wing often slightly paler than forewing. Head moderately swollen, especially vertex. MT weak to moderate. Forewing: PPV rather short, moderately transverse; 1r-m more-or-less strongly curved in anterior half (sometimes more-or-less evenly curved throughout; rarely sharply curved anteriorly or strongly sloping antero-distally); 2r-m more-or-less angulate at or just behind the middle; stigmal fenestra usually extremely thin (occasionally broader, but scarcely paler than the surrounding area; rarely absent); radial vein usually meeting costa at a more-or-less shallow angle; SMC3 with anterior and posterior abscissae parallel. MPN usually slightly shorter than PST, occasionally equal; furrow narrow, weakly expanded apically or apicad (infrequently, broad throughout); carinae usually all very fine, occasionally a few slightly stronger. Propodeum: dorsal face always more-or-less longer than posterior. MG usually replaced by a broadly rounded ridge, but sometimes weakly indicated posteriorly; APT & PPT weak to moderate; DTC rather weak, especially anteriorly, but fairly well-defined, more-or-less regular, often partly obscured by rather dense hair which is at least as long as PST + half MPN. PTC usually strong, more-or-less wide, centrally emarginate. Posterior face: VR present over at most a short length adjacent to PTC, very rapidly obsolescent apicad. PFC above as DTC, posterad soon breaking centrally to leave a finely-sculptured matt area, PFC again more complete but much weaker below, concentric and shiny around petiole socket. Lateral extension of S.2 groove well-developed. Fairly abundant, rather coarse hair below anterior femur (soon abraded), less on others. Hind tibia: teeth usually strong and more-or-less rounded (occasionally narrow, sharp and somewhat distant); spines 2.0-2.5 times as high; inner spur reaching only to about 0.2-0.25 basitarsus length, more-or-less equal to tarsomere 3, only 1.0-1.2 times as long as outer spur.

Variation.— Occasionally the anterior part of the forewing has a silvery-copper metallic sheen. When this variation coincides with that in which the radial vein joins the costa very shallowly, the specimen strongly resembles a female of the *rubra*-group; however, *P. limbata* has hair below the anterior femur (or at least the insertion-pits if abraded).

A single male from Argentina: Mendoza, San Rafael, 1,200 m (MNHNPS) has a few hairs on each side of S.5 similar to those on S.4.

Distinctions.— The male of this species, although on average much larger than that of *P. thoreyi*, is quite similar to it; in *P. limbata* the S.4 hairs change gradually towards the sternite centre instead of abruptly giving way to uniformly short hairs, and the hairs on preceding sternites are much longer and denser in *P. limbata*. Also the male of *P. flavescens* is similar to that of *P. limbata*, but the former has very few hairs on the sternites preceding S.4; but has many hairs between the lateral “brushes” on S.4, forming a semicircle (*P. limbata* has very sparse, weak hairs centrally); furthermore, in *P. limbata* the apical band of the

Table for distinguishing between *Pepsis aciculata*, *P. thoreyi*, *P. limbata* and *P. montezuma* females.

<i>P. aciculata</i>	<i>P. thoreyi</i>	<i>P. limbata</i>	<i>P. montezuma</i>
AE index 72-86.	AE index 67-83.	AE index 81-95.	AE index 81-107.
Temples strongly swollen (fig. 561).	Temples moderately swollen (fig. 596).	As <i>P. thoreyi</i> . (fig. 591)	Temples (fig. 576) moderately to strongly swollen.
Hairs of temples mostly a little shorter than OOD.	Hairs of temples distinctly longer than OOD.	As <i>P. thoreyi</i> .	As <i>P. thoreyi</i> .
MPN markedly shorter than PST.	MPN scarcely shorter than PST.	MPN equal to, to distinctly shorter than PST.	About equal.
MPN furrow expanded posterad (more-or-less V-shaped).	MPN furrow expanded posteriorly (more-or-less Y-shaped).	Variable: of even width, to moderately expanded posterad or only posteriorly.	Usually narrow, sometimes very narrow (suture-like), sometimes weakly expanded posterad or posteriorly.
MPN carinae irregular, matt, not contrasting with propodeal dorsum.	MPN carinae regular, somewhat shining (especially towards median groove) contrasting with propodeal dorsum.	Fine to very fine, almost always matt.	Fine or very fine, sometimes a few coarser.
Propodeal hair about as long as PST.	Propodeal hair much longer than PST.	As <i>P. thoreyi</i> .	As <i>P. thoreyi</i> or even longer.
Propodeal dorsum flat in profile, PTC easily visible, broad.	Propodeal dorsum slightly convex in profile, PTC difficult to see.	Flat or almost so, PTC usually rather broad but shallowly emarginate medially.	Slightly convex, PTC often difficult to distinguish.
DTC fine, sometimes coarser anteriorly, rather irregular, almost, matt; partly obscured by pilosity.	DTC fine, usually very fine anteriorly, irregular, matt; partly obscured by pilosity.	DTC fine, irregular, almost matt; partly obscured by pilosity.	Fine or very fine, sometimes coarser posterad, irregular, more-or-less matt, often obscured by pilosity.
PFC more regular, visible right to apex (especially beside centre-line).	PFC very irregular, rapidly obsolescent apicad, obscured by extensive, strong microreticulation.	Rapidly becoming finer distad; sometimes (especially medially) becoming very fine and matt.	Rapidly becoming finer distad and often becoming obsolete, leaving surface shining (especially in Chilean specimens).
Forewing with apical infusate band evenly dark, often diffusely entering distal cells.	Forewing with apical infusate band quite well-defined, markedly darker near costa and not entering radial cell, thus contrasting with its anterior part in colour.	As <i>P. thoreyi</i> .	Very variable; in Bolivia & west Argentina often reduced to very narrow, well-defined band (rest of wing very pale); more often a broad, poorly-defined band entering radial cell.
SMC3 of forewing elongate, bulging posterodistally.	SMC3 of forewing evenly rounded posterodistally.	More-or-less rounded, often obtusely angulate distally.	Very variable, between <i>P. thoreyi</i> and <i>P. aciculata</i> .
Hind tibial spines almost twice the height (not length) of the teeth they subtend; at about 30° to the perpendicular.	Hind tibial spines less than twice the height of the teeth they subtend; at about 45° to the perpendicular.	Hind tibial spines 2-3 times the height of the teeth they subtend.	As <i>P. limbata</i> .
Inner hind tibial spur reaching about 0.25 basitarsus length.	Reaching about 0.4 basitarsus length.	Reaching about 0.2-0.3 basitarsus length.	Reaching 0.3-0.4 basitarsus length.

forewing is broad, poorly-defined and extends around the posterior margin, and the wing-colour is usually deep orange-amber; in *P. flavescens* the apical band is narrow, well-defined and limited to the apex, while the wing-colour is pale amber.

The female is generally characterized by details of the forewing infuscation, shapes of 1r-m, 2r-m and stigmal fenestra, by MPN length and its furrow shape, strength of APT and PPT, shape of PTC, abundant femoral hair and rather short inner hind tibial spur. However, it is very like that of *P. thoreyi* and, to some extent, *P. flavescens*; a table of distinctions between the three is provided under *P. thoreyi*. Confusion is also possible with *P. aciculata* and *P. montezuma*; see the accompanying table.

Distribution.— A widely-ranging austral species, found in much of Chile, and in Argentina from Salta east to Buenos Aires and south to Chubut, about 44°S. in central Patagonia. There are isolated records from Uruguay: Montevideo, and Bolivia (no further locality); also from Brazil, Rio de Janeiro (1 ♀, MNHNPS); the last of these needs confirmation, while a further record from Perú, Yurimaguas (1 ♀, TMB) apparently represents a labelling error. Ascending to 3,000 m. Map fig. 669.

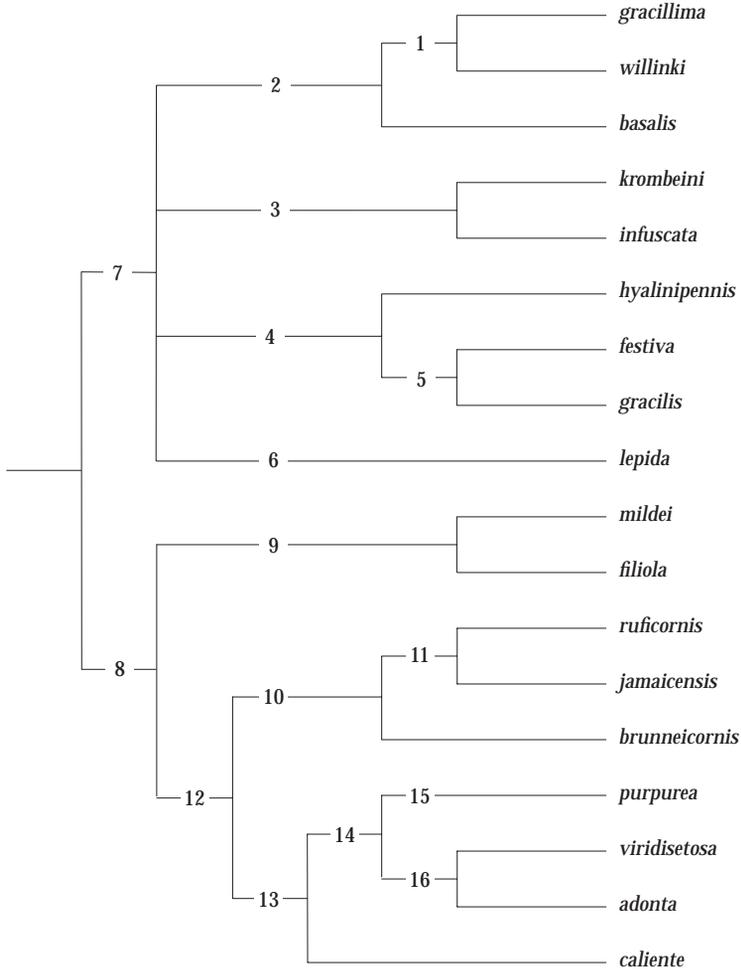
Material depositories.— 512 ♂♂, 508 ♀♀; AEIG, AMNH, BMNH, CAS, CMNH, CUNY, EMMSU, ETHZ, FDA, FRITZ, FSAG, IMLT, LACM, MACN, MCSNGO, MCZ, MHNGV, MHNSA, MLP, MLU, MNHNPS, MNRJ, MNS, MZEL, MZUSP, NHMBAS, NMV, OLLD, OSUC, PAGLIANO, PORTER, RMNH, SEMKU, SMF, TMB, UCALB, UCALD, UCV, UMCE, UMOX, USNM, USU, UZMC, WAHIS, WASBAUER, WILIAMS, ZMMOSC, ZSM.

The *Pepsis ruficornis*-group

Description.— The eighteen species of this group are small to medium (BL males 11-30, females 14-43) and mostly fairly slender (especially in the subgroup distinguished by character 7 in the cladogram). The group exhibits less diversity of colour than might be expected from its size; the body is black, usually with dark blue or green sheen, although in both sexes of one species it is strong violet-blue; and in several males, brilliant green. The antennae almost always have some apical segments orange. The wings of the males are usually clear or amber, with a dark apex somewhat variable in extent and definition; all the females except two have very dark wings, sometimes a little lighter, when they may have a red-brown admixture. In one female the wings are orange-amber with a broadly dark base and apical border; in another, the colour varies from amber with dark apical border to entirely dark. The male S.4 and S.5 hairs are usually both well developed; in the *ruficornis* sub-group the S.4 lateral brushes are usually extremely dense, their main axes convergent, and their apexes very strongly hooked but not touching those of the opposite side, while between them are usually weak or no hairs; the brushes in the *gracillima* sub-group are fairly dense, gradually curved, the apexes with small or no hooks but touching those of the opposite side or almost so, forming an arc; between them are usually many strong hairs. Both sub-groups have a band of erect hairs on S.5, usually denser, shorter and in a thicker band in the *ruficornis* sub-group. In the same sub-group the SGP is most often of average length and parallel-sided, while in the *gracillima* sub-group it is often very short, tapered apicad (especially in smaller specimens) and bent down approximately at the mid-point. The paramere is

about equal in length to the rest of the genitalia (sometimes a little longer in the *ruficornis* sub-group) broad, often with an expanded, flattened inner side, with the apex variably thickened and pointed. The inner, apical projection of the digitus is sharply pointed but not extended finger-like.

Cladogram for the *P. ruficornis*-group



Characters:

(Note: only male characters are given under (3) since the female of *P. krombeini* is unknown)

1. Body size small (both sexes); S.4 hairs denser laterally, strongly hooked apically; female SMC3 not very strongly bulging postero-distally, without spur vein; PTC weak.
2. Female head strongly rotund.
3. SMC3 not strongly bulging postero-distally; forewing infuscation details identical; S.4 inner hairs much shorter than outer; S.5 hairs short.
4. SGP elongate, apex with long hair fringe; female AS3 long.

5. S.5 without modified hairs.
6. Male wings entirely dark; antenna partly yellow.
7. Body size small; body slender; male head with temples flat in dorsal view; S.5 hairs in thin band, long; SGP bent in middle; paramere not longer than rest of genitalia, without subapical tubercle; female head strongly rotund.
8. Rather large species; male head with temples rounded in dorsal view; S.5 hairs in thick band, short; SGP straight; paramere with subapical tubercle on inner side.
9. Large species; male wings dark; S.4 hair brushes very large and dense; propodeum in male elongate, in female very robust, quadrate, both sexes with very strong PPT; female with proximal vein of SMC3 strongly outslipping antero-distally, abruptly recurved anteriorly.
10. Female MPN furrow abruptly expanded apically.
11. Small species; S.4 hairs sparse; SGP straight, keel complete; paramere narrow.
12. Female with proximal vein of SMC3 evenly rounded; propodeum with MG.
13. S.5 hairs sparse, straight; SGP parallel-sided.
14. Small species; male head rounded; male wings partly clear.
15. Very small species; SGP without keel; female MPN furrow expanded apically; female propodeum with strong PTC.
16. Female MPN furrow very narrow, suture-like.

Internal relationships.— This group divides into two sub-groups of equal size, those of *gracillima* and *ruficornis*; both include pairs of species more closely related to each other than to the remainder. Both sub-groups also include species with certain characters more common in the other sub-group, which makes it impractical to treat them as two distinct species-groups.

External relationships.— This group is most closely related to that of *montezuma*; they are similar in body size and general habitus. The male S.4 hairs also have much in common.

Biology.— No form in this group belongs to a mimicry-group.

Biogeography.— Although this group is found in all the northern parts of the range of the genus (i.e. USA and West Indies) and in most of South America including the western desert coast, it falls a long way short of reaching central Patagonia; its southern limits are in northern Argentina. One of the most interesting aspects of this group is its heterogeneity, i.e. paucity of regular patterns; despite including a relatively large number of species, very few of them form species-pairs. One such is *P. mildei* in the north and *P. filiola* in the south, which however are not especially closely related to each other. The two West Indian species are the sister-group of *P. brunneicornis* in the south, whereas the closely-related pair *P. festiva* and *P. gracilis* display a largely sympatric distributional range. All these circumstances together suggest a group of some antiquity which has undergone much extinction, including perhaps many cases of single members of a species-pair. In the circumstances, it is perhaps surprising that only a single species has reached the USA, and none Patagonia. This could be explained by the group as a whole having difficulty in adapting to higher altitudes, only crossing mountain barriers during the warmest interglacials. The two species united by character 1 in the cladogram appear to be siblings recently evolved in the area of the northwestern Andes.

Pepsis gracillima Taschenberg, 1869
(Figs 487-492, 566, 670)

Pepsis gracillima Taschenberg, 1869: 30, no. 8. Lectotype ♀ (MLU), here designated [examined].

Type material.— *P. gracillima*: I have seen a single type-material ♀ with the data “Columb.” [= Colombia] and labelled it lectotype.

Description.— ♂ (figs 487-492). BL 15-20. Body very slender. Body and legs black with dark blue or green sheen. Antenna black with 5-10.5 apical segments orange; wings amber with a narrow but well-defined, apical dark border, to almost entirely and fairly heavily infuscate. S.4 hairs inserted in a very broad band, equally wide throughout; the outermost long, directed strongly inwards and backwards, apically strongly hooked, forming a very dense “brush”, scarcely touching that of opposite side; towards the centre/anterior, becoming shorter, straighter, more erect and less dense; reaching the same height as the outer ones. S.5 hairs inserted in a narrow, very dense, apical band; hairs a little shorter than antero-central hairs of S.4, the outermost hairs slightly incurved. SGP narrow, quite strongly bent down about the middle and strongly narrowed to the rounded apex. Paramere short, only about as long as rest of genitalia, and (viewed perpendicular to the long axis and to the plane of maximum width) with a sharp point on the inner side of the apex. Inner projection of digitus apex rather bluntly pointed, directed slightly apicad.

♀ (fig. 566). BL 19-32. Body very slender. AS3 very long; AE index 124-138. Colour as in male but body sheen sometimes violaceous; 5-9.5 apical antennal segments orange; wings amber to entirely infuscate (see Variation). Head of unusual shape in dorsal view: little swollen behind orbits but quite deep from front to back, almost semi-globular. MT moderate to strong, often sharp. MPN most often equal in length to PST, its furrow narrow to very narrow, more-or-less obsolete anteriorly and expanded posteriorly, carinae fine to very fine, matt, sometimes a few coarser. Propodeum: rather strongly tapered posterad, especially in smaller specimens. MG very variable, sometimes indicated anteriorly narrowly, sometimes posteriorly broadly; usually contained in a broad, flat ridge. APT and PPT weak but crossed by carinae, with one often forming a point in profile. DTC fairly strong and regular. PTC absent to strong (more-or-less size-related). Propodeal hair variable, from equal to MPN to almost as long as PST and MPN lengths together. VR weak, PFC as DTC, becoming weaker posterad, especially in the centre-line. Anterior femur with some short hairs below. Lateral extension of S.2 groove well-developed, shorter in smaller specimens. Hind tibial teeth a little smaller than usual and much broader than high (commensurate with slender build); spines 1.0-2.5 times height of teeth; inner spur reaching to about 0.25-0.3 basitarsus length (about equal to tarsal segment 3) and about 1.3 times outer spur length.

Variation.— From Venezuela, only males have been seen: sometimes the wings are entirely orange-amber except for a narrow basal infuscation and a very narrow apical border; sometimes the wings have the basal half pale, and either clear or tinted with orange, while the apical half is infuscate and the boundary very diffuse. The pattern in females usually resembles the first-mentioned male one; occasionally the basal infuscation can be a little more extensive, and sometimes the wings are entirely, evenly, and fairly heavily infuscate; one specimen has the infuscation weakly suffused with orange but without the zonation sometimes found in males.

A female from Ecuador (USNM) is covered with pale yellowish pubescence (see Part 1, p. 18).

The slender form of this species, extreme for its group, (and hence its resemblance to species of the *hymenaea*-group) may be connected with its occurrence over a great range of altitudes.

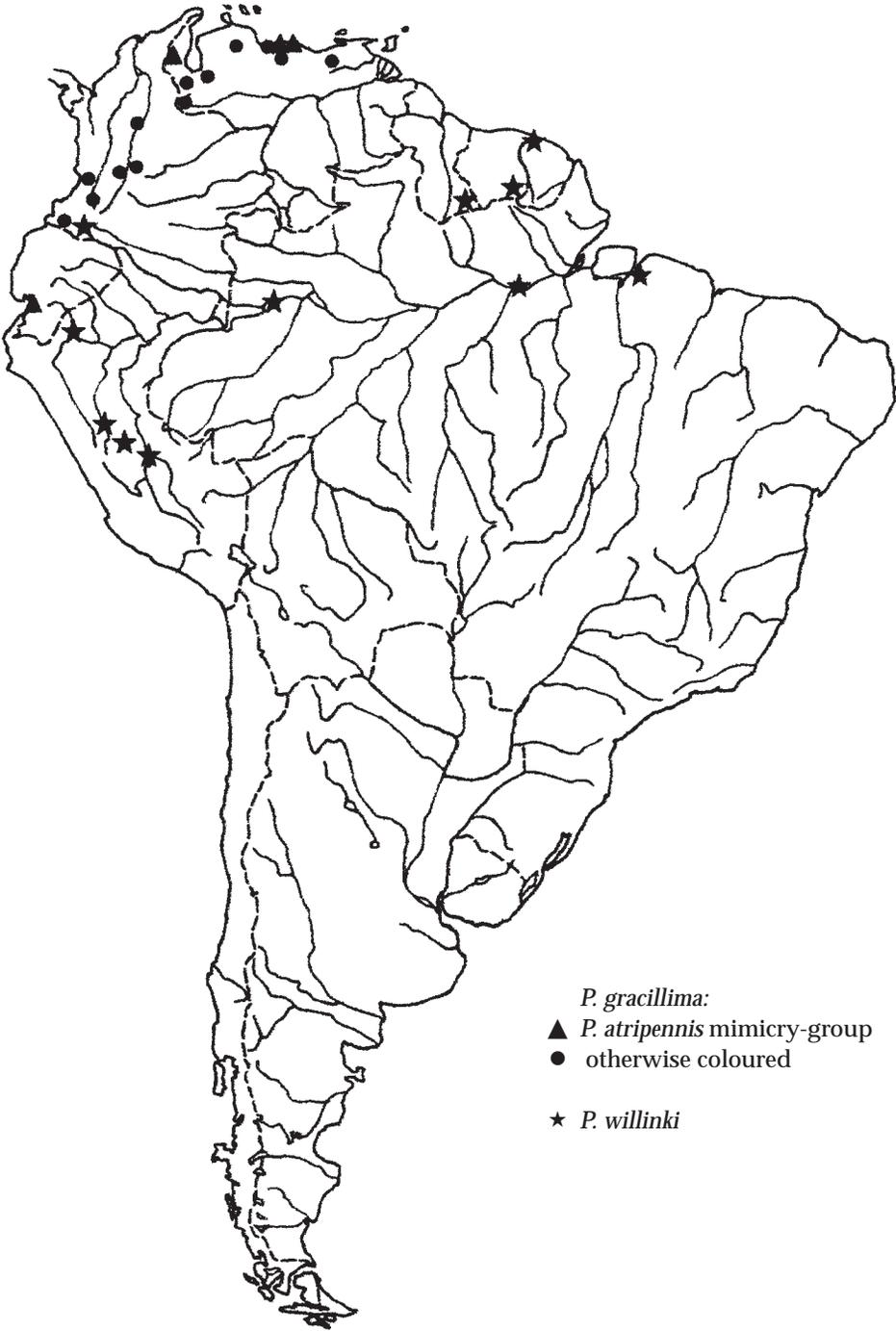


Fig. 670. Collection localities of *Pepsis gracillima* and *P. willinki*.

Distinctions.— Both sexes are characterized by their unusual head-shape (almost triangular in the male). The male is further distinguished by details of the sternal hairs and SGP from the males of *P. basalis* and *P. lepida* (which see); the female is distinguished from that of the very similar *P. basalis* as given under that species. It also resembles slender species of the *P. hymenaea*-group, but those have the radial cell apex forming virtually a right angle on the costa (the apex is rounded and away from the costa in this species). The female also resembles that of *P. hyalinipennis* but that species has the AS3 shorter and the head a more usual transverse shape, is less slender, and its wings have distinct blue-violet reflections; *P. gracillima* also has a more limited distribution (see below). Confusion is possible with unicolorous-winged specimens of *P. purpureipes* – see Distinctions under that species. The female also strongly resembles that of *P. willinki*, which see.

Biology.— A female from Venezuela: Aragua, carret[era] Maracay-Choroni (MI-ZAM) is pinned with its prey, a terrestrial spider belonging to the Theraphosidae, subfamily Theraphosinae (det. A. Smith, 1992). Some males of this species belong to the *atripennis* mimicry-group (which see).

Distribution.— Known only from north and west of the Andes in Ecuador, Colombia and Venezuela, with a single doubtful record from “Cayenne” (1 ♀, MNHNPS); at moderate altitudes (about 250-1,800 m). Map fig. 670.

Material depositories.— 21 ♂♂, 43 ♀♀; AMNH, BMNH, CAS, COOPER, CUNY, EMMSU, FDA, FRITZ, FSAG, MACN, MHNGV, MIZAM, MLU, MNHNPS, OSUC, SEMKU, TMB, UNPBOG, USNM, UZMC.

Pepsis willinki spec. nov.
(figs 499-506, 624-626, 670)

Type material.— Holotype ♂, **Perú**: Cuzco, Atalaya, Rio Tambo (Schunke) (BMNH). Paratypes: Perú: 1 ♂, Loreto, Atalaya 3.iv.1954 (Schunke) (BMNH); 1 ♂, Pasco, Puerto Bermudez 300 m (Cooper) (BMNH); 1 ♂, Rio Santiago, 28.viii.1924 (Bassler) (AMNH); 2 ♀♀, Monzon Valley, Tingo Maria, 2 & 29.xi.1954 (Schlinger & Ross) (CAS, BMNH); 1 ♀, Tingo Maria, iii-vii.[19]62 (WAHIS); 1 ♀, Dp.[Departamento] Huanuco, Fundo Sinchono, 1,300 m, 30.viii.1947 (Schunke) (USNM). **Colombia**: 1 ♂, Cauca [= Putumayo], Napoles, 5k e Puerto Limon, forest at foot of sierra, 350 m, 14.ix.1984 (Cooper) (BMNH); 1 ♂, Colum [= Colombia] “Chart.” [N.F.D.] (UMOX). **Guyana**: 1 ♂, New River, 1,000-1,500ft, 1-10.v.1938 (Hudson) (BMNH). **Suriname**: 1 ♂, source area of Paloemeu, forest, 11.iv.1952 (Geijskes) (RMNH). French Guiana: 1 ♂, Charvein, Bas Maroni, ix (Le Moulton) (MNHNPS); 1 ♂, no further data (UZMC). **Brazil**: 1 ♂, Amazon inf[erior], Taperinha, viii.1921 (?Baly) (ZSM); 1 ♂, Pará (de Mathan) (MNHNPS); 1 ♂, Amazon Riv[er], Tonantins, viii.1923 (Klages) (CMNH).

Etymology.— Named after the late Dr Abraham Willink, a respected and popular entomologist.

Description.— ♂ (figs 499-506). BL 16-20. Body & legs black with brilliant green to deep blue sheen. Antenna black with 0-2 apical segments orange. Wings clear to pale amber, forewing with about apical 1/3 dark brown, the boundary usually well-defined, hindwing with up to 1/3 of apex dark. S.4 hairs set in an arc, the outer ones **black**, forming a pair of very dense brushes, directed strongly inwards and backwards, apically very strongly hooked; towards centre of segment changing abruptly to sparser, thinner, almost straight and erect, **brown** hairs almost reaching the height (not length) of outer

hairs. S.5 hairs similar to central ones of S.4, in very narrow, transverse band. SGP virtually flat, parallel-sided or slightly constricted basally; with a narrow, transverse, pre-apical impression. Paramere broad, obliquely truncate, about as long as rest of genitalia. Inner projection of digitus apex rather sharply pointed, turned slightly distad.

♀ (figs 624-626). BL 22-28, rather elongate. AE index 115-121. Body & legs black with deep green-blue metallic sheen. Antenna black, with orange colour beginning diffusely on AS5-6. Wings fairly heavily infuscate with very weak blue-violet reflections. Head of unusual shape: in dorsal view rather long, but temple only moderately swollen. AS3 long, slender. MT very weak, sometimes moderately strong and bluntly pointed. Forewing with SMC3 very long, its anterior vein equal to or longer than postero-distal, and postero-proximal vein often as long as postero-distal; 1r-m weakly curved anteriorly, 2r-m increasingly strongly curved posterad, so that SMC3 is strongly bulging postero-distally. MPN slightly shorter than PST; furrow rather wide, parallel-sided; carinae moderately fine, matt. Propodeum: rather flattened dorsally, MG replaced by a very broad but poorly-defined median ridge; APT weak, PPT weak to moderate, PTC fairly strong but quite narrow; DTC even, regular except the last few are more broken and distant. Propodeal hair about as long as MPN. Posterior face: VR weak, rather distant; PFC similar to DTC except slightly weaker, covering whole of face, weaker in median line. Lateral extension of S.2 groove well-developed. Hind tibia: teeth small but sharp, subtended by spines 2-3 times as high; inner spur slender, appearing rather long, reaching to 0.3-0.35 basitarsus length (about equal to tarsal segment 2) and 1.3-1.4 times as long as outer spur.

Variation.— Only as noted above.

Distinctions.— The male is very similar to that of *P. infuscata*, but differs in having modified hairs on S.5. The female is very similar to that of *P. hyalinipennis*, but has a much more globose head. It also strongly resembles the female of *P. gracillima*; they are distinguished as follows (*P. gracillima* in parentheses): AS3 long, AE index 115-121 (AS3 very long, AE index 124-138); propodeum of normal shape, somewhat flattened dorsally, with PPT and PTC strong (strongly tapered, dorsally rounded, PPT and PTC often weak or absent); teeth of hind tibia tiny (rather small to normal).

Distribution.— Very sporadic: known from the Guianas, Upper and Lower Amazon, and the eastern watersheds of Colombia and Perú; ascending to 1,300 m in Perú. Map fig. 670.

Material depositories.— 14 ♂♂, 4 ♀♀; AMNH, BMNH, CAS, CMNH, MNHNPS, RMNH, UMOX, USNM, UZMC, WAHIS, ZSM.

Pepsis basalis Mocsáry, 1885
(figs 319-330, 567, 671)

Pepsis basalis Mocsáry, 1885: 241, no. 5. Lectotype ♂ (MHNNEU), here designated [examined].

Pepsis erdmanni Lucas, 1895: 516, no. 23. Lectotype ♂ (MNHU), here designated [examined]. **Syn. nov.**

Pepsis basinigra Haupt, 1952: 359, no. 2. Holotype ♀ (MLU) [examined]. **Syn. nov.**

Type material.— *P. basalis*: I have seen a single type-material ♂ and labelled it lectotype. *P. erdmanni*: I have seen 2 conspecific syntype ♂♂ in MNHU and labelled the larger one as lectotype. Its label has the locality "Muzo"; Lucas gives "Brazil, Muzo" in

the description, but that locality is in Colombia. The paralectotype is labelled "Colombia, coastal cordillera" etc.

Description.— ♂ (figs 319-330). BL 15-25. Body and legs black with deep blue-green metallic sheen. Antenna black with 1-5 apical segments orange. Wings with the basal half glass-clear, the apical more-or-less heavily infuscate and with blue-violet reflections. S.4 hairs inserted in a very broad band of equal width throughout; the outermost long, moderately dense, only occasionally forming a distinct "brush", directed slightly backwards and strongly inwards; apically strongly curved or hooked (sometimes touching those of opposite side); towards the centre/anterior, becoming shorter and straighter, but scarcely weaker or sparser. S.5 hairs inserted in a narrow, shallowly arcuate, pre-apical, rather sparse band; the apexes slightly curved backwards, otherwise similar to the antero-central hairs of S.4. SGP rather narrow, usually parallel-sided, occasionally narrowed slightly basally or apically (when the latter, less so than in *P. gracillima*); weakly bent down about the middle, apex rounded-truncate. Paramere short, about as long as rest of genitalia; apex usually slightly swollen, more-or-less obliquely truncate.

♀ (fig. 567). BL 29-32. AE index 132-140. Body and legs black with blue-violet metallic sheen. Antenna black with about 6 apical segments orange. Basal part of wings infuscate (see Variation). Head in dorsal view with temple and vertex not swollen, but head rather deep from front to back, giving a somewhat hemispherical appearance. AS3 very long. MT rather weak. SMC3 of forewing rather elongate, postero-distally bulging and almost perfectly rounded with only a trace of the spur-vein. MPN equal to or scarcely shorter than PST, its furrow rather broad, parallel-sided; carinae mainly very fine, a few moderate. Propodeum: MG indicated anteriorly, contained in a broad ridge which narrows strongly posterad, the MG obsolescent. APT moderate to strong, PPT strong; PTC strong, narrow and strongly raised. DTC very weak, irregular, some slightly stronger in posterior half. Propodeal hair about 1.5 times PST length. Posterior face: VR very weak, parallel or slightly divergent from PTC; PFC strong, sometimes stronger than DTC, very gradually weaker apicad but not obsolete until very close to the petiole socket, where the surface is slightly shining due to a change in the microsculpture. Lateral extension of S.2 groove well-developed. Anterior femur with some short, very sparse hair below. Hind tibia: teeth low but still quite sharp, the subtending spines 2.0-2.5 times as high; an incomplete row of much shorter spines on the inner side of the teeth. Inner spur reaching to 0.25-0.3 basitarsus length (about equal to tarsal segment 3 or slightly longer), and 1.2-1.4 times as long as outer spur.

Variation.— Males: the lectotype of *P. basalis* has the apical halves of the wings less heavily infuscate than usual, and the basal halves more so, the junction between the two diffuse; thus the contrast between the two parts is less than usual. Paramere variable according to population, in the north-coastal population of Colombia approaching the shape of that of *P. gracillima*.

In females, the extent of the dark base varies a little from one-third to half the wing length (but note that only three females have been seen, all from Central America).

Distinctions.— The male is structurally similar to that of the partly-sympatric *P. lepida* (see that species for distinctions); it is very similar to the male of *P. gracillima*, but in those specimens of that species which have bicoloured wings, the boundary between the two colours is usually very diffuse instead of sharp as in *P. basalis*; fur-



Fig. 671. Collection localities of *Pepsis basalis*.

thermore the SGP is always strongly narrowed apicad and bent down in *P. gracillima*, at most weakly so in *P. basalis*.

The female of *P. basalis* is very similar to that of *P. gracillima*, but differs as follows (characters of *P. gracillima* in parentheses): larger species, BL 29-32 (19-32); basal one-third to half of wings dark, more than thorax width (only extreme base dark, less than thorax width, or wings entirely dark); PTC strong, usually highest in middle (most often weak, not stronger than DTC; when present, usually broad and flat or even slightly emarginate centrally); PFC as strong as or stronger than DTC (weaker). See also under *P. chiron*.

Distribution.— Found from Costa Rica southwards to the north Colombian coast and Magdalena valley; also occurs in the interior of that country on the borders of the Amazon Basin; a single record from “Demerara” [Guyana] (1 ♂, NMW) needs confirmation. Ascends to 1,000 m in Colombia, Santander. Map fig. 671.

Material depositories. 54 ♂♂, 3 ♀♀; AMNH, BMNH, BRIO, CUNY, FSAG, INBIO, LACM, MACN, MEM, MHNNEU, MLU, MNHU, NMW, TMB, UCR, UMOX, UNPBOG, UPAN, USNM, WAHIS, ZSM.

Pepsis krombeini spec. nov.
(figs 481-486, 672)

Type material.— Holotype ♂ [Perú:] Pebas, Amazonas, fin Xbre. & 1er. Tr. 1880 (Mathan); D.G. Shapiro Collection, 1970. (USNM). [Parts of tarsi and antennae missing; parts of antennae glued on card].

Etymology.— Named after the late Dr Karl V. Krombein, who greatly encouraged this work.

Description.— ♂ (figs 481-486). BL 18. Body bright golden-green, legs darker; antenna black with last segment orange (more extensively orange below); wings clear with about apical one-third rather dark. Head in dorsal view scarcely swollen behind eyes, strongly transverse. MT very weak. MPN equal to PST, its furrow narrow, even and carinae very fine. Propodeum rather short (only slightly longer than basal width). MG weak, DTC moderately strong, both indicated in anterior half only; APT very weak, PPT strong, elongate, PTC virtually absent. S.4 with a pair of very thin, lateral hair brushes, inclined inwards and backwards, with apexes very strongly hooked but not quite touching those of opposite side; between them is an apical band of much shorter, lighter hair (about half the height), with only very few transitional hairs (i.e. of intermediate height) between the two kinds. S.5 has an apical band of hair almost identical to the short hairs on S.4. SGP very small, short, slightly tapered apicad and weakly bent down about the middle, its apex strongly rounded. Paramere as long as rest of genitalia, flattened in basal two-thirds of inner side, apex swollen and roundly truncate. Inner projection of digitus apex acute, bluntly pointed.

♀. Unknown.

Distinctions.— Very similar in colour to many other males of this group; the SGP strongly resembles that of *P. gracillima*, the S.4 lateral brushes are like those of *P. hyalinipennis* but more strongly hooked (this may be an artifact); the most distinctive combination of characters is the rather short hairs of S.4 which are duplicated on S.5, and the almost complete lack of transitional hairs between the lateral brushes and apical band on S.4. Particular care is needed to separate *P. krombeini* from *P. infuscata*, a very variable species which is common in the locality where *P. krombeini* was collected. The following characters of *P. krombeini* are the best to distinguish the two (those of *P. infuscata* indicated in brackets): S.4 has almost no hairs intermediate in size and position between those of outer brushes and central band (many, forming a graduated series); S.5 has a quite strong band of hairs almost at the posterior margin of the segment (a few, weak, irregular hairs near mid-segment); forewing 1r-m evenly curved throughout (curved more strongly before joining RS). SGP quite strongly bent down (straight), its apex strongly rounded (more-or-less truncate); paramere with inner lamella very narrow, ending in a weak tubercle (broad, ending in a strong tubercle), apex rounded-truncate (rounded to pointed).

Distribution.— Known only from the low-altitude locality of Pebas, upper Amazon. Map fig. 672.

Material depository.— 1 ♂ (USNM).

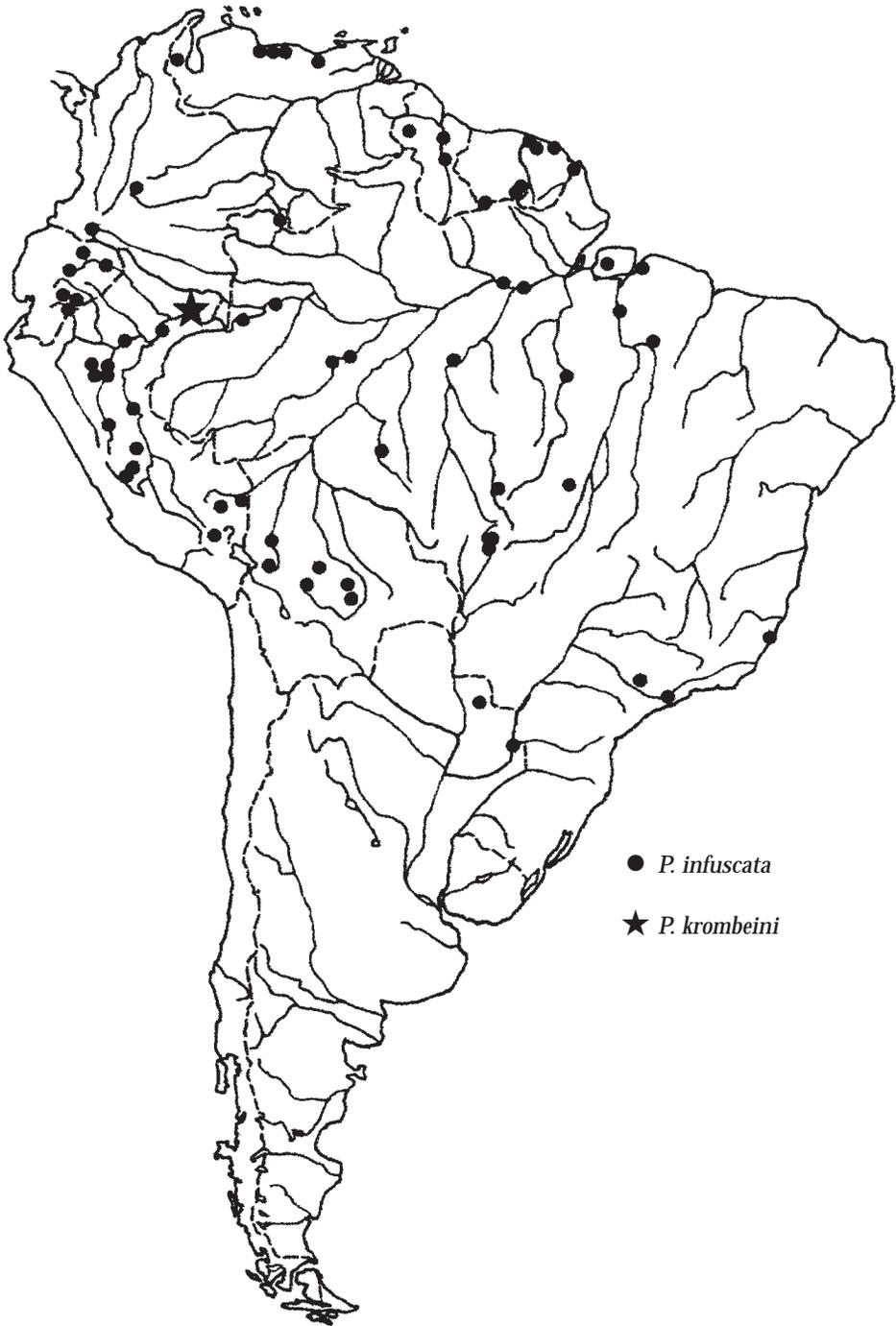


Fig. 672. Collection localities of *Pepsis infuscata* and *P. krombeini*.

Pepsis infuscata Spinola, 1841 spec. rev.
(figs 275-282, 629, 630, 672)

Pepsis infuscata Spinola, 1841: 104. Lectotype ♂ (MIZSU), here designated [examined]. [Wrongly given as a synonym of *P. viridisetosa* in Hurd, 1952: 320; I have not succeeded in tracing the source of this synonymy with certainty; Hurd himself made no synonyms of extralimital taxa. However, Lucas (1895: 504) synonymized a Klug manuscript "*infuscata*" under *viridisetosa*, but did not mention *P. infuscata* of Spinola. He (1919: 155) in effect repeated this].

Pepsis niobe Mocsáry, 1885: 268, no. 50. Lectotype ♀ (MHNNEU), here designated [examined]. **Syn. nov.**

Pepsis sagana Mocsáry, 1894: 10, no. 17. Lectotype ♀ (TMB), here designated [examined]. **Syn. nov.**

Pepsis incerta Banks, 1946: 369. Holotype ♀ (AMNH) [examined]. **Syn. nov.**

Type material.— *P. infuscata*: I have seen 3 ♂ syntypes and labelled them "a", "b" and "c", because they have no other labels. Specimen "a" agrees best with the description and I have labelled it lectotype. Males "b" and "c" are paralectotypes and are specimens of *P. smaragdina* Dahlbom. *P. niobe*: I have seen a single type-material ♀ and labelled it lectotype. *P. sagana*: I have seen a single type-material ♀ and labelled it lectotype.

Description.— ♂ (figs 275-282. BL (14-)15-20(-25). Body and legs black; most parts dorsally except MPN, and gaster entirely, with brilliant light green metallic sheen. Dense yellowish-silvery hair, both adpressed and erect, clothe sides of scutellum and PST, whole of MPN, a narrow triangle broadening posterad from PTC, sides of head, thorax and propodeum. Antenna black with last 1-4(-6) segments orange. Wings pale to deep amber; forewing has apical third with dark brown band, the junction well-defined; tip of hindwing also dark brown. Wings occasionally much darker (see Variation). S.4 hairs black, set in a pair of oval patches which merge centrally; outer hairs long, forming a more-or-less dense brush, directed strongly inwards and backwards, apically weakly hooked; towards centre of segment, becoming much shorter, thinner, straighter, more erect and brownish. S.5 with only the usual weak lateral tufts (essentially unmodified). SGP usually parallel-sided, occasionally slightly narrowed or expanded apicad; the apex rounded-truncate; the base with a very weak, broad keel; sometimes apex with a few hairs whose length is up to about 1/2 SGP width (soon abraded). Paramere about as long as rest of genitalia, apically more-or-less obliquely, bluntly pointed. Inner projection of digitus apex sharply or rounded-pointed, sometimes slightly turned distad.

♀ (figs 629-630). BL 18-32. AE index 105-125(-132). Body and legs black with weak blue-violet sheen. Antenna black; orange colour beginning, usually diffusely, on AS4-8 (most commonly on 6), often only on the inner side for the first few segments. Wings usually quite heavily infuscate yet almost completely lacking coloured metallic reflections, but otherwise occasionally showing striking variation (see below). Head in dorsal view with temple slightly swollen. MT moderate to strong, often sharp (occasionally weak or very strong). Forewing with PPV rather short and transverse; stigmal fenestra usually broader than subcosta; 1r-m more-or-less sharply bent anteriorly; 2r-m usually increasingly strongly curved posterad, so that SMC3 is fairly strongly bulging postero-distally; SMC3 rather long, with anterior vein often slightly longer than postero-distal. MPN equal to or slightly shorter than PST, its furrow usually either stopping short of anterior margin (especially in specimens from the Guianas) or reaching it in attenuated form, but occasionally complete; carinae very fine to extremely fine, matt. Propodeum: MG extremely

variable: from totally absent to indicated at differing strength at varying points. APT and PPT weak to moderate (the last occasionally strong and often sharp). DTC fine to moderate, gradually increasing in strength and distance posterad but not strong. PTC weak to moderate. Propodeal hair usually shorter than MPN, sometimes as long. Posterior face: VR very weak to fairly strong, covering most of face, often slightly bowed outwards centrally, 1/4-1/3 of face-width apart; PFC: usually a few upper ones complete, otherwise strong on VR only. Lateral extension of S.2 groove rather short and weak. Hind tibia: teeth often rather larger, more upright and distant than usual (but see Variation), subtended by spines 2-3 times as high; on their inner side is a sparse row of backwardly-directed bristles. Inner spur usually long, reaching to 0.4-0.45 basitarsus length (intermediate in length between tarsal segments 2 and 3), and 1.2-1.5 times as long as outer spur.

Variation.— In some Venezuelan males the normally clear parts of the wings are noticeably darker, while in a male from Guyana: Upper Mazaruni river (AMNH) (the only one seen from that country) the wings are entirely heavily infuscate and the antenna black; in these specimens, also the central hairs of S.4 are darker. Structurally, the SGP and genital organs vary considerably as mentioned above.

Female colour variation is uncommon but striking when it does occur. A few specimens have the wings orange-amber (North Perú: Achinamiza (AMNH); Brazil: Amapá, Oucatopi I. (CMNH); Brazil: Rondonia (INPA); Brazil: Pará (MNHNPS). A specimen from Venezuela: Rancho Grande near Maracay (AMNH) has the apical 2/3 of the wings paler than the rest. Specimens from [Brazil:] Amazonas, Iquitos (MNHNPS) and Brazil: Arima, Rio Purus (CMNH) have the wings a dirty amber with pale apex; while the oddest one of all, also from Arima (CMNH) has the apical 1/3 of the forewing a warm amber, exactly like the Guyana form of *P. luteicornis* (it is just possible that this is a limited mimicry-group extending to the Amazon via the low mountain pass in south-western Guyana). Antennal colour appears not to vary in any particular pattern in either sex, even when the wing colour is aberrant. The hind tibial teeth are occasionally small, and in one female from Brazil: Piauhay (TMB) they are vestigial. This specimen also has amber wings but is otherwise normal.

Distinctions.— Structurally the male is very similar to that of *P. dimidiata*, but that species is never brilliant green and its SGP is broader. For female distinctions, see under *P. viridisetosa*, *P. hyalinipennis* and *P. esmeralda*.

Biology.— A spider evidently caught by this wasp has been identified as a member of the family Dipluridae (det. P. Hillyard, BMNH). Later, this spider was further identified as *Linothele* sp. (det. R. Bertani, MZUSP). However, the collecting data of the wasp and its believed prey conflict. Both bear “Dry forest, 1.iv.1968”, and the wasp bears “with spider prey, in alc[ohol]” and the spider, “Prey of pompilid” and “Pompilid on wood”. However, whereas the wasp bears a general label with, amongst other data, “Mato Grosso. O.W. Richards” and [on another label, in Richards’ writing] “Pompilid with prey. Dry Forest. 1/4. A G A Mathews”, the spider bears “Pará, Belém” and likewise both collectors’ names. Tony Shelley (BMNH) informs me that there is no dry forest in the vicinity of Belém, but that some of the woodland in the Mato Grosso could be classified as such in April. A. Smith (1971: 285) states that both O.W. Richards and Mathews were in the Mato Grosso during periods which included April, 1968. The confusion may have arisen from one or both collectors making a side-trip to Belém. I conclude that the spider has the wrong locality and that the prey record is valid.

This is the third record of a *Pepsis* species taking a Mygalomorph spider which does not belong to the Theraphosidae (tarantulas); see *P. smaragdina* and *P. atripennis*.

Distribution.— Found in the whole of South America, including the Maracaibo basin but excluding the west coast; south to Bolivia, Paraguay and southeastern Brazil; ascending to 1,260 m in Perú. A record from Perú, Sicuani [c.4,000 m] (1 ♀, TMB) probably represents a labelling error. Map fig. 672.

Material depositories.— 68 ♂♂, 87 ♀♀; AEIG, AMNH, BMNH, CAS, CMNH, COOPER, CUNY, FRITZ, IMLT, INPA, MCZ, MHNNEU, MIZAM, MIZSU, MNHNPS, MNRJ, MPEG, MZUSP, NHMLIM, NMV, OSUC, PUCEQ, RMNH, SMF, TMB, USNM, UZMC, WAHIS, WASBAUER, ZSM.

Pepsis hyalinipennis Mocsáry, 1885
(figs 346-351, 609-611, 673)

Pepsis hyalinipennis Mocsáry, 1885: 240, no. 3. Lectotype ♂ (TMB), here designated [examined].

Pepsis subruficornis Haupt, 1952: 390, no. 7. Holotype ♀ (MLU) [examined]. **Syn. nov.**

Type material.— *P. hyalinipennis*: I have seen 3 ♂ syntypes, all in TMB. The one I have labelled lectotype bears the locality “Peru, Yurimaguas”. The 2 paralectotypes, both from “Peru, Pebas”, are specimens of *P. purpurea*.

Description.— ♂ (figs 346-351). BL 15-21. Body and legs bright metallic green to blue-green, sometimes with rather small patches of silver or golden hair; antenna black with 0-2.5 apical segments orange, wings entirely strongly infusate with strong blue-violet reflections, or clear to amber with about apical 1/3 moderately infusate, the boundary sharp to very diffuse. S.4 with a transverse patch of black hairs, a few outermost long, sometimes denser than the rest and forming a poorly-defined brush, curved inwards and backwards, touching those of opposite side; the intervening hairs shorter, straighter and rather sparse, most reaching the height (not length) of the outer hairs; S.5 with a transverse, pre-apical, very narrow band of brown hairs, longest in centre, almost as high as those of S.4. SGP rather elongate, sometimes weakly downcurved, virtually parallel-sided, apical part moderately expanded; the apex rounded-truncate to strongly rounded, with apical hairs of mixed lengths, the longest about equal to maximum SGP width (but sometimes worn). Paramere a little longer than rest of genitalia, apically more-or-less obliquely truncate and with only short hairs. Inner projection of digitus apex more-or-less sharply pointed, sometimes turned distad.

♀ (figs 609-611). BL 18-29. AE index 104-130. Body and legs black with bright green to dark blue metallic sheen, antenna black with orange colour beginning on AS3-7, wings always strongly infusate with moderate blue-violet metallic reflections. Temple in dorsal view scarcely swollen. AS3 long, MT moderate to strong. Forewing with PPV very short, SMC3 long, 1r-m gently curved throughout, 2r-m strongly so posteriorly, so that cell is strongly bulging postero-distally, spur-vein Ma often weak. MPN about equal to PST or slightly shorter, its furrow fairly broad but often weak or absent in anterior 1/4, sometimes weakly expanded apicad; carinae very fine, sometimes a few coarser. Propodeum: MG sometimes weakly indicated anteriorly. APT and PPT weak to moderate, PTC usually moderate to strong (usually strongest in larger specimens) sometimes weak, narrow. DTC moderately strong and regular; on apical 1/3 usually

markedly stronger, more distant and irregular. Propodeal hair equal to or slightly shorter than MPN length. Posterior face: VR very variable (see Variation); PFC usually weak, irregular, but extending over most of surface. Lateral extension of S.2 groove well developed. Hind tibia: teeth normal in size or slightly smaller and distant, strongly backwardly-directed, subtended by spines about twice their height (3 times when teeth smaller). Inner spur long, reaching to 0.3-0.45 basitarsus length (about equal to tarsal segment 2) and 1.2-1.5 times as long as outer spur.

Variation.— [The following account is based primarily on a comparison between west-coastal Colombian and Amazon basin populations. Specimens from higher altitudes in Colombia, from Central America, and from Venezuela are intermediate in various ways.]

Colour. Males from west of the Andes differ from their Amazonian counterparts as follows (Amazonian in parentheses): body dark green (blue-green); wings entirely, or almost entirely, heavily infuscate with strong blue-violet reflections (amber with about apical 1/3 moderately infuscate, reflections weak); antenna with up to 2 apical segments unilaterally orange (up to 2.5 segments orange over entire width). Males in all populations often have the metallic colour, especially on the sides of the thorax, replaced by pale silver-buff, mixed adpressed and erect hairs.

Females differ in: body bright yellow-green (deep blue-green); orange begins very diffusely on basal half of AS3 (usually on AS7 but varies from 3-8); wing-colour in females scarcely differs.

Structure. Both sexes from the west-coast region are on average smaller than their eastern counterparts (BL males 15-16 and 17-21 respectively, females 18-20 and 20-29).

Males also differ in that the paramere is on average slightly longer and narrower in the west-coast population.

Females also differ in the AE index 104-113 (108-130); MT on average sharper in specimens from west of the Andes; spur-vein Ma (of SMC3) often weak or absent, especially in small specimens and therefore commonest in west-coast populations; these usually also have weak VR, sometimes moderately strong near PTC, usually less than 1/3 posterior face-width distant and virtually parallel, sometimes more distant and bowed outwards centrally in larger specimens. Other differences, in particular sculptural, are in proportion to the smaller size and thus commoner in west-coast specimens.

Distinctions.— The male differs from that of most other brilliant green species with similar S.4 hairs in that it has the S.5 hairs also distinctly modified.

The female is very similar to those of *P. viridisetosa* and *P. infuscata*, but has a distinct, raised PTC (including in the west-Andean population); also the SMC3 is more elongate and the MPN furrow usually narrow throughout and reaching the anterior margin. The female has the forewing SMC3 configuration similar to that of *P. willinki*, but in the latter the entire cell is elongate, i.e. including the anterior vein.

Distribution.— A northwestern, transandean species: found from Costa Rica to west-coastal Ecuador; western Amazon basin only, from Colombia to Perú, with a single record from Bolivia; also single records from Venezuela and Guyana (both near the coast); ascending to 1,300 m in Colombia. Map fig. 673.

Material depositories.— 18 ♂♂, 33 ♀♀; AEIG, AMNH, BMNH, CMNH, COOPER, INBIO, MCZ, MIZAM, MLU, MNHNPS, PORTER, PUCEQ, TMB, UCALD, USNM, WAHIS.



Fig. 673. Collection localities of *Pepsis hyalinipennis*.

Pepsis festiva Fabricius, 1804
(figs 3, 4, 383-385, 631, 632, 674)

- Pepsis festiva* Fabricius, 1804: 214, no. 31. Lectotype ♂ (UZMC), here designated [examined].
- Pepsis apicalis* Gray, 1832: 516. Lectotype ♂ (BMNH), here designated [examined]. [Synonymized by Lucas, 1895: 501].
- Pepsis pulchella* Lepeletier, 1845: 491. Lectotype ♂ (MIZSU), here designated [examined]. **Syn. nov.**
- Pepsis thalassina* Erichson, 1848: 588, ♂, Guyana. (Lost). [Synonymized by Lucas, 1895: 501].
- Pepsis solitaria* Smith, 1879: 156. Lectotype ♂ (BMNH), here designated [examined]. **Syn. nov.**
- Pepsis gallardoii* Brèthes, 1908: 236. Lectotype ♀ (MACN), here designated [examined]. **Syn. nov.**
- Pepsis hora* Brèthes, 1914: 289, no. 48. Lectotype ♀ (MZUSP), here designated [examined]. **Syn. nov.**
- Pepsis amok* Lucas, 1919: 66. ♀, Panama: Chiriqui (lost). **Syn. nov.**
- Pepsis riojaneirensis* Lucas, 1919: 67. ♀, [Brazil:] Rio d[e] J[aneiro] (lost). **Syn. nov.**

Type material.— *P. festiva*: I have seen a single type-material ♂, bearing an original Fabrician label, and have labelled it lectotype. The original description states that the antenna is black; however, all other ♂♂ I have seen have a few apical segments orange. Unfortunately both antennae are now missing from the type. *P. apicalis*: I have seen a single type-material ♂ and labelled it lectotype. The specimen is unusual on account of its bronzy colour (normally a clear green in this species); furthermore, although the specimen lacks the antenna, the description states that the last 3 segments are “pale buff”, also unusual since these segments are normally orange in this species (similar species with such antennal colour do exist, but structural characters distinguish them). *P. pulchella*: I have seen a single ♂ syntype and labelled it lectotype. *P. solitaria*: I have seen a single type-material ♂ and labelled it lectotype. *P. gallardoii*: I have seen 13 specimens purporting to be type-material; of these, 4 are in MACN, 1 in MLP, and 8 in MNHU. All but one in MNHU are ♀. Two of the specimens in MACN are labelled Misiones; I have labelled as lectotype the one bearing a printed locality label; the one bearing a written label is a paralectotype, and is a specimen of *P. viridis* Lep., as also is a specimen without type status from Villa Morra. A fourth specimen, from Villa Encarnación, also without type status, is a specimen of *P. inclyta* Lep. The specimen in MLP is from Bonpland and is a specimen of *P. viridis* Lep. Of the 8 specimens in MNHU, one is a ♂, which sex Brèthes did not describe; only 3 of the 7 ♀♀ are from a locality (Sapucay) mentioned in the original description, and are paralectotypes. One of these latter is conspecific with the lectotype, all the remaining specimens, including the ♂, are specimens of *P. viridis* Lep. *P. hora*. I have seen all 3 syntypes mentioned in the original description and labelled the set specimen with complete antenna as lectotype; the 2 paralectotypes are conspecific.

Description.— ♂ (figs 3, 383-385; cf. figs 358-360). BL 15-23. Body and legs bright metallic yellow-green to deep blue-green; much of head and thorax often with bright, pale silver-golden pubescence in defined areas; antenna black with 2-5 apical segments orange; wings entirely black, or pale amber with apical 1/4 dark. Posterior face of propodeum in pale specimens usually with narrow stripe of pale hair beginning at PTC, extending posterad towards apex of propodeum, often becoming broader as it does so. S.4 hairs forming an approximate 1/4-sphere in outline; the lateral ones very dense, forming a brush, those of opposite sides meeting to form an arc; inwards becoming less dense, shorter and straighter, the central ones as long as the outer are high. S.5 with

only a small, lateral patch of short, weak, sparse hair. SGP virtually parallel-sided, sometimes slightly laterally expanded about the middle, slightly downcurved, apex truncate to slightly rounded. Paramere about as long as rest of genitalia, shape variable, more-or-less strongly obliquely truncate, the apical hairs very short. Inner projection of digitus apex sharply pointed to slightly attenuate.

♀ (figs 4, 631, 632). BL 18-35. AE index 114-133. Body and legs black with dark blue to blue-green metallic sheen. Antenna black with variable number of apical segments orange (usually starts at base of AS4); wings red-brown to black with strong blue-violet metallic reflections. Temple in dorsal view weakly swollen. AS3 long, occasionally with a few bristles on the inner side of its basal half. MT moderate to strong. Forewing with stigmal fenestra narrow; 1r-m bent or strongly curved anteriorly, 2r-m posteriorly, i.e. SMC3 more-or-less strongly bulging postero-distally. MPN equal to or slightly shorter than PST, its furrow beginning fairly broad although sometimes not reaching anterior margin, but usually more-or-less strongly expanded apicad; carinae fine. Propodeum: APT weak to moderate (rarely strong), PPT moderate to strong (occasionally very strong), PTC usually moderate to strong but very variable. DTC moderate, often becoming stronger and sometimes more irregular posterad. Propodeal hair about as long as MPN. Posterior face: VR usually strong, very close and slightly bowed outwards centrally, but extremely variable; PFC usually a few uppermost ones strong, rapidly disappearing below. Lateral extension of S.2 groove long and distinct. Front femur often with a few weak hairs below, mostly near the base. Hind tibia: teeth rather small, upright, usually somewhat distant; inner spur rather long, reaching to 0.3-0.4 basitarsis length (about equal to tarsal segment 2 or a little less) and 1.2-1.5 times as long as outer spur.

Variation.— In Central American males, the wings are always dark; in all other specimens, amber (varying a little in shade but never perfectly clear) with a dark apical band which varies slightly in width and whose inner boundary is variably distinct. In Central America is found a greater proportion of males with more apical antennal segments orange; also, in that area the body is usually deep blue rather than blue-green, and pale hairs are totally lacking. Whereas most South American males have the mesopleuron covered with long, pale hair except for a patch in the centre, the population found on the coast in the vicinity of Rio de Janeiro and São Paulo entirely lacks such pale hairs, indeed, such are much less evident on most of the body.

Colour variation in females concerns mainly the antenna; commonly the first 3 segments are black, the rest orange (i.e. the junction is sharp), but the orange can invade AS3, or the black AS4; in the two latter cases the boundary between the colours is usually diffuse. Although the wings are usually dark brown or black, some specimens from Panamá have red-brown wings with a very narrow dark border, most evident on the hind wings. The wings of such specimens lack metallic reflections.

Structural variation in the female is considerable, and concerns especially the propodeal sculpture; the PTC and DTC are quite variable and the VR varies from very strong to totally absent, and from very close to distant (more than 1/3 total width of posterior face).

The propodeum is generally less strongly tapered and the DTC more regular in Central American specimens than in South American.

In the red-brown winged specimens from Panamá, the SMC3 is sometimes evenly, shallowly rounded apically, i.e. scarcely bulging. A female from Costa Rica (BMNH)

has the body covered with fine, dense, yellowish pubescence.

Note.— The strong colour differences of the Central American males of this species hints at specific distinction, but insufficient structural characters have been found in either sex to support this possibility.

Distinctions.— The configuration of the S.4 hairs will separate the male from all except that of *P. gracilis*, which see.

The main distinguishing characters of the female are the long AS3; most specimens also have the division black/orange coinciding exactly with the AS3/AS4 junction; the strong, close VR; and the hind tibia with extremely fine, dense hair between the teeth; and the rather long inner spur (see *P. gracilis*). The female is distinguished from that of *P. mildei* in Central America, where the two species are sympatric, as follows (*P. festiva* characters in parentheses where not obvious): body larger, more robust, BL 23-43 (18-35), temple more swollen, antenna more robust, AE index 94-118 (114-133), orange colour starts sub-basally on AS3 (usually diffusely on mid-AS3 or after), MT more blunt, PTC stronger, VR vestigial (often strong), hind tibial spurs almost equal, inner reaching to at most about 0.3 basitarsus length (inner distinctly longer than outer, often reaching further along basitarsus), SMC3 longer anteriorly, stigmal fenestra shorter, discoidal fenestra very distinct. This species is also sympatric with *P. lepida* in Central America, and females could be confused with large specimens of the latter; see the table given under *P. lepida*. Female *P. festiva* and *P. xanthocera* are separable as given under the latter species. Small females of *P. amyntas* are easily confused with those of *P. festiva*; see the following table.

Table to distinguish females of *Pepsis festiva* and *P. amyntas*.

<i>P. festiva</i>	<i>P. amyntas</i>
MT smaller, less sharp.	MT very large and sharp.
Wings with violaceous reflections.	Wings without violaceous reflections.
MPN furrow rather narrow (slightly Y-shaped posteriorly).	MPN furrow very broad, shining; V-shaped.
Inner spur of hind tibia straight.	Inner spur of hind tibia slightly curved at extreme apex.
Propodeal VR strong.	Propodeal VR weak.
Head in dorsal view moderately expanded posteriorly (fig. 631).	Head in dorsal view scarcely expanded posteriorly (fig. 545).

Distribution.— Found from southern Mexico southwards, in the whole of Central and South America except the west coast south of Colombia, extending to northern Argentina in the west and southern Brazil in the east; ascending to about 1,800 m in Costa Rica and Bolivia. Map fig. 674.

Material depositories.— 252 ♂♂, 420 ♀♀; AEIG, AMNH, BMNH, BRIO, CAS, CMNH, COOPER, CUNY, EMMSU, FDA, FRITZ, FSAG, HENSEN, IMLT, INBIO, INPA, LACM, MACN, MCZ, MEM, MHNGV, MICR, MIZAM, MIZSU, MLP, MLU, MNHNPG, MNHNPS, MNHU, MNRJ, MNS, MPEG, MZUSP, NHMBAS, NMV, NRS, OSUC, PUCEQ, RMNH, SEMKU, SMF, TEXAMU, TMB, UBRAS, UCALB, UCR, UFP-CUR, UFVIC, UMBREM, UMOX, UNPBOG, UPAN, USNM, USPRIB, USU, UZMC, WAHIS, WASBAUER, ZMMOSC, ZSM.



Fig. 674. Collection localities of *Pepsis festiva*.

Pepsis gracilis Lepeletier, 1845
(figs. 358-363, 599, 600, 675)

Pepsis gracilis Lepeletier, 1845: 474. Lectotype ♀ (MIZSU), here designated [examined].

Pepsis diana Mocsáry, 1885: 260, no. 35. Lectotype ♀ (TMB), here designated [examined]. **Syn. nov.**

Pepsis hecate Mocsáry, 1885: 268, no. 49. Lectotype ♀ (TMB), here designated [examined]. **Syn. nov.**

Pepsis spathulifera Lucas, 1895: 503, no. 13. Lectotype ♂ (MNHU), here designated [examined]. **Syn. nov.**

Pepsis sphinx Lucas, 1895: 610, no. 68. Lectotype ♀ (MNHU), here designated [examined]. **Syn. nov.**

Pepsis ierensis Banks, 1945: 83. Lectotype ♀ (MCZ), here designated [examined]. **Syn. nov.**

Pepsis alceste Banks, 1946: 388. Holotype ♀ (CUNY)[examined]. **Syn. nov.**

Pepsis scalaris Haupt, 1952: 386, no. 3. Lectotype ♀ (MLU), here designated [examined]. **Syn. nov.**

Type material.— *P. gracilis*: I have seen a single ♀ syntype and labelled it lectotype. *P. diana*: I have seen 2 syntype ♀♀ from TMB, and labelled the one from Manaus as lectotype. The conspecific paralectotype is from Iquitos. *P. hecate*: I have seen a single type-material ♀ and labelled it lectotype. *P. spathulifera*: I have seen a single type-material ♂ (labelled “*spatuligera*”) and labelled it lectotype. *P. sphinx*: I have seen only a single ♀ syntype, which I have labelled lectotype. *P. ierensis*: Banks mentioned only a “type” but evidently saw multiple specimens since he gave variation in forewing length. I have seen 5 ♀♀ in all; 3 of these (in MCZ) are labelled “NW part of Trinidad” corresponding with the locality given in the original description, and I have labelled one of them (bearing a red MCZ “type” label) as lectotype. The other two are paralectotypes. Another specimen in MCZ is labelled “Ecuador, Bucay 1,000 ft”; although all 4 are conspecific, the last-mentioned specimen has no type status. However, it appears to be the only one bearing a correct locality, since all these specimens are from the population characteristic of west of the Andes (see Introduction - Locality Notes). The remaining specimen (in AMNH) is labelled Colombia (only) and is aberrant; it is probably conspecific but cannot be adequately distinguished from *P. infuscata*. All 5 bear Banks’ identification labels, but the last two have no type-status added thereon. *P. alceste*: The holotype bears the name “*alcestris*”, as also do the 2 paratype ♀♀ in MCZ; the 2 paratype ♀♀ in CUNY bear the name “*alceste*”, although not in Banks’ handwriting; all 5 are conspecific. *P. scalaris*: I have seen both ♀ syntypes, and labelled the larger one as lectotype. The paralectotype is conspecific with it.

Description.— ♂ (figs 358-363). BL 14-26. Body and legs brilliant metallic green, antenna black with a very variable number of apical segments orange; wings yellowish-amber with the apical 1/4-1/3 more-or-less heavily infusate, the boundary usually fairly well-defined. S.4 with a semicircle of hairs, the postero-laterals strong, very dense and forming a fairly well-defined and broad “brush”, the apexes strongly curved and meeting those of opposite side; towards the centre, becoming shorter, less curved and forming a very narrow line; S.5 with only a few, very weak and mainly lateral hairs. SGP elongate, quite strongly expanded towards the strongly-rounded, spathulate apex, which has very long hairs, as long as maximum SGP width. Paramere rather broad, about 1.5 times as long as rest of genitalia, bluntly pointed, also with long apical hairs. Inner projection of digitus apex sharply angulate.

♀ (figs 599, 600). BL 22-35. AE index 102-126. Body and legs black, antenna black with orange colour beginning abruptly or diffusely on any segment from AS3 onwards (sometimes only apex of last segment orange). Wings orange-amber to black, with

strong, almost colourless reflections. Temple in dorsal view slightly to moderately swollen. AS3 usually rather long. MT weak to strong. Forewing with 1r-m strongly sloping anterodistad, more-or-less strongly bent inwards anteriorly; SMC3 more-or-less strongly bulging postero-distally, sometimes 2r-m angulate near mid-point. MPN equal to or slightly shorter than PST, its furrow narrow, parallel-sided, sometimes not reaching anterior margin; carinae very fine but slightly shining. Propodeum: most of surface characterized by an unusual slightly shiny appearance due to microsculpture; MG often indicated, especially just behind mid-point; APT weak to moderate, PPT weak to strong, PTC absent to moderate. DTC fairly strong but more-or-less irregular, usually stronger and much more distant in posterior 1/3-1/2, this area commonly delimited anteriorly by a carina almost as strong as the PTC. Propodeal hair: varying in length from PST to PST+1/2 MPN. Posterior face: VR weak to moderate, usually close (distance between them about equal to PST length), PFC strong on approximately upper half, very weak or absent below. Lateral extension of S.2 groove well-developed. Hind tibia: teeth usually strong but a little distant (but see Variation); inner spur rather long, reaching to 0.3-0.4 basitarsus length (about equal to tarsal segment 2, occasionally only as long as 3), and 1.1-1.3 times as long as outer spur.

Variation.— Males from west of the Andes have the body usually more blue-green and the antenna commonly with only the last 1-2 antennal segments orange; specimens from the Caribbean coast and Amazon have the body more yellow-green; the antenna in Amazon specimens often has all segments orange except the basal 2, while those from the north coast are intermediate in this respect. Males from the Caribbean coast are larger on average than others.

Females also exhibit population differences; west of the Andes the antenna is commonly black except for the apex of the last segment (usually much more orange in other populations) while the wings are an unusual sooty-black colour due to the strongly-pigmented pilosity (in all specimens from the Guianas, occasional ones from Venezuela and some from the Amazon, the wings are orange-amber). Structurally, specimens from west of the Andes are on average smaller and more robust than others, in particular the propodeum is more compact; their AE index is also lower on average (102-110 as opposed to 111-126 in other areas). In all populations, the hind tibial teeth are most commonly rather small and distant (hence fewer than usual); they can also be of more usual size, when they are either distant or normally close.

Distinctions.— The male is virtually identical to that of *P. festiva*, except that *P. gracilis* has the S.4 hair-band much narrower in the middle, and the SGP elongate, with the apex expanded (spathulate) and long-haired.

The female is similar to those of the following species, but is distinguished as follows (characters of *P. gracilis* are given in brackets): *P. festiva*: AS3 longer on average, usually black (orange); wings always black (often orange-amber), usually with strong metallic reflections (weak or none), PPV shorter, stigmal fenestra narrower, SMC3 shorter anteriorly; MPN furrow wider, carinae coarser; MG rarely indicated (often), DTC weaker but denser and more regular, propodeal hair shorter, about equal to PST length (up to PST + 1/2 MPN), PTC and VR stronger; hind tibial teeth narrower and more upright, inner spur longer. *P. infuscata*: smaller, BL 18-32 (22-35); MPN furrow usually not reaching anterior margin (complete), carinae coarser; DTC more regular, propodeal hair shorter, VR more distant. *P. xanthocera*: wings with strong, metallic blue-

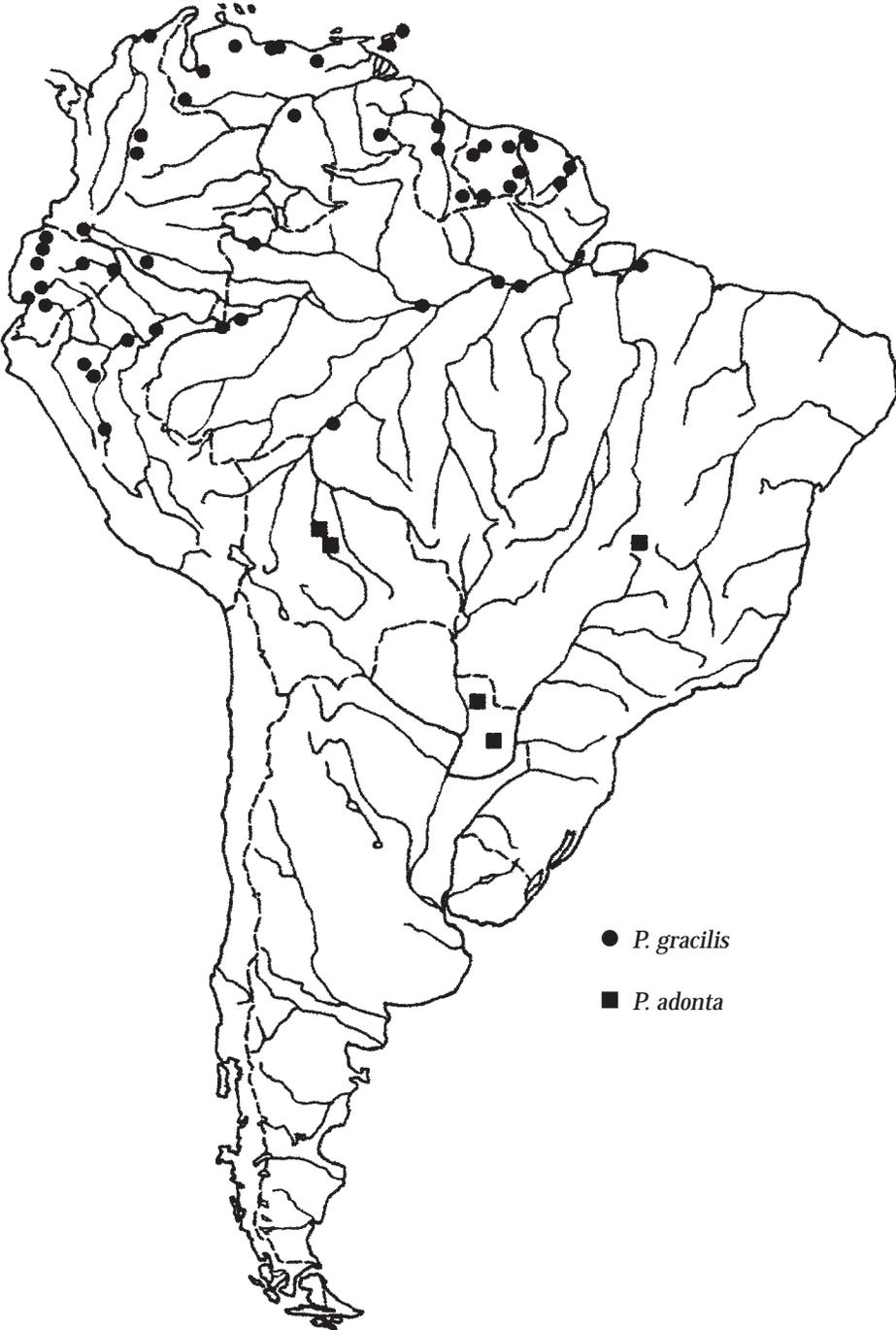


Fig. 675. Collection localities of *Pepsis gracilis* and *P. adonta*.

violet reflections (without); MPN furrow wider, often also expanded posterad (narrow, parallel-sided); DTC very fine and regular, except posteriorly (stronger, less regular); propodeal hair longer; lateral extension of S.2 groove very short (well-developed); inner spur of hind tibia very short.

Distribution.— A north-western, transandean species: found north of the Andes at the Sierra Nevada de Santa Marta and in the Magdalena valley, and west of the Andes in Ecuador (no specimens have been seen from west-coastal Colombia, although the species might be expected to occur there; see also lectotype notes for *P. ierensis*); along the entire Caribbean coast of South America, the whole of the Amazon (apparently scarcer in the middle), but southwards only in the western Amazon basin, at least to central Perú; although it is recorded from Bolivia, Juntas (1 ♀, TMB), this name is duplicated several times in that country and hence not possible to locate exactly; a record from Brazil, Taubaté (near the south-east coast) (1 ♀, ZSM) probably represents a labelling error; ascending to 1,120 m in Venezuela. Map fig. 675.

Material depositories.— 33 ♂♂, 113 ♀♀; AEIG, AMNH, ANSP, BMNH, BPBM, BRIO, CAS, CMNH, COOPER, CUNY, ETHZ, FDA, FRITZ, HENSEN, INPA, LACM, MCZ, MEM, MHNGV, MIZAM, MIZSU, MLU, MNHNPS, MNHU, MNRJ, MPEG, MZUSP, NMV, NRS, OLLD, PACKER, PORTER, PUCEQ, RMNH, SMF, TMB, UCALB, USNM, UZMC, ZSM.

Pepsis lepida Mocsáry, 1894
(figs 371-376, 608, 677)

Pepsis lepida Mocsáry, 1894: 9, no. 16. Lectotype ♂ (TMB), here designated [examined].

Type material.— *P. lepida*: I have seen 3 ♂♂ and 2 ♀♀ standing under this name in TMB. All are labelled Panama: Chiriqui except one male Brazil: Fonteboa. However, the latter is probably mislabelled because no Brazilian material compares with it; furthermore, all 5 specimens appear to be conspecific. Of the 2 ♂♂ with correct localities, I have labelled as lectotype the specimen complete with genitalia; the other lacks them. The remaining 4 specimens are paralectotypes.

Description.— ♂ (figs 371-376). BL 14-22. Body and legs black with deep blue-green metallic sheen. Antenna with 2 basal segments black, the rest variable but mostly pale (see Variation). Wings black with (usually strong) blue-violet reflections. S.4 hairs inserted in a rather narrow band, increasing to twice the width laterally; the outermost hairs long, forming a very dense “brush”, very strongly directed backwards basally, then inwards and less strongly backwards; the apexes strongly hooked, scarcely touching those of opposite side; towards the centre, becoming gradually shorter, straighter, more erect and less dense. S.5 hairs inserted in a narrow, shallowly arcuate, pre-apical band; hairs moderately dense, almost straight, not quite as long as the central ones of S.4. SGP rather broad, parallel-sided to the rounded apex, more-or-less strongly bent down just beyond the middle. Paramere about as long as rest of genitalia; viewed perpendicular to the long axis and to the plane of maximum width, with rounded point on inner side of apex. Inner projection of digitus apex slender, turned slightly distad.

♀ (fig. 608). BL 16-34. AE index 113-125. Colour as in male except from subbasal AS3

the antenna is usually pale lemon-yellow to yellow-orange. Head in dorsal view with temple and vertex scarcely swollen. MT moderate to strong. MPN furrow narrow, slightly broader posteriorly or posterad; carinae fine, often with a few coarser ones mostly around the middle. Propodeum: MG extremely weak, in the centre of a more-or-less flattened median ridge. APT, PPT and PTC weak to strong, more-or-less size-related.

Table to distinguish between females of *Pepsis festiva* and *P. lepida*.

<i>P. festiva</i>	<i>P. lepida</i>
Average size larger, BL 29-32.	Average size smaller, BL 16-34.
Antenna partly orange.	Antenna partly yellow.
Body pubescence blue-violet.	Body pubescence deep green.
In dorsal view, head behind eyes moderately swollen, almost as convex as part of eye immediately in front of it.	In dorsal view, head behind eyes scarcely swollen, much less convex than part of eye immediately in front of it.
AE index 114-133.	AE index 113-125.
Forewing: basal fenestra of first discoidal cell large but not very pale, shaped like a very thick crescent with its concave side facing distad; occupying about $\frac{3}{4}$ of the maximum transverse width of the cell.	Forewing: basal fenestra of first discoidal cell small, very pale, comma-shaped, with the tail directed posterad; occupying little more than $\frac{1}{2}$ of the maximum transverse width of the cell.
PPV moderately long, at about 30° to longitudinal wing-axis; about as long as first abscissa of radial vein.	PPV short, at about 45° to longitudinal wing-axis; about $\frac{2}{3}$ of length of first abscissa of radial vein.
1r-m fairly strongly curved in anterior half.	1r-m mainly straight, more-or-less sharply bent just before anterior end.
2r-m rather strongly bent just behind its mid-point, so that the SMC3 is flat postero-distally.	2r-m straight anteriorly, its posterior half strongly curved, so that the SMC3 is strongly bulging postero-distally.
MPN furrow very broad, at least from its mid-point posterad (broad throughout or expanded posterad); carinae entirely very fine, scarcely obscured by pubescence.	MPN furrow broad only posteriorly, otherwise narrow throughout; carinae fine, some stronger than others, partly obscured by pubescence.
Propodeum rather transverse, posterior face clearly longer than scutellum and PST together.	Propodeum rather strongly tapered posterad, posterior face about equal in length to scutellum and PST together.
PPT in profile very strong, peg-like, apically truncate.	PPT in profile moderately strong, sides converging to a blunt point.
PTC strong; VR moderate to strong.	PTC rather weak; VR represented only by low ridges.
PFC strong above, especially on VR, rapidly becoming very weak apicad; a broad middle area is covered by dense, matt, granular sculpture, becoming less dense just below PTC and apically, leaving surface more shining there.	PFC moderately strong above, but only very gradually weaker apicad, present right to apex; obsolescent in median line only; face without granular sculpture.
Transverse carina above anal valve produced on each side into a low, obtuse tooth not or scarcely higher than rest of carina.	Transverse carina above anal valve produced on each side into an almost right-angled tooth rising well above rest of carina.
Hind tibia: teeth rather weak, the subtending spines strong and about twice as high as the teeth.	Hind tibia: teeth normal, the subtending spines about 1.5 times tooth height in larger specimens, 2.0 in smaller.

Table to distinguish between female *Pepsis lepida* and *P. purpurea* in Panamá.

<i>P. lepida</i>	<i>P. purpurea</i>
Larger, more robust; BL 16-34.	Smaller, more slender; BL 14-26.
Temple somewhat swollen.	Temple scarcely swollen.
AE index 113-125.	AE index 102-128.
Wings of one colour; usually with strong blue-green reflections.	Hindwing often slightly paler than forewing; with weak violaceous reflections.
Often a few, short hairs below anterior femur.	Anterior femur without hairs.
MPN furrow narrow, usually parallel-sided and reaching anterior margin.	MPN furrow rather broad, sometimes expanded posterad; often obsolete before reaching anterior margin.
PTC narrow, with a flat top.	PTC rather broad, convex.
Hind tibial teeth usually close together.	Hind tibial teeth rather distant.
Inner spur of hind tibia slightly curved in apical 1/4; reaching to about 0.4 basitarsus length.	Inner spur of hind tibia slightly curved at extreme apex; reaching to about 0.3 basitarsus length.

DTC fairly coarse and regular. Posterior face: VR only moderately strong at most PFC similar to DTC, weaker between VR and below but also fairly regular overall. Propodeal hair as long, or almost as long, as PST. Lateral extension of S.2 groove well-developed. Hind tibia: teeth rather sharply pointed, directed strongly backwards, subtending spines c. 1.5-2.0 times their height; inner spur reaching to 0.3-0.4 basitarsus length (about equal to tarsal segment 3) and 1.2-1.5 times as long as outer spur.

Variation.— The male antenna varies in colour: at any point between segments 3 to 5 the black of the 2 basal segments shades into dark brown, then into cream, lemon-yellow or orange. The female antennal colour is generally more constant than in the male; however, in females from Colombia the orange colour begins as proximally as AS3. In a female from Panamá the black on the outer side of AS3 is more distinct and extensive than usual, running slightly on to AS4; the wings are darker than usual, grey rather than brown, and lacking most of the usual metallic reflections.

Distinctions.— The male is similar to those of *P. basalis* and *P. gracillima*; *P. lepida* always has entirely dark wings, whereas those of *P. basalis* are strongly bicoloured, and of *P. gracillima* usually so; when not, the infuscation is less heavy than in *P. lepida*. The S.4 hair-band insertion-pattern in *P. lepida* is strongly narrowed centrally, in the other two males it is broad throughout; further, in *P. lepida* the SGP is never strongly narrowed apicad, as it is in *P. gracillima*.

The female also resembles those of *P. festiva* and *P. purpurea* (the latter especially in Panamá); see the tables above.

Distribution.— Known from Costa Rica to Panamá, and from eastern Colombia; a single record from Mexico, Córdoba (♂, UCALD) needs confirming. Both apparent disjunctions may be due to under-collecting; ascending to altitudes of 1,200 m. Map fig. 677. Material depositories.— 183 ♂♂, 65 ♀♀; AEIG, AMNH, ANSP, BMNH, CAS, CUNY, FDA, INBIO, LACM, MCZ, MEM, MICR, MNHNPS, MZUSP, OLLD, PMA, PORTER, RMNH, SEMKU, SMF, SMTD, TMB, UCALB, UCALD, UMOX, UNPBOG, UPAN, USNM, USU, WAHIS, WASBAUER, ZMMICH.

Pepsis mildei Stål, 1857
(figs 377-382, 573, 676)

Pepsis mildei Stål, 1857: 64, no. 3. Lectotype ♂ (NRS), here designated [examined].

Pepsis charon Mocsáry, 1885: 255, no. 26. Lectotype ♀ (TMB), here designated [examined]. **Syn. nov.**

Pepsis hesperiae Patton, 1894: 46, ♂, ♀, California (lost). [Synonymized by Fox, 1898: 145].

Pepsis cyanoptera Lucas, 1895: 590, no. 57. Lectotype ♂ (MNHU), here designated [examined]. **Syn. nov.**

Pepsis boguei Fox, 1898: 146. Lectotype ♀ (ANSP), here designated [examined]. [Synonymized by Hurd, 1948: 127].

Pepsis dryas Lucas, 1919: 60. Lectotype ♂ (MNCN), here designated [examined]. **Syn. nov.**

Type material.— *P. mildei*: I have seen a single type-material ♂ and labelled it lectotype. *P. charon*: I have seen 7 ♀ syntypes; 6 in TMB and 1 in MHNNEU. Although only 4 of the TMB specimens bear original Mocsáry identification labels, one of the remaining two is the smallest individual of all and agrees perfectly with the lowest of the range of measurements given in the original description. I have labelled one of the ♀ ♀ in TMB bearing an original Mocsáry label as lectotype, and regard all other specimens as paralectotypes; all are conspecific with the lectotype. *P. cyanoptera*: I have seen 3 syntypes: a ♂ and ♀ in TMB and a ♀ in MNHU. I have labelled the ♂ as lectotype; the two ♀ ♀ are paralectotypes, and all three specimens are conspecific. *P. boguei*: I have seen only the ♀ syntype, and labelled it lectotype. *P. dryas*: I have seen a single type-material ♂ and labelled it lectotype.

Description.— ♂ (figs 377-382). BL 19-30. Body and legs black with blue to blue-violet, occasionally green, metallic sheen. Antenna with any number of apical segments orange from 0.5-11. Wings deep amber with infuscate base and an apical band occupying most of the area outside the cells, usually darker anteriorly; both dark parts with rather diffuse boundaries. Wings sometimes partly to entirely dark; when the latter, then with quite strong blue-violet reflections. S.4 with a dense, rather broadly-based lateral “brush” of long hairs, directed inwards and backwards, the apexes very strongly hooked; a distinct gap between bases and apexes of brushes of opposite sides. S.5 with a rather broad and dense, transverse band of much shorter hairs, whose length is about half the height of those on S.4, the central ones slightly curved apically. SGP weakly expanded apicad, apex rounded-truncate; more-or-less flattened in basal 2/3, which is more shining than the rest, with a very weak but broad median ridge. Paramere short, about as long as rest of genitalia. Apical projection of digitus with a blunt point on the inner side.

♀ (fig. 573). BL 23-43. AE index 94-118. Colour as in male. Head in dorsal view with temple slightly swollen, vertex more so. MT weak to strong. MPN furrow rather narrow but expanded a little posteriorly (sometimes posterad); carinae fine, slightly shining. Propodeum: MG narrow, broader anteriorly, shallow; often totally absent or indicated anteriorly only. APT weak to moderate, PPT moderate to strong, DTC strong. Propodeal hair about as long as PST. PTC weak to quite strong. All tubercles and carinae often stronger in large specimens. Posterior face: VR varying from absent to very strong. PFC strong above, gradually weaker below and in a usually broad, median area where it is replaced by a finely-sculptured, matt or shining surface. Lateral extension of S.2 groove well-developed. Hind tibia: teeth of usual size, the subtending spines 1.5-2.5 times as

high; inner spur reaching to 0.2-0.25 basitarsus length (about equal to tarsal segment 3 or slightly less); 1.1-1.2 times as long as outer spur.

Variation.— In specimens from the USA and most of Mexico the wings are orange-amber with dark base and apex; however, from USA, Arizona I have seen 2 males (BMNH) with mainly infusate wings, and from the same state a ♀ (CAS) with entirely black wings; the antenna is partly orange as usual. (Hurd (1948: 144 & 1952: 298) also reported a single melanistic ♂). However, from Mexico: Yucatan to Panamá, the wings are always entirely black. On average, the female antenna is not so extensively or brightly orange as that of the male, but the colour varies independently of wing-colour and apparently at random.

Distinctions.— The male modified gastral hairs, and rather large size are distinctive. The female antennal colour (at least apex of last segment orange), strong DTC, and its rather large size help to distinguish it from other nearctic species. However, the female of this common species is so poorly characterized and variable in both structure and colour, that after all the other, better-distinguished, sympatric species have been eliminated, *P. mildei* is what is left. Another variable species, *P. festiva*, is perhaps the most likely to be confused with it; for distinctions, see under that species; also under *P. chiron*.

Distribution.— USA southwards to Panamá, ascending to about 2,500 m in Mexico: Durango. Single records from Colombia: Muzo (♂, BMNH) and Ecuador (no further locality) (♂, USNM) need confirmation. Map fig. 676.

Material depositories.— 198 ♂♂, 153 ♀♀, 1 gynandromorph); AMNH, ANSP, BMNH, BRIO, CAS, CMNH, CSU, CUNY, EMMSU, FDA, GILLASPY, INBIO, LACM, MCZ, MHNGV, MHNNEU, MICR, MLU, MNCN, MNHNPS, MNHU, MZUSP, NRS, OSUC, PORTER, RIBPRET, SEMKU, SMF, TEXAMU, TMB, UCALD, UMOX, UNAN, UPAN, USNM, USPRIB, USU, UZMC, WASBAUER, WILLIAMS, ZMMICH.

Pepsis filiola Brèthes, 1914
(figs 386-391, 619, 620, 679)

Pepsis filiola Brèthes, 1914: 312, no. 89. Holotype ♂ (MACN) [examined].

Pepsis denserugosa Haupt, 1952: 341, no. 2. Lectotype ♀ (MLU), here designated [examined]. **Syn. nov.**

Type material.— *P. denserugosa*: I have seen both ♀ syntypes and labelled one as lectotype. The paralectotype is a specimen of *P. flavescens* Lucas.

Description.— ♂ (figs 386-391). BL 19-27. Body and legs black, with dark green (occasionally blue-green) sheen; antenna entirely black; wings dark brown (not black). S.4 with a pair of very dense, broad, lateral hair brushes; hairs strongly hooked at apex, just touching those of opposite side; interstitial hairs few, becoming rapidly shorter, straighter and sparser centrad. S.5 with only weak, lateral hair-patches. SGP with lateral, submarginal, elongate depressions in basal half; apex rounded; paramere short, only as long as rest of genitalia, apically rounded-truncate.

♀ (figs 619, 620) BL 25-34. Antenna short and thick, AE index 85-93. Colour as in male, except wing-veins more-or-less outlined paler. Head in dorsal view with temple very strongly swollen, also vertex fairly strongly. Forewing with radial cell rather rounded, SMC3 elongate. MT moderate. MPN a little shorter than PST; its furrow narrow, more-or-less strongly expanded posterad; carinae usually very fine, sometimes a

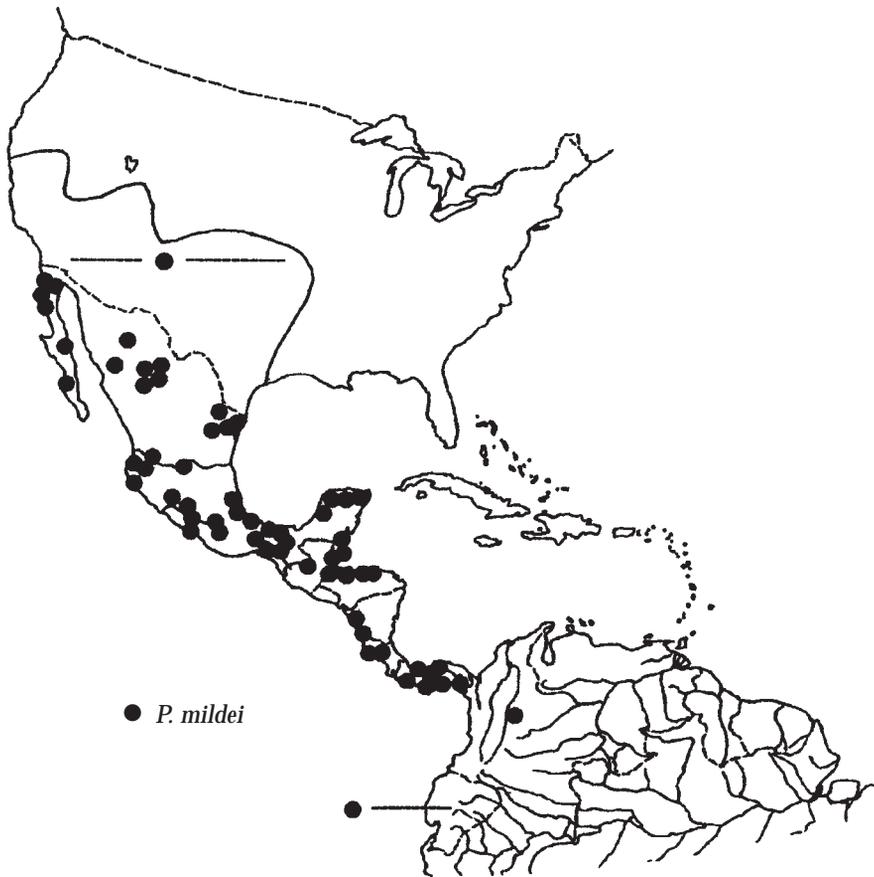


Fig. 676. Collection localities of *Pepsis mildei*.

few coarser. Propodeum: MG sometimes shallow in anterior 2/3, more often flat or ridged; always ridged in posterior 1/3. APT moderate to strong, PPT weak to moderate; DTC strong, especially medially and laterally, rather irregular, only slightly obscured by pubescence. Propodeal hair usually shorter than PST. PTC moderate to strong. Posterior face: VR absent or very weak. PFC fairly strong near PTC, usually weaker apicad and medially, giving way to a finely-sculptured, matt median area; sometimes PFC entirely weak. Lateral extension of S.2 groove strong. Hind tibia: teeth of normal size, the spines about 1.5-2.0 times as high; inner spur reaching to 0.25-0.45 basitarsus length (about equal to tarsal segment 3 or slightly longer); 1.2-1.5 times as long as outer spur.

Variation.— An aberrant male is keyed-out at couplet 4 in the General Key to males. A single female from Brazil: Minas Geraes, Araguary (MZUSP) resembles the usual colour form of *P. discolor* in that the hindwing, especially basally, is markedly paler than the fore.

Distinctions.— The male is best distinguished by details of sternal hairs and SGP; also the unusually strong PPT for its size, and the all-black antenna. The female is best characterized by the details of head shape, AS3, radial cell and SMC3 shapes, ratio of PST and MPN lengths, structure of propodeum and S.2 groove shape. It strongly resembles the darkest females of *P. discolor*; the best distinguishing characters are that *P. filiola* usually has shorter propodeal hair, a shorter MPN with a broad furrow, and a stronger PTC. For distinctions from *P. brunneicornis*, see under that species.

Distribution.— Unusual: although basically south-eastern (south-eastern Brazil and north-eastern Argentina) this species also occurs very sparsely in the west, from northern Bolivia to west-central Argentina; two records from Paraguay lack further locality; found up to about 850 m. Map fig. 679.

Material depositories.— 35 ♂♂, 35 ♀♀; AMNH, BMNH, CUNY, EMMSU, FRITZ, IMLT, INTAC, MACN, MCZ, MHNNEU, MLU, MNHNPS, MNS, MZUSP, NMV, OSUC, TMB, UCALB, ZSM.

Pepsis ruficornis (Fabricius, 1775)
(figs 364-370, 565, 677)

Sphex ruficornis Fabricius: 1775: 352, no. 37. Lectotype ♀ (UZMCK), here designated [examined].

Pepsis ruficornis; Fabricius, 1804: 215, no. 36.

Pepsis saphirus Palisot de Beauvois, 1805: 39, pl. 1, f. 4, ♀, Saint-Domingue. [Lost]. **Syn. nov.**

Pepsis ramicornis; Palisot de Beauvois, 1805: 39. [Lapsus for *ruficornis*].

Pepsis violacea Mocsáry, 1885: 255, no. 27. Lectotype ♂ (MHNNEU), here designated [examined]. **Syn. nov.**

Pepsis hexamita Lucas, 1895: 609, no. 67. Lectotype ♀ (MNHU), here designated [examined]. **Syn. nov.**

Pepsis omniviolacea Haupt, 1952: 390, no. 6. Holotype ♀ (MLU) [examined]. **Syn. nov.**

Type material.— *P. ruficornis*: in UZMCK are a ♂ and 3 ♀ specimens referable to this species; the ♂ is labelled “a”, the ♀♀ “b”, “c” and “d” (Petersen, pers. comm.). They are further labelled: “a”: original Fabrician label “*ruficornis*”; = *Priocnemioides ?bituberculata* Guérin det. Wahis; “c”: *Priocnemioides magnus* Cress., det. Wahis; “d”: *Cyphononyx bretoni* Guérin, det. Wahis. Van der Vecht (pers. comm.) notes that “specimen “b” must be regarded as type, not “a”. I have seen specimen “b” and labelled it lectotype. The other 3 specimens are paralectotypes. *P. violacea*: I have seen a single type-material ♂ and labelled it lectotype. *P. hexamita*: I have seen a single type-material ♀ and labelled it lectotype. *P. omniviolacea*: Haupt gives ?Columbia [sic] as locality for this species. However, of two ♀ specimens standing under *P. ruficornis* in MLU, one is the holotype of *P. omniviolacea* but bears no locality; the other bears the locality ?Columbia [= Colombia] and is a specimen of *P. ianthina* Erichson, which species occurs in Colombia but not in the West Indies.

Note.— The application of the name *P. ruficornis* has hitherto never been properly clarified. Banks (1946: 315) caused confusion by arbitrarily interpreting Fabricius’ term “America meridionale” as restricted to South America. In fact Fabricius gave this as a locality both in his descriptions of endemic West Indian species e.g. *P. ruficornis*, *P. rubra* (as *P. stellata*) and also in those of exclusively South American mainland species e.g. *P. luteicornis*, *P. dimidiata* etc. Thus Banks’ attempt to clarify the status of *P. ruficornis* and that of *P. saphirus* Palisot de Beauvois (described later, also from the West Indies) was doomed to failure from the outset, since it was based on a false as-

sumption. Hurd (1952: 288) pointed out that Palisot de Beauvois had himself suggested that his "*saphirus*" might be the same as "*ramicornis*" Fabricius, and that, since no such name exists, this could be a mis-spelling of *P. ruficornis*. Hurd seems to have overlooked Banks' misinterpretation of locality, and accepted the latter's conclusion that *P. saphirus* should be the valid name for the common West Indian species, further pointing out that Palisot de Beauvois' illustrations of *P. ruficornis* and *P. saphirus* certainly differed in colour. This, however, still left the name *P. ruficornis* in limbo. The lectotype of this name designated above is certainly from the West Indies; the colour differences between Palisot de Beauvois' two illustrations could be explained by the wings having strong metallic reflections which change colour according to the viewing angle. Also, this may well have encouraged a degree of "artist's licence". Perhaps surprisingly, no author has raised any objections to the apparently extremely large size of the specimen of *P. ruficornis* illustrated. The female of *P. marginata*, depicted immediately next to it, also appears to be very large for its species. Fortunately however, this latter specimen still survives, and it is indeed an outsize member of its species. Perhaps very large specimens may have been commoner at that time. Finally, of the few species which occur in the West Indies, there appears to be no other which could be represented by either of the two illustrations.

Description.— ♂ (figs 364-370). BL 11-27. Body and legs black, usually with strong violet sheen, sometimes blue or green. Antenna usually with only the 2 basal segments black, the rest more-or-less bright orange; sometimes the black extends a few segments further. Wings strongly infuscate with strong blue-violet reflections. S.4 with a pair of rather dense, lateral "brushes", the hairs of which are strong, directed inwards and backwards, very strongly hooked apically, but the apexes of the brushes not touching; between them is a variable number of much shorter, more erect hairs with weakly hooked apex, attaining about the height (not the length) of the brushes. S.5 with an arcuate band of rather dense hairs, longest towards the sides, apically curved inwards and backwards. SGP slightly flattened and expanded apicad, with a very weak median ridge; apex rounded-truncate. Paramere bluntly pointed, about 1.5 times as long as rest of genitalia. Apical projection of digitus sharply pointed on inner side.

♀ (fig. 565). BL 17-34. AE index 84-104. Colour as in male except that of antenna less variable. MT very variable, usually weak to moderate. MPN from 2/3 as long to almost equal to PST, its furrow very variable, narrow or moderately broad anteriorly and usually more-or-less strongly expanded posterad, sometimes only posteriorly; carinae usually very fine, coarser in a few very small specimens. Propodeum: MG sometimes weakly present, otherwise represented by a more-or-less flattened ridge. APT and PPT weak to moderate, sometimes strong in large specimens; PPT elongate, peg-like when strong; DTC fine to moderate, usually regular. Propodeal hair shorter than PST length. PTC weak to moderate, occasionally strong. Posterior face: VR absent to weak, moderately strong near PTC in larger specimens. PFC usually weak above, virtually absent below; sometimes gradually weaker apicad; where weaker or absent, replaced by fine, matt sculpture. Lateral extension of S.2 groove well-developed. In fresh specimens there is some rather short hair below the anterior and middle femora (less below posterior). Hind tibia: teeth of usual size, the subtending spines 1.5-2.5 times as high; inner spur reaching to 0.3-0.35 basitarsus length (about equal to tarsal segment 3 or slightly less); 1.21.5 times as long as outer spur.

Variation.— This species displays an interesting kind of variation, in which the population of each island group tends to gravitate towards a certain structural type. This is most marked in the shape of the MPN furrow; it can be anteriorly narrow or broad, then gradually or strongly expanded posterad, beginning at any point along its length, or sometimes scarcely expanded at all. Different combinations of these variables tend to crystallize into various “types” for each island group; however, although they can often be used to make an informed guess about the provenance of any single specimen, they are not sufficiently constant to be diagnostic.

Distinctions.— The strong violet body colour of most specimens and orange antennae, combined with the provenance, are diagnostic. The male modified sternal hairs are distinctive, and the female has a longer AS3 than the otherwise similar *P. ianthina* (found on the South American mainland and Trinidad); identification of both sexes is aided by the usually very fine MPN carinae. (See also *P. jamaicensis* spec. nov.). Curiously, in colour this species also closely resembles the Paraguayan form of *P. viridis*, which see.

Biology.— The following information is based on observations in the British Virgin Islands by Roy Snelling (pers. comm.). The species is found in dense forest (contrasting with *P. rubra*, treated in the first part of this work). The females avoided tarantula burrows; possibly they prey only on smaller individuals. They hold their wings flat, back over the body, constantly flicking the hind wings out to a position perpendicular to the long axis of the body. Also in contrast to *P. rubra*, they seemed to check out more limited areas before flying to a new spot, seldom venturing into dense clusters of leaf-litter, rather, running about in a very rapid and seemingly more superficial manner. Males may also cluster at night (see *P. rubra*) but only once were two seen doing this; however, the preference of this species for more forested areas makes the finding of such aggregations more difficult.

Distribution.— Endemic to the West Indies except Jamaica (where it is replaced by the closely related *P. jamaicensis*) and south of Guadeloupe. Occasionally recorded from Florida, but a single male from “Georgia” (BMNH) is probably mislabelled; occurring at altitudes up to 1,600 m in Haiti. Map fig. 677.

Material depositories.— 346 ♂♂, 258 ♀♀; AEIG, AMNH, ANSP, BMNH, BRIO, CAS, CMNH, CUNY, EMMSU, FDA, LACM, MCSNGO, MCZ, MHNGV, MHNNEU, MLU, MNCN, MNHNPS, MNHU, NHMBAS, NMV, NRS, PAGLIANO, PMA, PORTER, RMNH, SEMKU, SMF, TEXAMU, TMB, UMOX, USNM, UZMC, WAHIS, WASBAUER, ZMMOSC, ZSM.

Pepsis jamaicensis spec. nov.

(figs 468-474, 564, 677)

Type material.— Holotype ♂, **Jamaica**: U.W.I. [University of the West Indies], St. Andrews (BMNH). Paratypes: Jamaica: 1 ♀, May Pen, 28.iv.1976 (Johnson) 2 ♀♀ (N.F.L.) (all BMNH); 1 ♀, Baron Hill, Trelawny (Perkins) (MCZ); 1 ♀, St. Ann Par., Rose Hill, Runaway Bay 277 m, 29.iv.-2.v.1973 (Davis) (USNM); 1 ♀ Stoney Hill [19]37 (Bovell) (USNM); 1 ♀ (no data) (BMNH).

Note.— A ♀ found in the named collection in BMNH has an old label “*Sph. ruficornis* F. 1. 450”. These numbers coincide with Fabricius (1781) Species Insectorum, vol. 1, p. 450, his first mention of the species after its description. However, he does not mention Banks collection in either of the two papers.

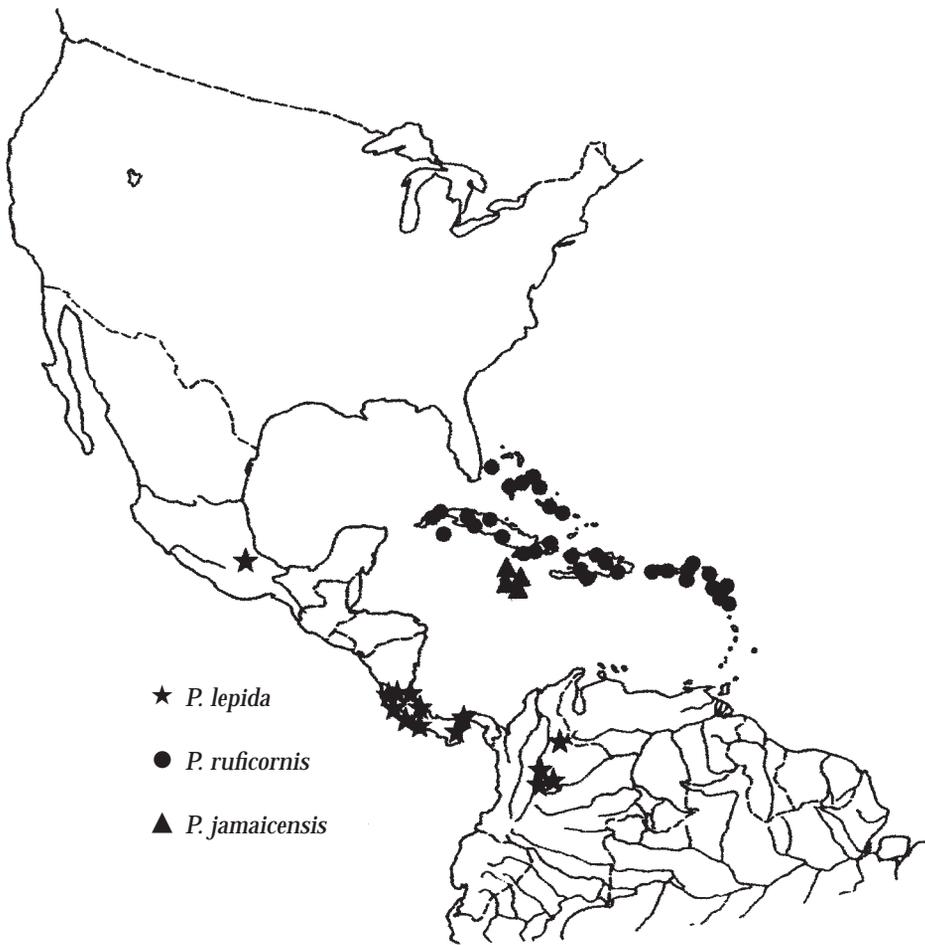


Fig. 677. Collection localities of *Pepsis lepida*, *P. ruficornis* and *P. jamaicensis*.

Etymology.— Named after Jamaica, to which island it is apparently confined.

Description.— ♂ (figs 468-474). BL 15. Body black with deep blue-green sheen, and patches of pale hair especially at sides of scutellum and MPN. Legs dark brown. Antenna black with the last 2 1/2 segments orange. Wings almost glass-clear with about the apical 1/3 of the forewing moderately infuscate, the junction diffuse; heavily infuscate along the anterior margins of SMC1 and the radial cell. About the apical 1/5 of the hindwing slightly infuscate. Antenna slender, with segments in profile progressively more strongly bent towards apex. S.4 with a weakly-defined pair of lateral brushes, whose hairs are black, quite strong but rather sparse, directed inwards and backwards, and apically strongly hooked. Between them are equally sparse but much shorter, straighter and more erect dark brown hairs. S.5 with a rather dense band of dark brown hairs, towards the sides longer and more curved apically. SGP scarcely expanded to-

wards the rounded apex; with a very broad but shallow ridge basally, obsolescent apicad. Paramere short, about as long as rest of genitalia, bluntly pointed at apex. Apical projection of digitus sharply pointed.

♀ (fig. 564). BL 15-21. AE index 87-100. Body and legs both with weak blue-violet sheen. Antenna orange from base or middle of AS3. Head in dorsal view with temple scarcely expanded. MT weak. MPN shorter than PST, its furrow very short, broad, open V-shaped; carinae very fine. Propodeum: MG present anteriorly but very shallow. APT, PPT and PTC all weak to moderate. DTC medium to fine. Propodeal hair shorter than PST. Posterior face: VR variable, at least indicated weakly near PTC, often stronger and more extensive, slightly divergent apicad. PFC strong near PTC, weaker in mid-line and gradually weaker apicad, complemented by fine, matt sculpture. Lateral extension of S.2 groove well-developed. Hind tibia: teeth small, distant, the subtending spines 2.0-2.5 times as high; inner spur reaching to 0.25-0.3 basitarsus length (about equal to tarsal segment 3), about 1.2-1.3 times as long as outer spur.

Variation.— Only as noted above.

Distinctions.— From the few specimens available, this species would appear to be smaller on average than its close relative *P. ruficornis*. The male is immediately distinguishable by its very different wing and antennal colour, also by its gastral sexual characters and very unusual antennal structure. The female body sheen is much weaker than that in *P. ruficornis*, and unlike that species the basal fenestra of DC1 is distinct. The two species are also allopatric.

Distribution.— Known only from Jamaica, ascending to about 280 m. Map fig. 677.

Material depositories.— 1 ♂, 7 ♀♀; BMNH, MCZ, USNM.

Pepsis brunneicornis Lucas, 1895
(figs. 493-498, 612, 613, 678)

Pepsis brunneicornis Lucas, 1895: 510, no. 18, ♂ (lost).

Pepsis glabripennis Lucas, 1895: 613, no. 69. Lectotype ♀ (MNHU), here designated [examined]. **Syn. nov.**

Type material.— *P. brunneicornis*: although the two syntype ♂♂ mentioned by Lucas are now lost, Haupt (1952: 338) saw one of them (from Rio de Janeiro) and considered a ♂ from Paraguay, Villarrica in his own collection as conspecific with it. I have seen this latter specimen and accept Haupt's opinion, particularly as the species is a distinctive one. *P. glabripennis*: I have seen 3 ♀♀, 2 of them certainly syntypes, from "Porto Allegre" and Pará; I have labelled the first of these lectotype. The second is a paralectotype and is a specimen of *P. festiva* Fabricius. The third specimen, which is without locality but probably a syntype, is conspecific with the lectotype.

Description.— ♂ (figs 493-498). BL 16-27. Body and legs black with dark green sheen, sometimes tinged bluish; legs, especially femora, sometimes translucent reddish-brown. Antenna mainly black to mainly orange. Wings pale amber, the extreme bases black; the forewing apex broadly and rather strongly infusate, covering almost all of the radial cell, all of SMC3, and apical parts of SMC2 and second discoidal. S.4 with modified hairs in the form of a dense, black brush on either side, the hairs of which are basally adpressed posterad, then directed inwards and backwards, finally reflexed to form a strong hook, leaving a gap between the apexes of the brushes of opposite sides; between their bases are a few much shorter hairs without hooks. S.5 has a dense,

transverse brush of rather short, sinuate but not hooked hairs, which decrease in length centrad and posterad. The SGP is slightly expanded at about one-third from its apex, and is unusual in being distinctly bent down from that point; the apex is again (narrowly) reflexed and truncate; the entire apical half of the SGP is shallowly concave. The paramere is only about as long as the rest of the genitalia, and its shape is unusual.

♀ (figs 612, 613). BL 24-34. AE index 105-115. Colour as male, except: antenna entirely orange except first 2 segments [but no females seen from northern part of range, where males have mainly black antenna]; wings entirely dark brown. Head only a little swollen; SMC3 rather large, angulate distally. MT moderate to strong; MPN slightly shorter than PST, furrow narrow to very narrow, sometimes a little expanded posteriorly; carinae rather fine, matt. Propodeum: MG usually weakly indicated near MPN, otherwise replaced by a broad, rounded ridge. APT & PPT weak to moderate, PTC moderate to strong. DTC moderately fine, regular except often a little coarser posterad, not obscured by pubescence. Propodeal hair almost as long as PST. Posterior face: VR

Table to distinguish between females of *Pepsis brunneicornis* and *P. filiola*.

	<i>P. brunneicornis</i>	<i>P. filiola</i>
Antennal colour.	Usually some apical segments orange.	Usually entirely black.
AE index.	110-115.	85-93.
Temples.	Slightly swollen.	Fairly strongly swollen.
MPN length compared with that of PST.	Equal or slightly shorter.	Slightly to distinctly shorter.
MPN furrow.	Rather narrow, parallel-sided, sometimes a little expanded posteriorly.	Narrow anteriorly, gradually widened posterad, then pre-apically abruptly, strongly widened.
MPN carinae.	Very fine, a few moderate ones centrally.	Rather fine, weakly angled, almost matt.
Length of hairs on upper side of propodeum compared with those of PST.	Equal or slightly shorter.	Equal or slightly longer.
Propodeal dorsum.	Slightly convex.	Flat.
Overall profile.	Rounded.	Distinctly angulate.
PTC.	Fairly strong, broad.	Strong, crest often narrow.
DTC.	Moderately strong, becoming more distant apicad, almost matt, clearly visible.	Moderately strong, usually regular, almost matt but not obscured by pilosity.
Carinae of propodeal posterior face.	Much weaker than DTC but still regular, obsolescent medially. Vertical ridges very weak.	Finer than DTC, regular; obsolete (sometimes only obsolescent) in a broad, matt, median area. No trace of vertical ridges.
SMC3 shape.	Usually weakly angulate distally.	Rather evenly rounded apically, only slightly bulging posterodistally.
Height of hind tibial spines.	2.0-2.5 times height of teeth.	About 2.0 times height of teeth.
Extent of hind tibial inner spur along basitarsus.	0.25-0.3.	0.25-0.4.

very weak, a little divergent posterad. PFC similar to DTC but weaker, more so posterad, often obsolescent medially. Lateral extension of S.2 groove present but usually shallow. Hind tibia: teeth often rather small but not distant, the subtending spines about twice their height; inner spur reaching to 0.25-0.30 of basitarsus length (about equal to tarsal segment 3) and 1.1-1.3 times as long as outer spur.

Variation.— Slight except in antennal colour; in Brazilian specimens (at least in males) 1-4 apical segments are orange (the junction of the colours very diffuse), while in Paraguay and Argentina the entire antenna except the two basal segments are bright orange.

Distinctions.— The male is distinguished from similar ones by the characteristics of wing-colour, sternal hair modifications, SGP and paramere structure. The female is similar to the commonest colour form of *P. viridis*, which see for differences. It is also very similar to that of *P. filiola*; see the accompanying table above.

Distribution.— Restricted to eastern and southern Brazil, Paraguay and Argentina (Misiones); a record from Argentina, Chubut, Rawson (2 ♂♂, IMLT) probably represents a labelling error; ascends to 850 m in Rio de Janeiro. Map fig. 678.

Material depositories.— 28 ♂♂, 43 ♀♀; AEIG, AMNH, BMNH, CUNY, EMMSU, ETHZ, FRITZ, IMLT, MACN, MCZ, MLU, MNHNPS, MNHU, MNRJ, MZUSP, SMF, TMB, UCALB, UFPCUR, UFVIC, UMOX, USNM, WILLIAMS.

Pepsis purpurea Smith, 1873
(figs 2, 475-480, 583, 678)

Pepsis purpureus Smith, 1873: 51. Lectotype ♀ (BMNH), here designated [examined].

Pepsis pan Mocsáry, 1885: 240, no. 2. Lectotype ♂ (TMB), here designated [examined]. **Syn. nov.**

Pepsis parthenope Mocsáry, 1885: 242, no. 6. Lectotype ♀ (TMB), here designated [examined]. **Syn. nov.**

Pepsis sagax Lucas, 1895: 681, no. 105. Lectotype ♀ (TMB), here designated [examined]. **Syn. nov.**

Pepsis clypeata Brèthes, 1914: 310, no. 86. Holotype ♀ (MZUSP) [examined]. **Syn. nov.**

Pepsis consimilis Banks, 1946: 369. Lectotype ♀ (MCZ), here designated [examined]. **Syn. nov.**

Pepsis laconia Banks, 1946: 361. Lectotype ♀ (AMNH), here designated [examined]. **Syn. nov.**

Type material.— *P. purpureus*: I have seen 3 ♀ syntypes in BMNH; 2 are from Tapajos, the other (Smith's "variety") from Pará. I have labelled as lectotype the larger of the 2 ♀♀ from Tapajos, which is conspecific with the Pará specimen. The smaller ♀ from Tapajos is a specimen of *P. dimidiata* F. Both of the latter are paralectotypes. *P. pan*: I have seen a single type-material ♂ and labelled it lectotype. *P. parthenope*: I have seen 3 ♀ syntypes: 2 labelled "Pebas" in TMB, 1 labelled "Minas Geraes" in MHN-NEU. I have labelled as lectotype one of the specimens in TMB; the other one is conspecific, but the one in MHN-NEU is a specimen of *P. smaragdina*. Both of the latter are paralectotypes. *P. sagax*: I have seen a single type-material ♀ and labelled it lectotype. *P. consimilis*: I have seen 5 ♀ syntypes; however, although 5 are mentioned in the original description, one locality (PERU: Putumayo district, El Eucanto [= El Encanto]) is not represented among the specimens I have seen. The specimen I have labelled lectotype is from Ecuador, Tena, as also are another 3 (likewise in MCZ). The fifth specimen (in AMNH) is from Ecuador, Rio Upano, Sucria [= Sucua]. The last 4 specimens mentioned are paralectotypes, and all 5 are conspecific. *P. laconia*: Although Banks mentioned 3 specimens from 2 localities, and 2 depositories, he did not make

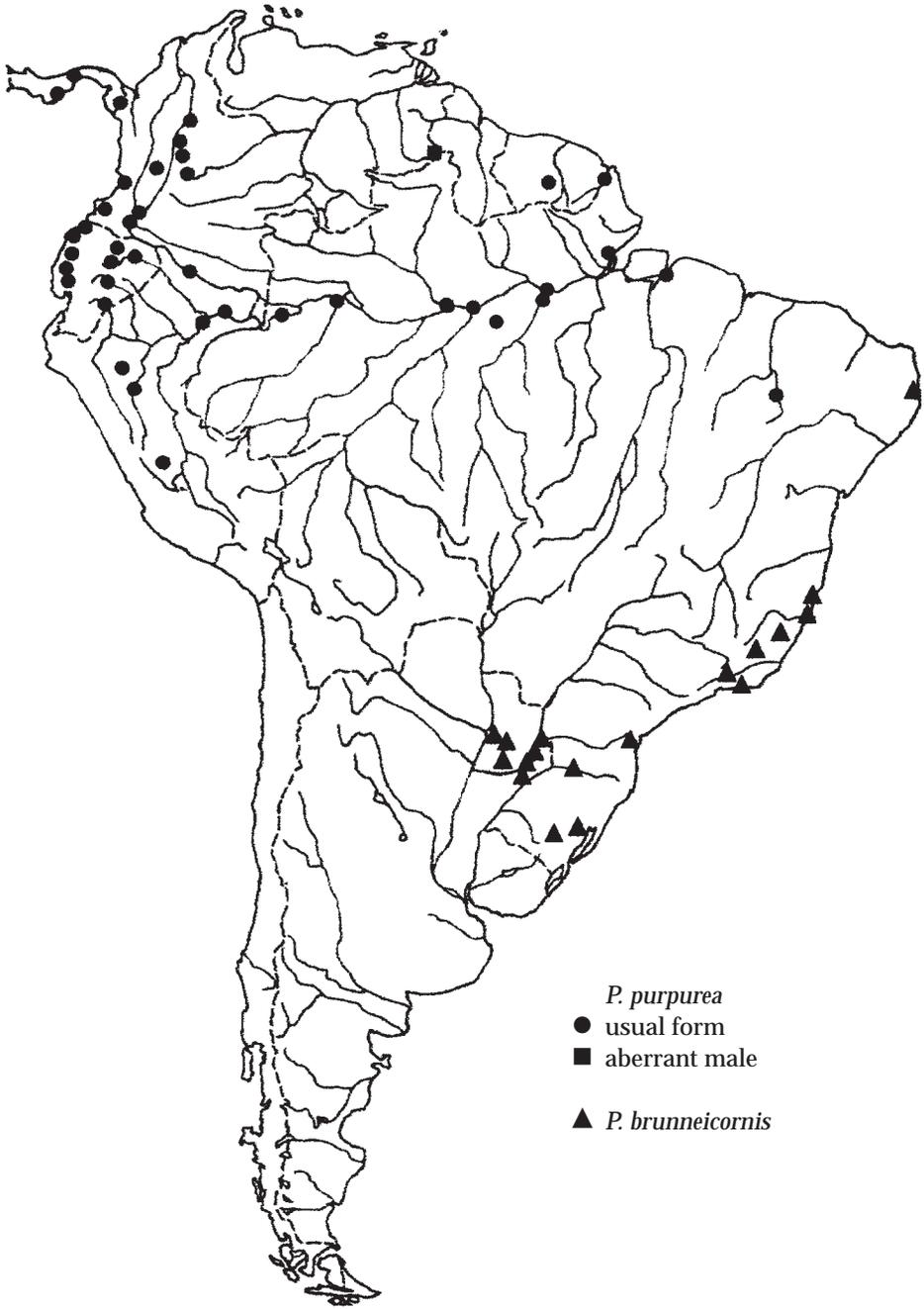


Fig. 678. Collection localities of *Pepsis purpurea* and *P. brunneicornis*.

clear to which specimens his use of the words “type” and “paratype” pertained; I have therefore designated one of the 2 ♀♀ from Achinamiza (both in AMNH) as lectotype. The remaining 2 ♀♀ are paralectotypes, but only the one from Achinamiza is conspecific with the lectotype; the one from Moyobamba is a specimen of *P. infuscata*.

Description.— ♂ (figs 2, 475-480) BL 11-18(-20). Body and legs black with brilliant light green or blue-green reflections; antenna black with 0-3 apical segments pale (see Variation). Wings with apical third to half moderately or heavily infuscate, the boundary well-defined to very diffuse. S.4 hairs forming small but very dense lateral brushes directed strongly inwards and backwards, strongly hooked apically, those of opposite sides scarcely touching; no hairs between the pair of brushes. S.5 sometimes has a more-or-less developed, thin, sparse, transverse band of rather long, straight, pale hairs. SGP rather elongate, virtually parallel-sided with apical hairs no longer than its maximum width. Paramere bluntly pointed apically, equal to or scarcely longer than rest of genitalia. Apical projection of digitus sharply pointed on inner side (see Variation).

♀ (fig 583). BL 14-26. AE index (96-)102-128. Body and legs black with deep blue-green metallic sheen. Antenna with 4-8 apical segments orange (but see Variation). Wings usually heavily infuscate. Head quite strongly transverse. SMC3 of forewing rather elongate and bulging postero-distally. MT weak to very strong; MPN length equal to or slightly shorter than PST; furrow rather narrow, stopping short of anterior margin or obsolescent before it; carinae fine. Propodeum: MG occasionally indicated weakly anteriorly, more rarely posterad, but usually replaced by a strong ridge; APT moderate to very strong, PPT weak to very strong, PTC absent to moderate. Propodeal hair length variable but always shorter than PST. DTC usually regular, stronger and more distant posterad. Posterior face: VR weak, but the area between them more-or-less raised; PFC: often a few rather strong ones near PTC, but quickly becoming weak and irregular posterad. Lateral extension of S.2 groove present but sometimes rather short. Hind tibia: teeth often rather distant, the spines 2.0-2.5 times their height; inner spur reaching 0.3-0.45 basitarsus length (approximately equal to tarsal segment 2), and 1.2-1.3 times as long as outer spur.

Colour variation.— Males from Central America tend to have the apical half of the forewing heavily infuscate, rather than the apical third moderately so. Specimens from the west coast of Colombia and Ecuador also have half the forewing infuscate, but more lightly and with the boundary very diffuse. Specimens from east of the Andes usually have about the apical third moderately heavily infuscate, but a few specimens, especially from the Amazon mainstream, resemble the west coast specimens. The heavier the infuscation, the stronger the blue-violet reflections. Males from Central America, west of the Andes and near the Amazon mainstream usually have the apical antennal segments pale yellow; those from the rest of the Amazon basin, orange. Amazon mainstream males also have very short, dense silvery hair on the sides of the thorax.

Most females have the wings entirely heavily infuscate; in occasional specimens the wings are slightly paler basad, or entirely lightly infuscate. One of two females labelled only “Amazonas” (ZSM) has the antenna pale yellow from sub-basally on AS3 onwards. Although females from the eastern Amazon tend to have more seg-

ments pale than do those in the west, occasional specimens from anywhere on the Amazon, also from Panamá, have the entire antenna from AS3 onwards pale yellowish-white.

Structural variation.— Many males from west of the Andes to Panamá, and a few from east of the Andes, have a slight pre-apical depression in the SGP; however, a range of intermediates occurs between these and the usual form, and all the specimens are otherwise structurally identical. A large male (BL 20) from Venezuela: Bolívar, El Dorado, Sta. Elena, km. 126, 1,300 m (MIZAM) has a brush of hairs on either side of S.3, similar to those on S.4 but with few hairs, which are only slightly hooked apically (altogether thus somewhat resembling those of *P. purpureipes*). Females vary only as noted above.

Particular variation.— A single male from Venezuela: Bolívar, Santa Elena-El Dorado km.126, 1,300 m, 3-9.vi.73 (MIZAM) differs from other males in the following ways (cf. description of usual males): BL 20; wings entirely dark; S.3 with very narrow lateral brushes formed of long hairs with small, apical hooks; S.4 hairs denser, with stronger apical hooks; SGP slightly more strongly expanded apically; paramere a little longer, with carina on inner side and more swollen apically; inner projection of digitus apex more slender and curved distad. Most of these differences can be extrapolated from the variation known in other specimens, but the S.3 hairs and differences in internal genitalia are suggestive of distinct species status. Nevertheless, since this specimen is geographically so far distant (extreme eastern Venezuela) from any others so far seen, the observed differences possibly represent no more than distinct population status, and it seems unwise to describe it as a new species at present.

Distinctions.— The male is distinguished from others by the shape of its S.4 hair-brushes, absence of intervening hairs between them, usually the lack of modified hairs on S.5, and SGP shape.

The female is similar to specimens of *P. sabina* but has normal-sized hind tibial teeth (very small in *P. sabina*); also, *P. sabina* has a longer AS3, the head more transverse, MPN furrow strongly expanded apicad and the DTC coarser. In Panamá, where this species is sympatric with *P. lepida*, the females strongly resemble small specimens of the latter (see the table of distinctions given under *P. lepida*).

Distribution.— A transandean species; found from Panamá southwards to Ecuador on the Pacific coast, and central Perú east of the Andes; apparently rare in Venezuela and not recorded from Guyana; found along the entire Amazon mainstream, but extending scarcely southwards except for a single record from eastern Brazil: Piauí (♀, TMB) which needs confirmation. Ascends to 1,800 m in Ecuador: Pichincha. Map fig. 678.

Material depositories.— 121 ♂♂, 101 ♀♀; AEIG, AMNH, BMNH, BRIO, CAS, CMNH, COOPER, CUNY, EMMSU, FDA, HENSEN, INBIO, INPA, LACM, MACN, MCZ, MNH-NPS, MNRJ, MZUSP, NRS, PMA, PORTER, PUCEQ, RMNH, SMF, TMB, UFPCUR, UMOX, UNCBG, UNPBOG, UPAN, USNM, USU, UZMC, WASBAUER, ZSM.

Pepsis viridisetosa Spinola, 1841
(figs 507-514, 627, 628, 679)

Pepsis viridisetosa Spinola, 1841: 104, ♂, Cayenne. (Lost).

Pepsis eximia Smith, 1873: 49. Lectotype ♂ (BMNH), here designated [examined]; Lucas, 1895: 509.

Syn. nov.

[*Pepsis thunbergi* Dahlbom; Lucas, 1895: 504. Misidentification].

Pepsis infuscata Lucas, 1895: 504. [MS name cited in synonymy].

Pepsis confusa Fox, 1897: 281. [Unnecessary replacement name for *eximia* Smith; Lucas, 1895: 509].

Type material.— *P. eximia*: I have seen a single type-material ♂ and labelled it lectotype.

Description.— ♂ (figs 507-514). BL 17-22. Body and legs black, most of body (especially sides; and entire posterior face of propodeum) with patches of pale golden hair, both adpressed and erect; where the body is not thus covered, it is brilliant metallic light green (especially on gaster). Antenna usually bright orange from AS3 to end (but see Variation). Wings amber with a dark brown band covering most of the apical third of the forewing, but only the tip of the hindwing. The S.4 hairs are black, and form a pair of very dense lateral brushes which are directed strongly inwards and backwards, very strongly hooked apically, in perfect specimens scarcely touching those of opposite side. Between the brushes anteriorly are no hairs; on the inner, posterior side of each brush are a few much shorter, pale brown hairs (easily overlooked). S.5 hairs rather short, medium brown, in a rather broad transverse band, the hairs either side of the centre-line longer and moderately curved apically. SGP essentially a long rectangle, in the basal half the sides sometimes very slightly flattened and expanded; apex rounded to rounded-truncate, sometimes with a few hairs at most as long as 1/2 SGP width; the extreme margin often translucent-brown. Paramere broad, apically asymmetrically rounded, about as long as rest of genitalia; inner projection of digitus apex round-pointed.

♀ (figs 627, 628). BL (18-)21-32(-34). AE index 105-118(-133). Body and legs black, with weak blue-violet sheen. Antenna basally black, the rest usually mainly orange, beginning very diffusely on AS3 and wings black with weak blue-violet reflections or orange-amber with dark apical band (see Variation). Head in dorsal view with temple slightly swollen. MT moderate to strong (occasionally weak), usually blunt. Forewing: stigmal fenestra usually only as broad as subcosta; 1r-m gently curved (sometimes more strongly anteriorly); 2r-m likewise but often more strongly posteriorly, so that SMC3 is quite strongly bulging postero-distally; SMC3 rather long, with the anterior vein usually a little shorter than the postero-distal, emphasizing the bulging effect. MPN usually a little shorter than PST (occasionally much shorter), its furrow usually stopping abruptly before anterior margin, narrow, but often strongly expanded posterad; carinae fine to extremely fine, matt. Propodeum: junction of dorsal and posterior faces more-or-less rounded in profile; MG sometimes indicated, when it can run straight through on to posterior face in the absence of a PTC. APT & PPT weak to moderate, the latter more-or-less rounded; DTC rather fine but regular and even, sometimes slightly stronger and more distant apicad; PTC commonly weak or absent, occasionally stronger, especially in larger specimens, when its position is often more anterior than usual. Propodeal hair about as long as MPN. Posterior face: VR usually quite strong and close, divergent from PTC, sometimes more distant and virtually parallel; PFC quite strong but usually none are complete across centre; rapidly obsolescent below. Lateral extension of S.2 groove rather short but deep. In fresh specimens there are a few weak hairs below the front femur. Hind tibia: teeth rather small, occasionally very small, subtended by spines about 2.0-2.5 times as high, and with a

sparse row of slightly curved, backwardly-directed bristles on the inner side of the teeth; inner spur very short, reaching to about 0.2-0.3 basitarsus length (about equal to tarsal segment 3) and 1.2-1.3 times as long as outer spur.

Variation.— The antenna has only the last 3 segments orange in a male from each of Venezuela: Amazonas, Rio Negro, Rio Baria (MIZAM) and Brazil: Pará, Belém-Mocambo (MPEG). In 4 females from Brazil: Pará (FRITZ, BMNH) the antennal orange begins more-or-less irregularly on AS5-7. Some of the females from French Guiana: Mana River have orange-amber wings with a narrow, dark apical border and mainly dark antenna; with this exception, the antennal orange is generally more extensive in specimens from the Guianas than from Amazonia proper.

Structural variation, although considerable in this species (see Description), shows little regional tendency.

Distinctions.— The male of this species and of the allopatric *P. brunneicornis* are the only two of similar appearance which usually have the antenna almost entirely orange; in the latter species the S.4 hair-brushes have many hairs in the gap between them, and the S.5 hairs are much denser and black.

The female of this species is very similar to that of *P. hyalinipennis*, which see. It is also extremely similar to female *P. infusata*, but usually has the hind tibia with a much shorter inner spur; in individuals where this character is inconclusive, the following table must be used.

Table to distinguish females of *Pepsis viridisetosa* and *P. infusata*.

[N.B. Most characters vary beyond the limits given.]

<i>P. viridisetosa</i>	<i>P. infusata</i>
AE index 105-118; orange colour usually beginning diffusely on AS3.	AE index 105-125; orange colour beginning on AS4-8.
MT most often bluntly pointed.	MT most often sharply pointed.
Forewing: stigmal fenestra narrow, about as broad as subcosta;	Forewing: stigmal fenestra broad, broader than subcosta;
PPV of normal length and position;	PPV often rather short and transverse;
SMC3 with anterior vein usually about equal to postero-distal vein.	SMC3 with anterior vein equal to or slightly shorter than postero-distal.
MPN furrow stops abruptly, before anterior margin.	MPN furrow attenuate anteriorly, often reaching margin (but usually as in <i>P. viridisetosa</i> in Guianas).
Junction of dorsal & posterior faces of propodeum rounded in profile;	Junction of dorsal & posterior faces of propodeum rather swollen, hence slightly angulate in profile;
PPT rounded.	PPT sharp.
PTC weak or absent, its position more anterior than usual; most PFC incomplete centrally.	PTC weak to moderate, its position normal; a few uppermost PFC more-or-less complete.
Inner spur of hind tibia short, reaching to about 0.4 of basitarsus or less, slightly longer than outer spur.	Inner spur of hind tibia long, reaching to about 0.45 of basitarsus, markedly longer than outer spur.

Distribution.— Recorded from southernmost Venezuela, the Guianas and entire Amazon mainstream in Brazil; always at low altitudes (up to 450 m in Suriname). Map fig. 679.

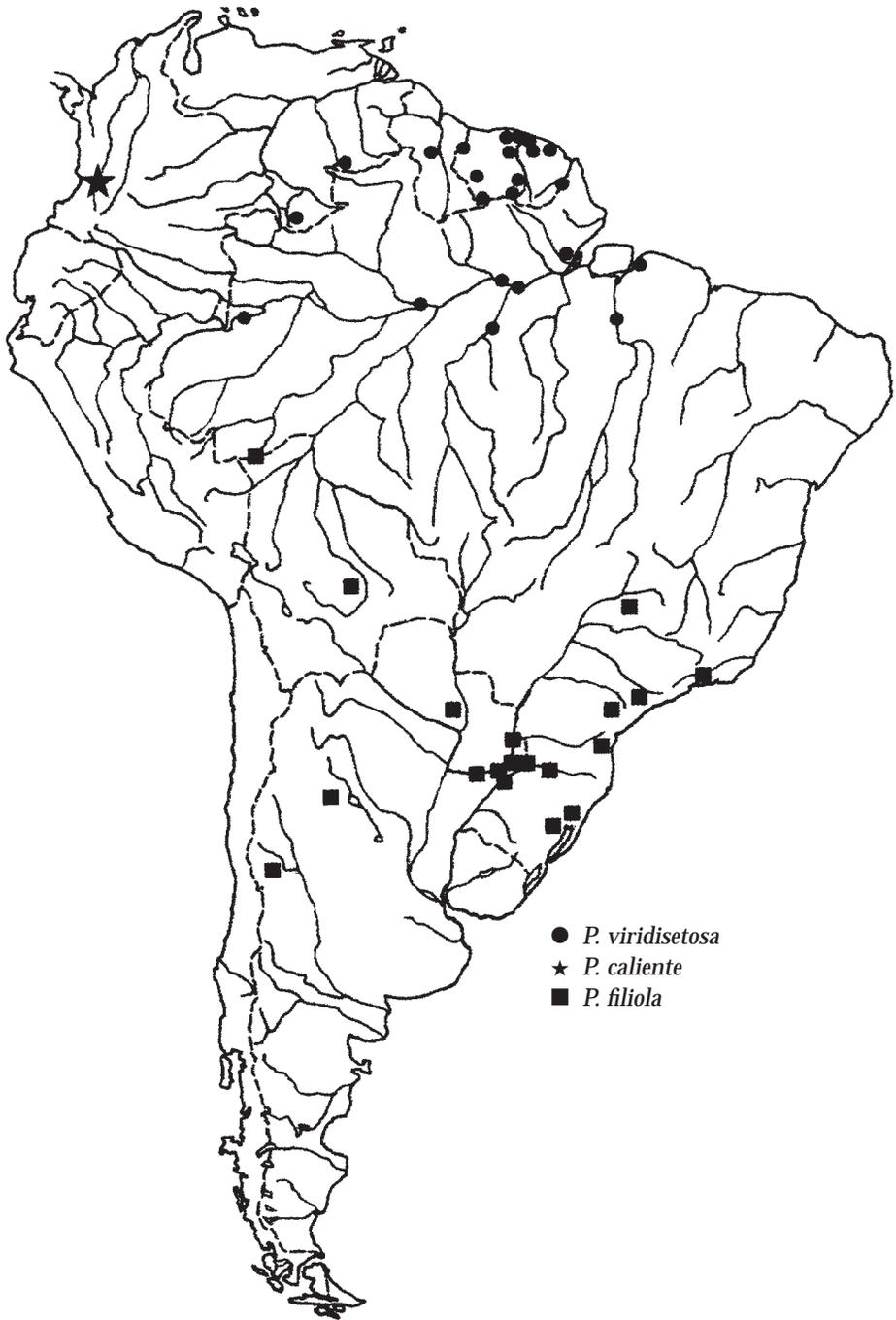


Fig. 679. Collection localities of *Pepsis viridisetosa*, *P. caliente* and *P. filiola*.

Material depositories.— 20 ♂♂, 60 ♀♀; BMNH, CMNH, CUNY, ETHZ, FRITZ, INPA, MCZ, MHNNEU, MIZAM, MLU, MNHNPS, MNRJ, MPEG, NMV, RMNH, SCHWARTZ, SEMKU, TMB, UFPCUR, UZMC, WAHIS, ZSM.

Pepsis adonta spec. nov.
(figs 515-521, 544, 675)

Type material.— Holotype ♂, **Paraguay**: San Pedro, Cororo-Rio Ypane, 2830.xi.1983, Malaise trap (Wasbauer) (WASBAUER). Paratypes: 1 ♂, data as holotype but 27-30.xi (not Malaise trap); 1 ♂ same data but 1-4.xii (Malaise trap); 3 ♂♂ same data but 5-9.xii (all WASBAUER, BMNH); **Bolivia**: Dept. Beni, Rio Mamore approx. 10km e San Antonio, 3 ♂♂, 11, 12 & 13.viii.1965 (Bouseman) (AMNH, BMNH); 1 ♂, same data but Rio Mamore at mouth of Rio Ibare, 15-16.viii.1965 (AMNH); **Paraguay**: Colonia Summerfield, 6 ♀♀, iv.1960 (WASBAUER, BMNH); **Brazil**: 1 ♀, BA (= Bahia), Roda Velha 20k s. 8.xi.85 (Raw) (UMOX); Brasilia, 1 ♀, 27.iii.1964 (Ross) (CAS); 1 ♂, Pará, Rio Xingu, Cach[oeira] do Espalho, 21-28.x.1986 (Val) (MZUSP); Canoas*, 1 ♂ (Steinheil) (ZSM); Canoas*, 1 ♂ (MZUSP). *This name occurs in several Brazilian states.

Etymology.— This species is named after the virtual absence of hind tibial teeth.

Description.— ♂ (figs 515-521). BL 14-21(-25). Body and legs black with bright, deep green to blue-green metallic sheen; sometimes some body parts are covered with short, dense, silver-golden hair patches. Antenna black with 2-3 apical segments orange or ivory-white (but see Variation). Wings clear to amber with base very narrowly, and apical 1/3 (approximately) fairly heavily infuscate, the junction rather diffuse, more so posteriorly. S.4 hairs long, apically very strongly hooked, forming a very dense, lateral brush, directed strongly inwards and backwards but not touching that of opposite side; no hairs between them anteriorly, but some short, sometimes dense ones near the apical margin of the segment. S.5 with a more-or-less dense, broad, apical band of short hairs; sometimes a few of the laterals longer and incurved apically. SGP rectangular, the basal half with an extremely weak median keel, the apex sometimes quite strongly and abruptly expanded, rounded-truncate. Paramere rather broad, about as long as rest of genitalia, apically obliquely truncate, the inner end of the truncation almost tuberculate; without long hairs. Inner projection of digitus apex bluntly pointed.

♀ (fig 544). BL 23-26. AE index 89-95. Body and legs black with a very weak blue-violet metallic sheen. Antenna black with orange colour beginning irregularly on AS3-5. Wings heavily infuscate with very weak blue-violet reflections. Head in dorsal view with temple weakly swollen. Antenna thick, AS3 appearing short. MT moderate to strong, sometimes quite sharply pointed. Forewing with PPV often shorter and more transverse than usual. MPN equal to or slightly shorter than PST, its furrow not reaching anterior margin (or doing so in attenuate form), beginning very narrow (almost suture-like) but weakly expanded posterad; carinae extremely fine, matt. Propodeum: MG sometimes very weakly indicated posteriorly, otherwise replaced by a ridge, broad and round anteriorly, narrow and flattened posteriorly. APT and PPT weak to moderate, DTC rather fine and regular anteriorly, becoming gradually stronger and more distant posterad. Propodeal hair very short, about 1/2 PST length. PTC moderate to strong, most often rather short. Posterior face: VR weak to moderate, usually strongly divergent from PTC, present in upper half or less; PFC strong above, weaker below but more-or-less covering whole of face; weaker in median line. Lateral extension of S.2 groove well developed. Hind tibia:

teeth vestigial (virtually absent), subtended by spines about 1/2-2/3 MPN length; with a sparse, more-or-less alternating row of weaker spines and bristles on their inner side. Inner spur reaching to about 0.3-0.4 basitarsus length (about equal to tarsal segment 3 or slightly longer) and 1.2-1.4 times as long as outer spur.

Variation.— Paraguayan and Bolivian males show population differences or tendencies as follows (Bolivian in parentheses where counterpoint not obvious): antennal apex is ivory-white (orange), but a large male, BL 25, from Brazil: Canoas has the antenna lemon-yellow from AS3 onwards, and the basic wing-colour clear (amber), S.4 hairs with fewer short apical hairs, S.5 with sparser hairs (the Brazilian male (see above) has S.5 hairs more like those of the Paraguayan males), SGP parallel-sided throughout (more-or-less expanded apically). However, there is much variation in structure within each population, such as to make it unlikely that two species are present. The holotype has been designated from the Paraguayan males because they are associated with females. The female varies only as noted above.

Distinctions.— The male is similar to that of *P. viridisetosa* but has much more orange colour on the antenna and that species is distantly allopatric; the female is well distinguished by its vestigial hind tibial teeth (a sporadic attribute in this genus), together with its more general characteristics.

Distribution.— Known only from Bolivia, Paraguay and Central Brazil, at low altitudes. Map fig. 675.

Material depositories.— 13 ♂♂, 8 ♀♀; AMNH, BMNH, CAS, MZUSP, UMOX, WASBAUER, ZSM.

Pepsis caliente spec. nov.
(figs 392-397, 679)

Type material.— Holotype ♂, **Colombia**: Cali 1,035 m, (Dirings); x.1959 [back of label] (MZUSP). (Parts of hind tarsi glued on card; antenna missing from AS4 onwards on both sides).

Etymology.— Named after the type locality, with a pun on the Spanish word for “hot”.

Description.— ♂ (figs 392-397). BL 25. Body black with weak violet reflections; antennal colour unknown, at least 3 basal segments black; wings quite strongly infuscate with very unusual, strong, metallic golden reflections. Head in dorsal view not swollen behind eyes, transverse-triangular. MPN as long as PST, flattened in centre, the furrow broad posteriorly but obsolescent anterad, with a few strong carinae. Propodeum elongate, MG distinct anteriorly, obsolescent posterad; DTC rather fine, very regular; APT very weak; PPT and PTC moderately strong but blunt, the PPT very elongate and the PTC a slightly transverse tubercle. S.4 with a pair of large, very dense lateral hair brushes, inclined strongly backwards and inwards, their apexes extremely strongly hooked but those of opposite sides not quite touching; between them are a few, short, very weak hairs. S.5 has a few short, weak hairs across the centre, and the postero-lateral tufts of short hair are a little stronger than usual. SGP rather small and narrow, parallel-sided, apically rounded-truncate; with a complete but weak median keel. Paramere scarcely longer than rest of genitalia, broad, inner side with a flattened flange in basal half, apical one-third swollen, apex with a rounded point. Inner projection of digitus

apex very sharply pointed but not slender, turned slightly distad.

♀. Unknown.

Distinctions.— The strong, metallic, golden-green wing reflections are very unusual; the S.4 hairs are very similar to those of *P. mildei* but the head shape, MPN, propodeum and S.5 hairs are all different.

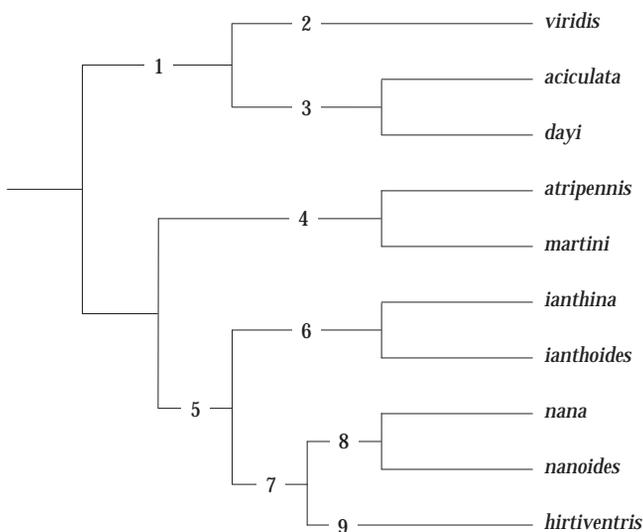
Distribution.— Known only from the type locality. Map fig. 679.

Material depository.— 1 ♂; MZUSP.

The *Pepsis viridis* group

Description.— The ten species assigned to this group are small and slender-bodied (BL males 12-25, females 14-38), except the females of *P. aciculata*, *P. dayi* and *P. viridis*, whose females are robust; that of *P. viridis* is also considerably larger (BL 23-38). The body is black with a blue, green or violaceous sheen; the amount of orange on the otherwise black antenna varies greatly, but most forms have at least some. A single species always, and another species sometimes, has the wings orange-amber with a dark, apical border, all the remaining species divide into two colour groups: one with all-black wings, the other with a transverse whitish or yellow-orange transverse band (belonging to the *atripennis* mimicry-group); both forms often occur in the same species. Males have the S.4 with an apical, transverse band of short hairs, resembling a toothbrush; the length of the hairs varies between species, and so does their overall outline: sometimes it forms a shallow, even arc, sometimes it is irregular due to slightly uneven hair length. Sometimes S.5 also has an extremely thin, apical band of hairs, about half as long as those on S.4. The females lack distinctive group-characters; however, the lateral extension of the S.2 groove is strong except in one species, where it is absent. Species whose main range lies in the east Andean precordillera have a strongly pilose body and legs.

Cladogram for the *P. viridis*-group



Characters:

1. Robust species; SGP broadened apicad; female propodeum broad, head swollen behind eyes.
2. Large species.
3. S.4 hairs in broad band.
4. S.4 hairs extremely short.
5. S.4 hairs long; S.5 hairs strong.
6. AS3 short.
7. SGP narrowed apicad, bent down; paramere short, truncate; female legs pilose.
8. S.4 hairs short; S.5 hairs weak; propodeal groove sinuate anteriorly.
9. Female S.1-S.2 junction constricted; sternites pilose.

Internal relationships.— Of the ten species in this group, six form very closely related pairs, *viz.* *atripennis/martini*, *ianthina/ianthoides*, *nana/nanoides*.

External relationships.— This group has strong affinity with that of *P. auriguttata*; the females of *P. nana* and *P. auriguttata* resemble each other in several strong characters, notably habitus, very short PPV, all legs densely hairy.

Biology.— At least some individuals of both sexes of most species belong to the *atripennis* mimicry-group (having yellow bands close to the base of the wings), and in a few cases all individuals belong. However, *P. viridis* is exceptional in occurring in no less than four distinct, geographically based colour forms.

Biogeography.— This group is found from Honduras southwards to Perú west of the Andes, and on the eastern side everywhere south to Argentine Patagonia; it is not known from the West Indies or Chile. Most species inhabit lowland; a few are found on higher ground, and a transandean one reaches 2,000 m in Colombia. The ranges of each pair of the three species-pairs in this group are more-or-less separated by the Amazon basin, and show a strong north-west/south-east bias. Species-pairs are discussed after the main cladogram (see Introduction), but although the pairs in the *viridis*-group are very closely related, they lack the unique characters of those in Part 2. They may thus represent another phenomenon of this kind, perhaps resulting from the fluctuating size of the Amazon lake isolating populations into eastern and western portions for a significant time.

Pepsis viridis Lepeletier, 1845
(figs 7-10, 149-158, 592, 593, 680)

Pepsis errans Lepeletier, 1845: 483. Lectotype ♀ (MIZSU), here designated [examined]. **Syn. nov.**

Note.— The name *viridis* is here retained rather than *errans* because the former is based on a male and is much the better-known name.

Pepsis viridis Lepeletier, 1845: 485. Lectotype ♂ (MIZSU), here designated [examined].

Pepsis chlorotica Mocsáry, 1885: 251, no. 20. Lectotype ♂ (MHNNEU), here designated [examined]. **Syn. nov.**

Pepsis excelsa Lucas, 1895: 592, no. 58. Lectotype ♂ (MNHU), here designated [examined]. **Syn. nov.**

Pepsis selene Lucas, 1895: 670, no. 95. Lectotype ♀ (MNHU), here designated [examined]. **Syn. nov.**

Pepsis fimbriata Lucas, 1895: 676, no. 100. Lectotype ♂ (MNHU), here designated [examined]. **Syn. nov.**

Pepsis calypso Brèthes, 1908: 236. Lectotype ♂ (MACN), here designated [examined]. **Syn. nov.**

Pepsis fluminensis Brèthes, 1908: 237. Holotype ♂ (MACN) [examined]. **Syn. nov.**

Pepsis argentinus Strand, 1910: 16, no. 25. Holotype ♂ (MW) [examined]. **Syn. nov.**

Pepsis mimetica Brèthes, 1914: 286, no. 43. Holotype ♂ (MACN) [examined]. **Syn. nov.**

Pepsis garbei Brèthes, 1914: 297, no. 60. Lectotype ♀ (MZUSP), here designated [examined]. **Syn. nov.**

Pepsis erecta Brèthes, 1914: 299, no. 64. Holotype ♂ (MZUSP) [examined]. **Syn. nov.**
Pepsis tandilensis Brèthes, 1914: 338, no. 131. Holotype ♀ (MACN) [examined]. **Syn. nov.**
Pepsis meridionalis Brèthes, 1914: 340, no. 135. Holotype ♂ (MACN) [examined]. **Syn. nov.**
Pepsis smaragdina var. *minor* Lucas, 1919: 77. Lectotype ♀ (SMTD), here designated [examined]. **Syn. nov.**
Pepsis smaragdina ab. *basifulgens* Lucas, 1919: 78. ♂. Brazil: Espirito Santo, (lost). **Syn. nov.**
Pepsis smaragdina ab. *nebulosipennis* Lucas, 1919: 78. ♀. [No locality], (lost). **Syn. nov.**
Pepsis smaragdina ab. *purpurea* Lucas, 1919: 79. [Not Smith, 1873]. ♀, Brazil: Espirito Santo, (lost). **Syn. nov.**
Pepsis koerberi Lucas, 1919: 82. ♀, [Brazil:] S. Paulo (lost). **Syn. nov.**
Pepsis inimicissima Lucas, 1919: 83. ♀, [Brazil:] S. Paulo, (lost). **Syn. nov.**
Pepsis debilitans Lucas, 1919: 84. ♀, [Brazil:] São Paulo, (lost). **Syn. nov.**
Pepsis itapaca Banks, 1946: 387. Lectotype ♂ (MCZ), here designated [examined]. **Syn. nov.**

Type material.— *P. errans*: I have seen 2 ♀♀ which were standing under this name in MIZSU, and have labelled one of them as the lectotype of this species. The other specimen is the lectotype of *Pepsis inclyta* (which see). *P. viridis*: I have seen 2 ♂ syntypes. I have labelled as lectotype the one with coarser propodeal sculpture, which is more complete than the other specimen and agrees better with the description. The paralectotype is conspecific. *P. chlorotica*: I have seen a single type-material ♂ and labelled it lectotype. *P. excelsa*: I have seen three ♂ and two ♀ syntypes, and have labelled as lectotype the the larger of the two ♂♂ (locality “Matto Grosso” [= Mato Grosso]) in MNHU; the other bears the locality “Muzo” (if the latter is the locality of this name in the Colombian Andes, the specimen must be mislabelled). These ♂♂ and the one in TMB (“Piauhy” [= Piauí]) are all conspecific, but the ♀ in MNHU (“St. Jean” [du Maroni, Cayenne?]) and the one in NMV (“Porto Rico” [= Puerto Rico]) are both specimens of *P. ruficornis* (F.). I have not been able to locate a “St. Jean” in the West Indies; if such does not exist, the specimen is probably mislabelled. Indeed, its sculpture type indicates a probable Cuban origin. All specimens apart from the lectotype are paralectotypes. *P. selene*: I have seen a single type-material ♀ and labelled it lectotype. *P. fimbriata*: I have seen a single type-material ♂ and labelled it lectotype. *P. calypso*: I have seen only the syntype in MACN. Two ♂♂ in MLP have no type status, though they are conspecific with the lectotype. *P. fluminensis*: In addition to the holotype (from Rio de Janeiro), I have seen also the additional ♂ (from Sarocaba, São Paulo) (MZUSP) mentioned by Brèthes later (1914: 300). It has no type status, but is conspecific with the holotype. *P. garbei*: I have seen all 4 syntypes mentioned in the original description: 3 from Espirito Santo and 1 from São Paulo, Raiz da Serra. I have labelled the only one with complete Antenna (from the first-mentioned locality above) as lectotype. Of the 3 paralectotypes, 2 are conspecific with the lectotype but the other (from São Paulo) is a specimen of *P. festiva* F. *P. minor*: I have seen 3 syntype ♀♀ and have labelled as lectotype the one bearing a hand-written label “*Pepsis smaragdina* var. *minor* n./Det. R. Luc.” This specimen and another are conspecific and the latter is a paralectotype; both are in SMTD. A third paralectotype ♀, which is in MNCN, is a specimen of *P. smaragdina* Dahlbom. *P. itapaca*: I have seen 6 ♂ and 3 ♀ syntypes in MCZ; all have identical collection data and are conspecific. I have labelled a ♂ in perfect condition as lectotype; the remaining specimens are all paralectotypes.

Description.— ♂ (figs 149-158). BL 12-25. Body and legs black with dark green, blue or violet sheen (see Variation); antenna black with up to 11 segments orange. Wings black with variably strong blue-violet reflections, black with yellow band, or mostly

amber (see Variation). S.4 with a narrow, transverse band of short hairs, length about 1.2-1.5 times SGP apex width and curved slightly inwards and backwards. S.5 with only a sparse band of weak hairs about half the height of those on S.4. SGP more-or-less strongly expanded towards the rounded-truncate apex; when strongly expanded, the apex is sometimes shallowly emarginate. Parameres blunt, about 1.5 times as long as the rest of the genitalia. Apical projection of digitus slender, slightly curved.

♀ (figs 592, 593). BL 23-38. AE index 76-108 (see Variation). Colour as in male except up to 10 antennal segments are orange. Head in dorsal view moderately swollen behind eyes. AS3 approximately equal to UID. PPV of forewing usually very short. MT small to moderate but usually quite sharp. MPN equal to, to distinctly shorter than, PST (see Variation); its furrow variable, usually more-or-less expanded posteriorly; carinae variable, usually moderately strong. Propodeum: MG replaced by a rather broad ridge, dorsal surface of propodeum very uneven at sides. APT and PPT moderate to strong. DTC quite strong, usually slightly wavy but otherwise fairly regular; partly obscured by hair. Propodeal hair a little shorter than PST. PTC usually rather wide, strong, often slightly emarginate centrally, especially in larger specimens. Posterior face: VR weak but emphasized by PFC which are fairly regular (usually weaker below) over most of surface; all (except sometimes uppermost) interrupted centrally leaving a finely-sculptured, matt area. Lateral extension of S.2 groove well-developed. Anterior femur with a few thin, short hairs below (cf. *P. inclyta*). Hind tibia: teeth variable in size and sometimes irregularly spaced, the subtending spines about 2.0-2.5 times as high; inner spur reaching to 0.2-0.35 of basitarsus length (equal to or slightly longer than tarsal segment 3) and 1.2-1.3 times as long as outer spur.

Variation.— An extremely variable species. Although the PPV of the forewing is usually very short, it varies in orientation from almost axial to about 45° from it; other veins also vary, especially 1r-m and 2r-m in degree of curvature. Females also vary considerably in propodeal dorsal structure. In smaller females, the dorsal median ridge of the propodeum and the PTC resemble those of *P. chrysoptera*, but the MPN is not similar. In 2 females from Alto [Upper] Paraguay and Misiones (both MACN) the entire insect is dark, and the MPN is distinctly shorter than the PST.

Four main colour forms exist:

1. The most-collected form, occurring in most of Brazil except the extreme south, has entirely dark wings and partly-orange antenna (fig. 7).
2. In central Paraguay and Argentina: Corrientes the body-sheen is brilliant violet to violet-blue, and the antennal orange extends to the maximum number of segments (all but 2 basal) (fig. 8). This form resembles *P. ruficornis* in colour.
3. In central and western Argentina, the wings are black with a broad, transverse, orange-yellow band; the male antenna usually has the apex of the last segment dull orange; the female, several apical segments orange.

In this case, there exists a complete range of fairly common intermediates between perfect *atripennis* or *completa*-group mimics and entirely dark-winged forms (fig. 10).

4. From extreme southern Brazil southwards through eastern Argentina to Patagonia (Rio Negro) the wings are orange-amber with variable basal and apical infuscation, and the antenna is entirely black (sometimes segments with obscure brown, apical rings in the female) (fig. 9).

Certain female structural variations coincide with the above colour-forms: in both of the dark-winged forms the AE index is (85-)97-108 and the MPN equal to or distinctly shorter than the PST; in the yellow-banded form the AE index is 82-87 and the MPN slightly to distinctly shorter than the PST; in the amber-winged form the AE index is 76-85 and the MPN is usually distinctly shorter than the PST. Furthermore, the amber-winged form is smaller on average than any of the others (BL 23-29); the yellow-banded form seems to be more-or-less intermediate in this respect. Further collecting is needed to establish the exact location and extent of the transition zones between the various forms, which may currently be undergoing a speciation process.

Biology.— Many specimens of both sexes belong to the *atripennis* or *completa* mimicry-groups.

Distinctions.— The sternal hairs and SGP characters will distinguish the males from those of other, sympatric, species; although the female is very variable, the propodeal dorsum is probably more constantly uneven than in any other species resembling it, which is the best available distinction among the species with dark wings and partly-orange antenna; also, the hair cover obscuring the DTC is constant. The two entirely dark females mentioned above can only be distinguished from female *P. filiola* by their general characters of sculpture and venation.

Females of colour-form (1) above are similar to *P. brunneicornis*; they are distinguished as follows (*P. viridis* characters in brackets):- body with very weak metallic sheen (fairly strong sheen); longer AS3: AE index 110-115 (76-108), and head slightly swollen (fairly strongly swollen); antenna entirely orange except the first 2 segments (frequently fewer segments orange); wings moderately infusate, virtually without metallic reflections (heavily infusate, with fairly strong blue-violet reflections); SMC3 longer, the anterior vein usually equal to or longer than the postero-distal veinlet (cell shorter; anterior vein shorter); the cell usually angulate distally at about the middle (curved); DTC regular, clearly visible (irregular and obscured by hair).

Females of colour-form (1) are also very similar to those of *P. helvolicornis*, but in that species the antenna is distinctly thicker and is yellow, not orange.

Females may be confused with those of *P. discolor* or *P. flavescens*; see the table given under the first-named species for distinctions.

Females of colour-form (3) above are very similar to the southerly, sympatric populations of *P. completa*; the accompanying table will assist in separating them:

<i>P. completa</i>	<i>P. viridis</i>
Antenna usually black.	Last segment orange.
Forewing band begins c. 1/4 from wingbase; covers c. 2/3 of first discoidal cell.	Band begins c. 1/5 from base; covers c. 1/3 of first discoidal cell.
Temple scarcely swollen.	Moderately swollen.
MPN furrow expanded posterad.	Furrow parallel-sided.
Propodeum:	
DTC finer anteriorly; continuing fairly strong on posterior face then becoming much finer posterad; PTC scarcely indicated.	DTC uniform; finer on whole of posterior face but not decreasing posterad. PTC distinct.
Hind tibial teeth as large as gaps between them; inner spur longer than tarsal segment 3.	Hind tibial teeth much smaller than gaps between them; inner spur as long as tarsal segment 3.

Females of colour-form (4) above closely resemble those of *P. aciculata* and smaller females of *P. discolor*; the accompanying tables will help to distinguish them:

<i>P. discolor</i>	<i>P. viridis</i>
Larger on average, BL 22-37.	Smaller, BL 23-29.
AS3 longer, AE index 81-94.	Shorter, AE index 76-85.
MPN equal to or slightly shorter than PST.	Distinctly shorter.
Propodeal hair shorter than PST.	About equally long.
Propodeal profile angulate.	Profile rounded.
PTC low and broad or high and narrow.	Angulate or slightly rounded, quite strong.
DTC fine, slightly shining; shallow punctures often visible between them.	Rather coarse, matt; punctures not visible.
Hind tibia with spines 2.0-2.5 times height of teeth.	About 2.0 times tooth height.
Hind tibia with inner spur often longer, reaching to 0.3-0.4 basitarsus length.	Shorter, reaching to 0.3-0.35.

<i>P. aciculata</i>	<i>P. viridis</i>
DTC very fine; PFC often curved concentrically around anal valve.	DTC moderately fine; PFC scarcely curved.
Propodeum with dorsal face usually longer than posterior.	Propodeum with dorsal and posterior faces equally long.
PTC weak, often double, with scarcely any central emargination.	PTC a fairly strong, usually single ridge, often emarginate centrally.
PPT weak, height much less than width.	PPT quite strong, almost as high as wide.
Head in dorsal view very strongly swollen behind eyes (as strongly as the eyes themselves).	Head in dorsal view usually only strongly swollen (less strongly than the eyes).
MPN furrow usually expanded apicad.	MPN furrow usually expanded only apically.

Females of colour-form (4) above also resemble those of several other amber-winged species of southern distribution; for these, refer to the keys to southern amber-winged females, starting at couplet 45 in the general key. In particular, small individuals of *P. viridis* from southern Uruguay and eastern Argentina, Buenos Aires to Negro provinces are best characterized by: the head strongly swollen behind the eyes, very short AS3, basal infuscation of forewing like that of *P. limbata* and *P. thoreyi*, MPN very short, furrow strongly expanded apicad, carinae fine and surface matt, PTC broad and notched, propodeal hair about equal to PST length.

Distribution.— A southern species, found from Argentina, Río Negro and Neuquén, north to Paraguay, but then the range appears to bifurcate northwards to extreme eastern and western Brazil, avoiding central Brazil. Records from Argentina: La Rioja (2 ♂♂) and San Juan (1 ♀) (both MACN) are probably correct, but lack minor localities. The following records probably represent labelling errors: “Muzo” (1 ♂, MNHU); this locality is in the Andes near Bogotá. “Suriname” (1 ♀, CUNY); from its colour, this specimen surely originated in Paraguay. “Mexico” (1 ♂, SCHWARTZ). “Mexico, Puebla” (1 ♀, MNHNPS). Always at low altitudes. Map fig. 680.

Material depositories.— 780 ♂♂, 690 ♀♀; AEIG, AMNH, BMNH, CAS, CUNY, CMNH, EMMSU, ETHZ, FDA, FRITZ, IMLT, INTAC, LACM, MACN, MCZ, MCSNGO, MHNGV, MHNNEU, MIZSU, MLP, MLU, MNHNPS, MNHNPG, MNHU, MNRJ, MNS, MZEL, MZUSP, NHMBAS, NHMW, NMV, NRS, OSUC, PORTER, RMNH, RSM,

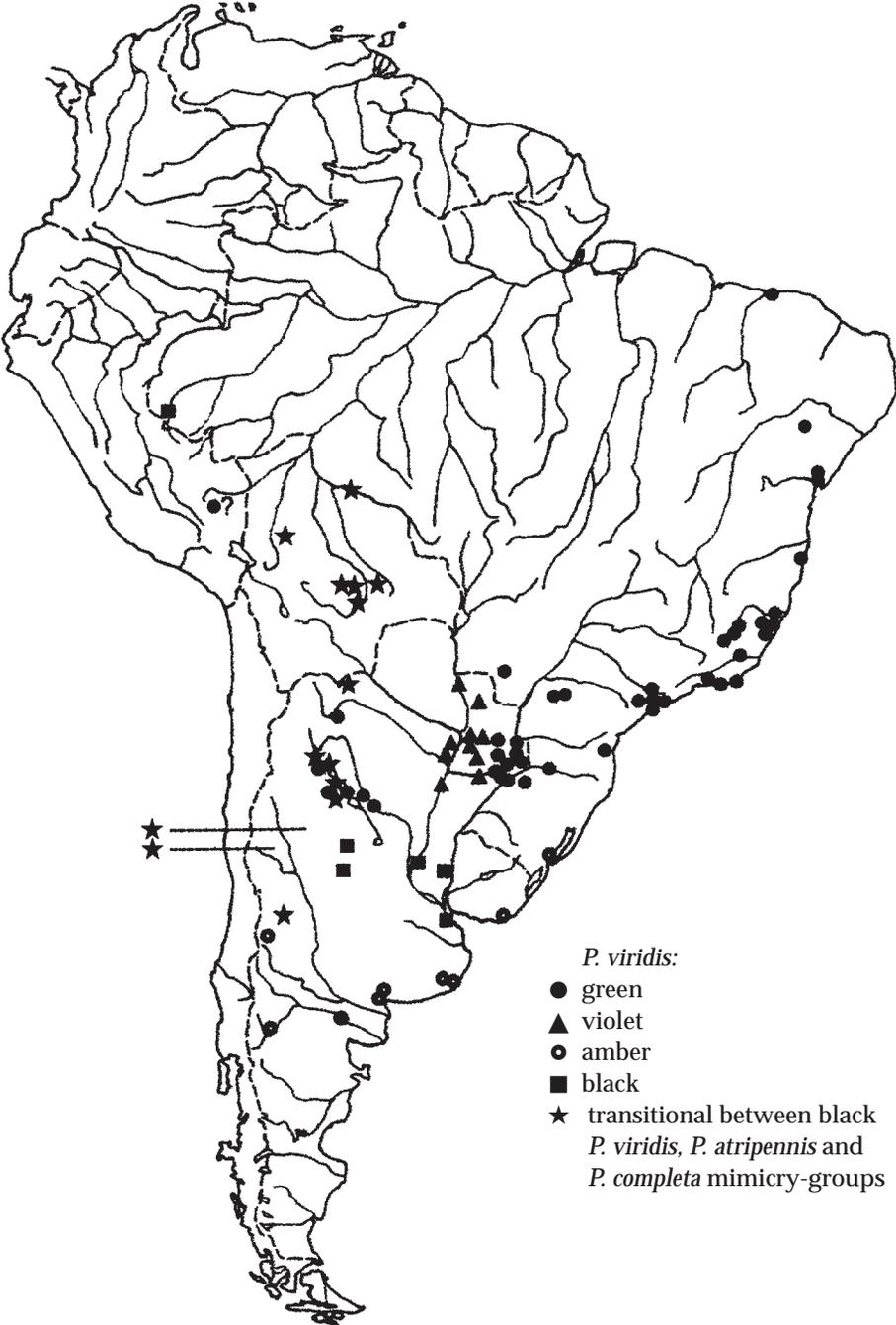


Fig. 680. Collection localities of *Pepsis viridis*.

SCHWARTZ, SEMKU, SMF, SMTD, TMB, UCALB, UFPCUR, UFPVIC, UMBREM, UMOX, USNM, USPRIB, USU, UZMC, WAHIS, WASBAUER, ZIUK, ZMHEL, ZMMOSC, ZSM.

Pepsis aciculata Taschenberg, 1869 spec. rev.
(figs 93-98, 561, 681)

Pepsis aciculata Taschenberg, 1869: 29, no. 6. Lectotype ♀ (MLU), here designated [examined]. [Wrongly synonymized with *P. limbata* Guérin by Lucas, 1895: 801, no. 178].

Pepsis nero Lucas, 1895: 791, no. 170. Lectotype ♂ (MNHU), here designated [examined]. **Syn. nov.**

Type material.— *P. aciculata*: I have seen only a single syntype ♀ from Rio de Janeiro and labelled it lectotype. Taschenberg mentions another ♀ from “Banda Oriental” [old name for Uruguay], but this is apparently lost. *P. nero*: I have seen 4 conspecific ♂ specimens, and have labelled as lectotype a ♂ from “Montevideo” in MNHU. The other 3 are in MLU but only one, with locality “Banda Oriental” is a paralectotype.

Description.— ♂ (figs 93-98). BL 13-24. Body and legs black with blue-green sheen, sometimes tinged violet. Antenna black. Wings orange-amber, forewing with apex fairly strongly and broadly infuscate (about 1/3 of wing length) with weak blue-violet reflections; the base similarly to 1/4-1/3 of wing length; the boundaries of both very diffuse. Extent of amber on hindwing extremely variable. S.4 with a very broad band of dense, short hairs, more-or-less strongly curved inwards and backwards, slightly sparser and straighter postero-centrally; all approximately as long as maximum SGP width. S.5 with a variable band of short, weak hairs, slightly longer and denser at the extreme sides. SGP quite strongly expanded towards the rounded-truncate apex, which is sometimes narrowly translucent. Hair cover short, slightly longer at apex of SGP. Paramere moderately pointed, about half as long again as rest of genitalia.

♀ (fig. 561). BL 21-32. AE index 72-86. Colour as in male but infuscation often less extensive and better defined. Head very strongly swollen in dorsal view. MT moderate to strong, occasionally weak. MPN a little shorter than PST, its furrow narrow but more-or-less strongly expanded apicad; carinae fine, sometimes a few slightly stronger. Propodeum: MG at most weakly indicated anteriorly, replaced by a very broad, rounded ridge. APT and PPT weak to moderate. DTC fine, dense, somewhat irregular, matt, slightly obscured by hair, with shallow punctures sometimes visible. Hair about as long as PST length. PTC weak to moderate, occasionally strong. Posterior face: VR at most weakly expressed near PTC. PFC similar to DTC, **posterad increasingly forming semi-circles concentric on petiole socket**; weaker in middle rather than below, leaving a variably-sized, finely sculptured, matt median area. Lateral extension of S.2 groove well developed. A few weak hairs below anterior femur. Hind tibia: teeth rounded apically, the subtending spines 1.5-2.0 times their height; inner spur short, reaching to 0.25-0.3 basitarsus length (about equal to segment 3, sometimes slightly shorter), and 1.3-1.5 times as long as outer spur.

Variation.— Only as given above (no dark-winged forms known).

Distinctions.— The male is sufficiently distinct on the basis of its S.4 hairs, which somewhat resemble only those of *P. inclyta*; however, that species is much larger, its hairs form a deep “cup” and the antenna is partly orange. The female is distinguished

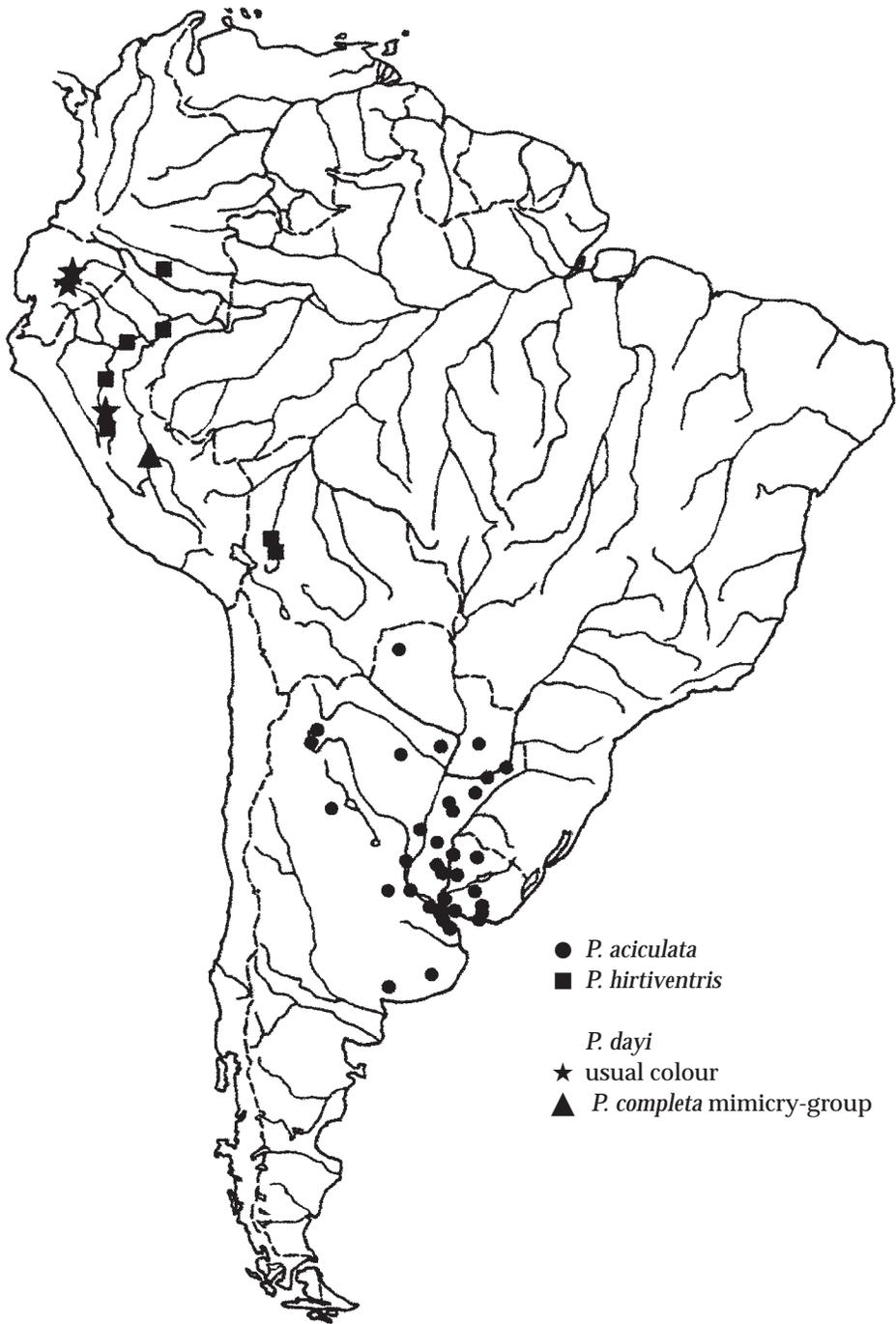


Fig. 681. Collection localities of *Pepsis aciculata*, *P. hirtiventris* and *P. dayi*.

from those of most similar-looking species by the combination of head shape, AS3 length, details of DTC and PFC, and length of hind tibial inner spur. It is otherwise similar to other southern species with amber wings, especially that colour form of *P. viridis* (see table under that species); it also appears like a small *P. laetabilis*, which see for differences. Females of *P. aciculata* are distinguished from those of *P. thoreyi*, *P. montezuma* and *P. limbata* in a table given under the last-named species.

Distribution.— This species has a strong south-eastern bias in its range; it is centred on northeastern Argentina and Uruguay, extending south almost to Bahía Blanca, north-west to Salta (but not approaching the Andes further south), and north to Paraguay; there are a few records (needing confirmation) from Brazil: Minas Gerais (N.F.L.) 4 ♂♂ BMNH; and Brazil, “Monchicourt” (not located) 1 ♀ RMNH; usually at low altitude but ascending to 1,200 m in Salta. Map fig. 681.

Material depositories.— 183 ♂♂, 131 ♀♀; AEIG, BMNH, CDFA, CUNY, EMMSU, ETHZ, FRITZ, IMLT, MACN, MHNGV, MIZSU, MLP, MLU, MNHNPS, MNHU, MNRJ, MNS, MZUSP, NMV, NRS, OLLD, OSUC, RMNH, TMB, UMOX, USNM, UZMC, ZMHEL, ZSM.

Pepsis dayi spec. nov.
(figs 111-116, 639-641, 681)

Type material.— Holotype ♂, **Perú**, Loreto, Boqueron Abad, 19.xii.1961 (Schunke) (BMNH). Paratypes: Perú: 2 ♀♀, Cuzco, Atalaya, Rio Tambo, 26 & 31.iii.1954 (Schunke) (BMNH); **Ecuador**: 2 ♂♂, Pasto province, Puyo, 18.v.1977 (Vincent) (BMNH, USNM); 1 ♂, Napo, viii-ix.1931 (Benoist) (MNHNPS).

Etymology.— Named after Michael C. Day.

Description.— ♂ (figs 111-116). BL 22-24. Body and legs black with deep blue or green metallic sheen. Antenna black with 0.3-2.0 apical segments partly orange. Wings strongly infusate with weak violaceous reflections. S.4 with a rather dense and broad, transverse band of hairs covering almost the posterior half of the segment; the anterior hairs are slightly longer than the others and slightly curved forwards basally and then backwards; the postero-median hairs are slightly shorter than the rest; the overall effect is that the “surface” formed by the apexes slopes downwards towards the back. S.5 with a narrow, apical band of rather sparse hairs, shorter than most on S.4. SGP essentially rectangular, but slightly expanded approaching the rounded apex; basal 1/3 flattened, changing to rather strongly convex apically. Apex very narrowly translucent, with a few weak hairs up to half as long as minimum SGP width. Paramere scarcely longer than rest of genitalia, slightly obliquely truncate-rounded apically, with dense, short hairs. Inner projection of digitus apex a slender point, turned distad.

♀ (figs 639-641). BL 24-25. AE index 89-93. Body colour violet-blue; antenna with orange colour beginning very diffusely over AS3-7. Forewing with irregular, transverse amber band about 1/3 from base (1/2 in hindwing). Head in dorsal view with temple and vertex slightly swollen. AS3 appearing rather short. Forewing with stigmal fenestra rather broad and distinct; PPV rather short but not transverse; 1r-m strongly sloping anterodistad, strongly curved inwards anteriorly. MT fairly strong and sharp. MPN equal to or slightly shorter than PST, its furrow rather broad, a little expanded posteriorly; carinae fine, with sometimes a few coarser ones as well. Propo-

deum: robust; MG extremely weak, replaced by a very broad ridge. APT and PPT moderate, PTC weak to moderate. DTC fairly strong, partly obscured by blue-violet pubescence, slightly stronger and more distant apicad. Propodeal hair only about 2/3 as long as MPN. Posterior face: VR weak, divergent from PTC; PFC fairly strong above, weaker below, strongly obsolescent in median line, where replaced by fine, matt sculpture. Lateral extension of S.2 groove well-developed. Hind tibia: teeth sharp, sometimes smaller than usual, subtended by spines 2.0-2.5 times as high; on their inner sides is a line of more-or-less alternating spines (shorter than the others) and bristles (longer than the subtending spines). Inner spur reaching to 0.25-0.35 basitarsus length (about equal to tarsal segment 3) and 1.2-1.3 times as long as outer spur.

Variation.— Only as given above. The pale wing band may vary more than is currently known.

Distinctions.— The male S.4 hairs form a much broader band than in other species with similar formations; the bands together look very like those of *P. sommeri* and its close allies, but the present species is much smaller. The female is very similar to several others, but the rather massive propodeum and wing-band, plus the limited distributional range, all help to distinguish it.

Biology.— Some females (possibly also some males) belong to the *completa* mimicry-group.

Distribution.— Apparently restricted to the eastern Andes of Ecuador and Peru, from about 500 m up to just over 1,000 m in Ecuador. Map fig. 681.

Material depositories.— 4 ♂♂, 2 ♀♀; BMNH, MNHNPS, USNM.

Pepsis atripennis Fabricius, 1804
(figs 18, 117-123, 621, 622, 682)

Pepsis atripennis Fabricius, 1804: 216, no. 46. Lectotype ♂ (UZMC), here designated [examined].

Pepsis flavilis Brèthes, 1908: 235. ♀, [Brazil] Jundiahy. (Lost). *Syn. nov.*

Type material.— *P. atripennis*: Petersen (pers. comm.) noted 2 ♂♂ in UZMC and 3 in UZMCK. I have seen one of the two in UZMC, which has an original Fabrician label "*P. atripennis* ex Am: merid: Schmidt", and have labelled it lectotype. Petersen believed that the other UZMC specimen and 2 of the UZMCK specimens (one of which also has an original Fabrician label) are conspecific with the lectotype, and that the remaining ♂ is closely related to them. All the above-mentioned specimens except the lectotype are paralectotypes.

Note.— The 3 UZMCK specimens are not mentioned by Zimsen, 1964: 391, no. 630 [not 600 as in index].

Description.— ♂ (figs 117-123). BL 13-20. Body and legs black with light or dark green-blue metallic sheen. Antenna black with 1-3 (rarely more) apical segments orange. Wings black, most often with wide, yellow (rarely whitish), transverse band, sub-basal on the forewing, basal (occasionally sub-basal) on the hind wing; its outer edge 1/2-1/3 from base of forewing, often uneven but usually well-defined. S.4 with narrow, apical transverse band of very short and dense hairs about as long as SGP width or slightly less, sparser towards the sides, and at the extreme sides longer, thinner and slightly hooked apically; the apexes altogether forming a very even outline. S.5 has a

very narrow transverse, apical line of short, weak, rather sparse hairs. SGP rather narrow, parallel-sided or weakly expanded apicad; apex rounded-truncate. Paramere bluntly pointed apically, about 1.5 times as long as the rest of the genitalia. Apical projection of digitus narrowly pointed, slightly turned distad.

♀ (figs 18, 621, 622). BL 16-29. AE index 82-100. Colour as in male except up to 6 apical antennal segments orange (see also Variation). Head scarcely swollen in dorsal view. SMC3 of forewing narrow to very narrow anteriorly, so that 1rm is often strongly curved anteriorly and 2r-m posteriorly (i.e. cell strongly bulging postero-distally). MPN equal to or slightly shorter than PST, its furrow fairly broad and more-or-less expanded apically; carinae moderate to fine. Propodeum: MG (when present) flattened-out forming a weak double ridge; sometimes the MG is absent and the ridge totally broadly rounded. APT and PPT weak to moderate; DTC moderate to rather coarse, regular. Propodeal hair very short, 1/2-3/4 PST length. PTC weak to moderate, occasionally absent. Posterior face: VR usually weak (fairly strong near PTC in large specimens), divergent above, then (when present) re-converging apicad. PFC quite strong above and usually complete (though often weaker medially), gradually becoming weaker apicad, especially in mid-line. Lateral extension of S.2 groove strong. Hind tibia: teeth rather small, the subtending spines 2.0-2.5 times as high; in fresh specimens there is a sparse line of backwardly-directed bristles on the inner side of the teeth; inner spur reaching to 0.25-0.35 of basitarsus length (between tarsal segments 2 & 3 in length) and 1.2-1.5 times as long as outer spur.

Variation.— Both sexes of this species belong to either of two colour patterns: one (by far the commonest form) has a broad, yellow band across the wings (the *atripennis* mimicry-group); the other, restricted to a small area of the northern coast of South America, has the wings entirely black.

Three females from Manaus (BMNH, INPA) have a paler patch included in the large, dark area of the forewing beyond the yellow band; one of these (INPA) also has the apex narrowly milky-white, but asymmetrical between opposite wings; another female from Manaus (INPA) has the yellow band dull and poorly-defined. A female from Suriname (BMNH) has the wing beyond the yellow band almost entirely pale except for a broad band at the base and a narrow one at the apex. A male from Brazil: São Paulo, Barueri (MZUSP) has the wings pale yellowish with the usual black forewing base, but only a dark border apically.

Distinctions.— The male is distinguished from those of other similar species by its extremely short and dense S.4 hairs; its apically bluntly-pointed paramere is important in distinguishing it from the male of its sister-species, *P. martini*. The black form of the female is structurally similar to that of the partly-sympatric *P. ianthina*, but has a longer AS3 and fewer antennal segments orange. The commonest form with yellow-banded wings, is similar to its sister-species, *P. martini* (which see) in south-eastern Brazil and Paraguay; it is indistinguishable in the former locality. It also resembles *P. nanoides* but lacks the abundant femoral hair of that species. (See also key to mimicry-group of *P. atripennis*). Apart from the colour differences between *P. atripennis* and *P. completa*, the females are similar in structure; those of *P. completa* have the MPN with entirely fine carinae (also a few coarser ones in *P. atripennis*); the DTC more numerous and weaker; PTC narrower and higher; VR usually stronger and closer together; inner hind tibial spur c. 0.45 of basitarsus (c. 0.3 in *P. atripennis*).

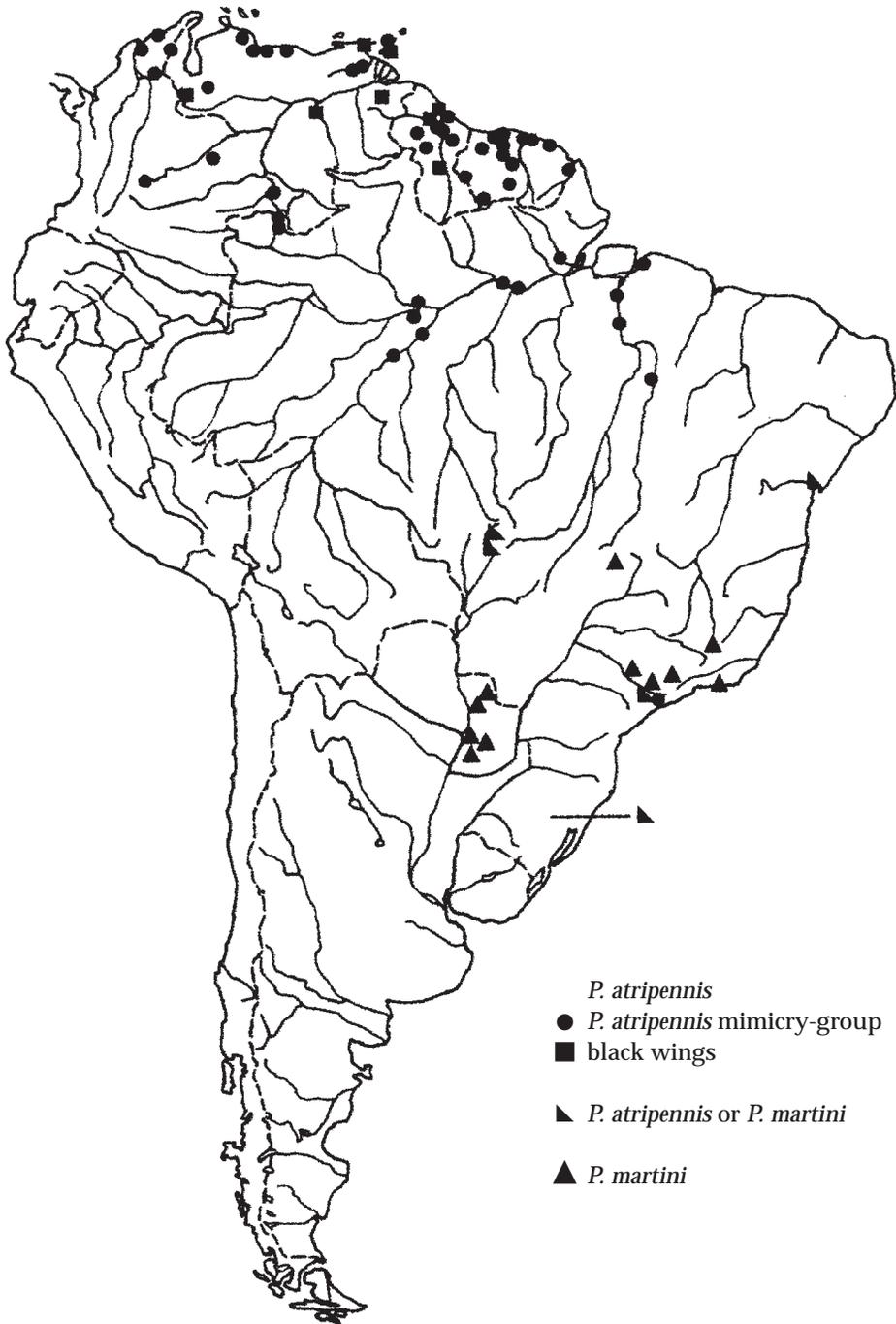


Fig. 682. Collection localities of *Pepsis atripennis* and *P. martini*.

Biology.— A female from Colombia: e San Martín, Hac[ienda] Barbasol [near Villavencio] (BMNH) has notes attached: “With spider prey; *Diplura* sp., det. Chickering”.

Most specimens of this species have yellow-banded wings; the species name is here chosen for a mimicry-group.

Distribution.— Found everywhere from the Amazon (along its entire mainstream) to the north coast of South America, including that of Colombia; ascending to just over 1,000 m in Venezuela. Map fig. 682.

Material depositories.— 241 ♂♂, 192 ♀♀; AEIG, AMNH, ANSP, BMNH, CARPENTER, CMNH, CUNY, EMMSU, FDA, FRITZ, INPA, MACN, MCZ, MHNGV, MHNLM, MHNNEU, MICR, MIZAM, MLU, MNCN, MNHNPS, MNRJ, MPEG, MZEL, MZFIR, MZUSP, NHMBAS, NRS, PAGLIANO, PMA, RMNH, SCHWARTZ, SEMKU, TMB, UCALB, UCALD, UMOX, UNCBG, USNM, USU, UZMC, WAHIS, WILLIAMS, ZMICH, ZMMOSC, ZSM.

Pepsis martini spec. nov.
(figs 124-127, 633, 682)

Type material.— Holotype ♂, **Paraguay**: Paraguari, Parque Nac.[ional] de Ybycui 300 m, 13-18.xii.1989 (Cooper) (BMNH). Paratypes: Paraguay: 1 ♂, data as holotype (Cooper); 1 ♂, Amambay, Cerro Corá 350 m, 3-10.ii.1990 (Cooper) (BMNH); 1 ♀, Asunción, Jardín Botánico 250 m, 31.xii.1989 (Cooper) (COOPER); 1 ♂, 1 ♀, S[an] Bernardino (Babarczy) (TMB); 1 ♂, same data (BMNH); San Pedro, Cororo, Rio Ypané, 1 ♂, 1 ♀, ii.1979 (Fritz) (FRITZ); 1 ♀, same data but xi.1979 (BMNH); 1 ♂, same data but Malaise Trap, 5-9.xii.1983 (Wasbauer) (WASBAUER); 1 ♀, Quatro [= Cuatro] Mojones, ii.1932 (MNHNPS). **Brazil**: Goias: Leop[oldo de] Bulhões, 1 ♂, xii.[19]33 (Spitz) (MZUSP); Minas Gerais: 1 ♂, Itajubá, xii.[1]955 [NFD]; 1 ♂, 350a, 827a [NFD] (MNRJ, BMNH); 2 ♂♂, Serra do Caraça, 1,380 m, xi.1961 (Kloss, Lenko, Martins, Silva) (MZUSP, BMNH); 1 ♂, Pouso Alegre, xii.1953 (Pereira) (MZUSP); Rio de Janeiro: 1 ♂ [NFL], 7.iii.[19]66 (Townes) (AEIG); 1 ♀, Itatiaya [= Agulhas Negras] 850 m, ii.1899 (Gouelle) (MNHNPS); São Paulo: 1 ♂ [N.F.D.] (MNHNPS); 1 ♂ [N.F.D.] (CUNY) Campinas: 1 ♂, 1903 (Hempel) (TMB); 2 ♂♂, ii.1924 (Williams) (MCZ, BMNH); 2 ♂♂ same data but iii.1924 (MCZ); 1 ♂, 3.484, “*Pepsis dimidiata* F., Brèthes det. 17”; 1 ♂, Guará, 20.xi.88 “Visitando planta” (Martins); 1 ♂, 15.xi.1900. 6502. 99398 (Hempel) (all MZUSP); Corumbataí, 2 ♂♂, 20.xi.1983, no. 227, 11.30h., Cerrado, visiting *Erythroxyllum suberosum* [Erythroxyllaceae]; 3.vii.1984, no. 430, 11.44h., Cerrado, visitng *Gochnatia pulchra* [Asteraceae], both (Mechi) (USPRIB); Monte Alegre, Faz[enda] Experimental 750 m, 1 ♂, 14-27.x.1942 (Trav., Almeida) (MZUSP); Salesópolis, 1 ♂, Est. Biol. Boraceia, 850 m, 5.iv.1966 (Rabello) “*Pepsis dimidiata* F. det. H. Evans 1966 (MZUSP); Ypiranga, 1 ♂, 2.iv.[1]936 (Lange de Morrets) (MZUSP).

Etymology.— This species is named after Martin Cooper.

Description.— ♂ (figs 124-127). BL 14-17. Body and legs black with dark green metallic sheen. Antenna black with 0.5-3 apical segments orange. Wings quite strongly infuscate with a variable sub-basal yellow band (see Variation). S.4 with a narrow, transverse band of very short, strong, dense hairs about 1.5 times as long as SGP width and about equal to basal width of hind basitarsus (in profile and without hairs). S.5 with a very sparse line of thin hairs a little shorter than those of S.4. SGP rather narrow, transversely convex, parallel-sided or sub-basally very slightly flattened, laterally expanded and slightly bent down; apex rounded and with a few hairs about as long as 1/4-1/3 SGP width. Paramere very short and broad, only about as long as rest of genitalia, the apex strongly obliquely truncate on the inner side. Inner projection of digitus apex rather slender and turned a little distad.

♀ (fig. 633).— BL 17-19. AE index 78-91. Colour as in male except 5-6 apical antenna segments orange. Head in dorsal view with temple and vertex scarcely swollen. MT weak to moderate. MPN equal in length to PST, its furrow narrow but more-or-less strongly expanded apicad; carinae fine or very fine, matt. Propodeum: MG at most weakly indicated in anterior half, otherwise replaced by broad ridge. APT weak to strong, PPT moderate, PTC absent to moderate. DTC fairly strong, often stronger still and more distant in posterior half. Propodeal hairs almost as long as PST. Posterior face: VR absent, PFC continued as strong as DTC, weakening slightly apicad and medially, where they are pervaded by microsculpture and slightly shining. Lateral extension of S.2 groove well-developed. Hind tibia: teeth of usual size, the subtending spines 2.0-2.5 times as high; inner spur reaching to 0.3-0.4 (about as long as tarsal segment 3 or slightly longer) and 1.4-1.5 times as long as inner spur.

Note.— In the zone of sympatry, further females of this species are probably present among females identified as *P. atripennis*, but indistinguishable from them.

Variation.— Although many specimens (of both sexes) of this species exhibit a wing pattern characteristic of the *atripennis* mimicry-group, there is also considerable variation. On the one hand, the yellow band can undergo reduction to only a diffuse, sub-basal patch on the hindwing (the forewing being entirely infuscate), and in a single male from Rio de Janeiro (AEIG) all the wings are entirely black; at the other extreme, all the wings are dirty yellowish with weakly infuscate apical bands (in one specimen only basal). It is probably significant that the specimens which most closely resemble the mimicry-group in distribution of the colour have the markings best defined. Occasional specimens belong to the *completa* mimicry-group. The geographical distribution of the various colour forms appears to be haphazard.

Biology.— Specimens of both sexes may belong to either the *atripennis* or *completa* mimicry-groups.

Distinctions.— This species is extremely similar to *P. atripennis*, and sympatric in central and southern Brazil. At least Paraguayan specimens have some basal infuscation on the hind-wing (*P. atripennis* has none at all); otherwise, the male is distinguishable from the latter only by the paramere shape (see above). No structural characters are known to distinguish the females, and the colour pattern is identical in the zone of sympatry in central to southern Brazil; the description of the female is therefore based on specimens from outside of the sympatric area, as defined by males. Females of *P. martini* also often resemble those of *P. completa* except that in that species the basal infuscation and the yellow band of the forewing are both a little broader, and the PTC a little stronger.

Distribution.— Known only from central Brazil to Paraguay, mainly at low altitudes, but reaching 1,380 m in Minas Gerais, Serra do Caraça. Map fig. 682.

Material depositories.— 27 ♂♂, 6 ♀♀; AEIG, BMNH, COOPER, CUNY, FRITZ, MCZ, MNHNPS, MNRJ, MZUSP, TMB, USPRIB, WASBAUER.

Pepsis ianthina Erichson, 1848
(figs 159-164, 563, 683)

Pepsis ianthina Erichson, 1848: 588. Lectotype ♀ (MNHU), here designated [examined].

Pepsis fulvicornis Mocsáry, 1885: 252, no. 21. Lectotype ♀ (MHNNEU), here designated [examined].

Syn. nov.

Pepsis sirene Lucas, 1895: 603, no. 64. Lectotype ♀ (MNHU), here designated [examined]. **Syn. nov.**

Pepsis balboae Lucas, 1919: 51. ♀, Panamá: Chiriqui (lost). **Syn. nov.**

Pepsis herodes Lucas, 1919: 52. ♀, [Panamá:] Chiriqui (lost). **Syn. nov.**

Pepsis curti Lucas, 1919: 149. ♀, Panamá: Chiriqui (lost). **Syn. nov.**

Type material.— *P. ianthina*: I have seen only a single syntype ♀, and labelled it lectotype (Erichson does not state the sex). *P. fulvicornis* I have seen a single type-material ♀ and labelled it lectotype. *P. sirene*: I have seen two ♀ syntypes; I have labelled as lectotype the one in MNHU, bearing the locality Colombia, Cauca valley; the one in TMB bears an almost illegible locality [Las Pabas?; ?= Pebas] but is a conspecific paralectotype.

Description.— ♂ (figs 159-164). BL 13-23. Body and legs black with green, blue or violet sheen; wings black with strong blue-violet reflections; antenna usually bright orange except for 2 basal segments black, but any or all segments are occasionally dark. S.4 apex with a thick, transverse band of hairs which are upright, slightly curved inwards, slightly shorter and straighter laterad; 2-3 times as long as apical SGP width. S.5 with an apical, very narrow band of rather thin and sparse hairs about half the height of those on S.4. SGP rather narrow, slightly expanded apicad, convex in cross-section, the apex rounded-truncate and sometimes narrowly translucent. Paramere blunt, rounded apically, a little longer than rest of genitalia. Apical projection of digitus slender, weakly turned distad.

♀ (fig. 563). BL 14-28. AS3 very short, AE index 82-95(-97). Colour as in male, but antenna rarely with more than the 2 basal segments (sometimes base of third) dark. Head moderately swollen. MT moderate to strong, often quite sharp. MPN equal to or slightly shorter than PST, its furrow rather broad, broader still apicad, shining; carinae fine to very fine, matt. Propodeum: MG replaced by broad, rounded ridge; APT and PPT weak to moderate; DTC regular, fairly coarse, often slightly stronger and more distant apicad; propodeal hair usually a little shorter than PST length, sometimes as long. PTC moderate to strong, sometimes weakly emarginate centrally. Posterior face: VR usually more-or-less strong for a short distance near PTC but rapidly obsolescent by 1/3 (rarely 1/2) way down the face, parallel or slightly divergent; PFC very variable, usually the uppermost weaker than DTC, gradually obsolescent apicad, but present over entire surface except for a median band of very variable width, where they are replaced by fine, matt sculpture. Lateral extension of S.2 groove well-developed. Anterior and middle femora with a few short hairs below (in fresh specimens). Hind tibia: teeth occasionally rather small and distant, the subtending spines 2.0-2.5 times as high; in fresh specimens, on the inner side of the teeth is a line of bristles a little longer than the spines and strongly directed (usually also slightly curved) backwards; inner spur reaching to 0.3-0.45 basitarsus length (about equal to tarsal segment 3) and 1.2-1.3 times as long as outer spur.

Variation.— Three males from the edge-of-range locality Perú: Lima, La Molina (LACM) have a tendency for the MPN furrow to be slightly broader anteriorly than usual. Two females from Venezuela (BMNH) have an extremely broad MPN furrow.

Distinctions.— A small species, similar to the sympatric black form of *P. atripennis*, and especially to the allopatric (West Indian) *P. ruficornis*. From the former, the male of *P. ianthina* differs by its much longer hairs of S.4, the female by its short AS3, and both

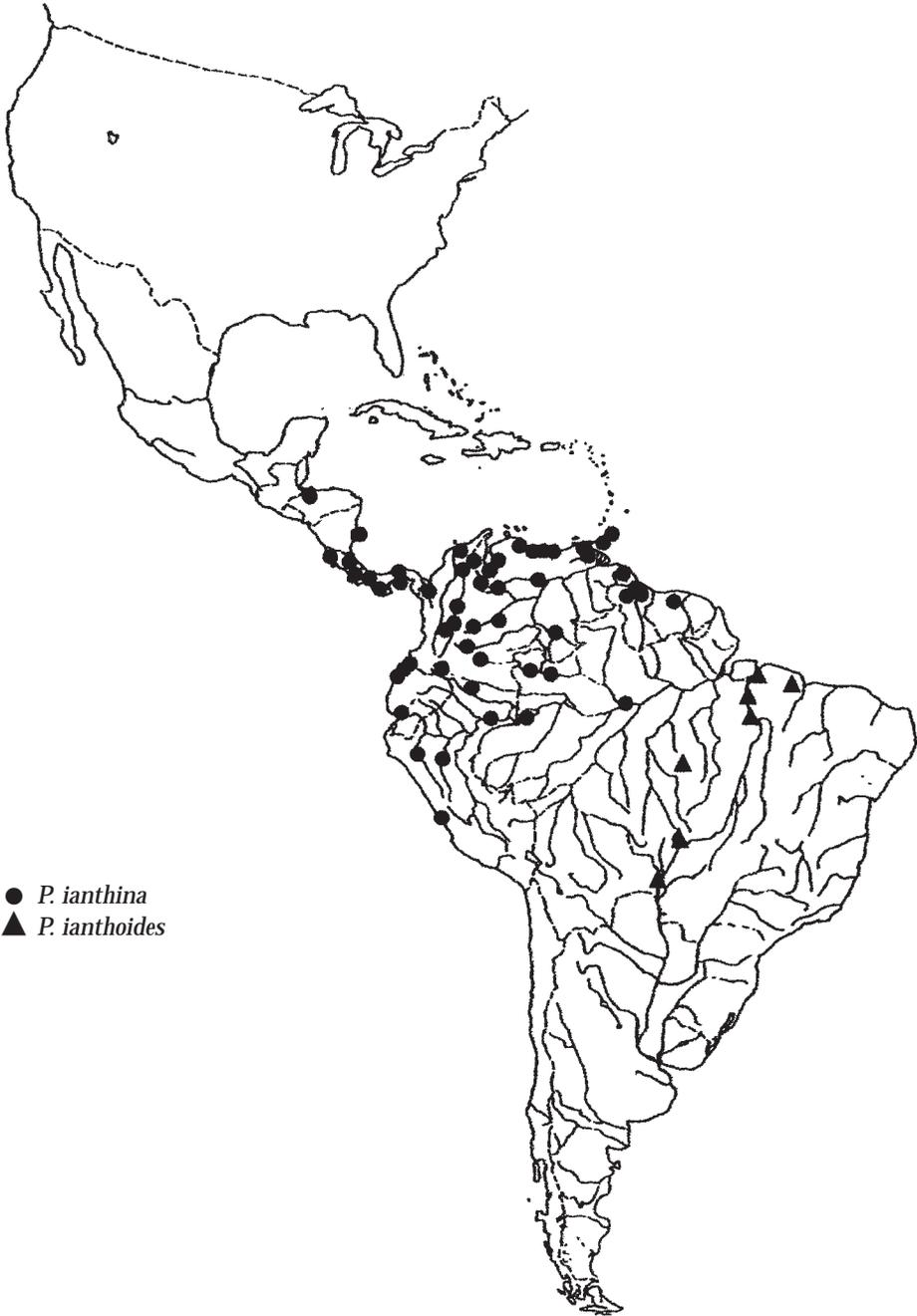


Fig. 683. Collection localities of *Pepsis ianthina* and *P. ianthoides*.

sexes by their antennal colour; from the latter, the male by its totally different S.4 hairs, and the female by its usually shorter AS3, sharper MT; and both sexes by their alloptry. The male strongly resembles the male of *P. nana* but that species has the S.4 hairs a little shorter, and all the apexes together forming a very evenly rounded outline; its SGP is bent back at about its mid-point and the paramere is truncate and shorter than the rest of the genitalia. The female is also distinct from that of *P. nana* by virtue of its broad MPN furrow and rather sharp MT. In the zone of sympatry, *P. nana* usually belongs to the *atripennis* mimicry-group (with a yellow band across the wings) whereas *P. ianthina* is always black-winged.

Distribution.— A transandean species; found from Honduras southwards on the coast to northern Perú; a record from Lima, La Molina (3 ♂♂, LACM – see Variation, above) needs confirming; and east of the Andes south to north-central Perú, extending to Suriname, and Manaus on the Amazon; ascending to 2,000 m in central Colombia; a record from “Malacca” (1 ♂, RSM) is mislabelled. Map fig. 683.

Material depositories.— 227 ♂♂, 142 ♀♀; AEIG, AMNH, ANSP, BMNH, BPBM, BRIO, CARRASCO, COOPER, CSU, CUNY, EMMSU, FDA, FRITZ, HENSEN, INBIO, INPA, LACM, MACN, MCZ, MHNNEU, MICR, MIZAM, MLU, MNHNPS, MNHU, MNRJ, MZEL, MZFIR, MZUSP, NMV, RMNH, RSM, SEMKU, TMB, UCALB, UMOX, UNCBG, UNPBOG, UPAN, USNM, USU, UZMC, WAHIS, WASBAUER, ZSM.

Pepsis ianthoides spec. nov.
(figs 165-170, 683)

Type material.— Holotype ♂, **Brazil**, Pará (Moss) (BMNH). Paratypes: **Brazil**: 5 ♂♂, Goiás, Jatai, xi.1972 (Oliviera) (AEIG); 2 ♂♂ same data (BMNH); 1 ♂, Alto Turi Sunta, Helena, Maranhão, 18.viii.1965. 2704 (Ourq.) (INPA); 1 ♂, Mato Grosso, 1886 (Germain) (MNHNPS); 2 ♂♂, Mato Grosso, Sinop, 12°31'S., 55°37'W., x.1974 (Alvarenga) (AEIG); 2 ♂♂, same data (BMNH); 2 ♂♂, same data but x.1975 (AEIG); 1 ♂, Chapada [dos Guimarães] xii [(Smith)] (EMMSU); 1 ♂, same data but iii (CMNH); 1 ♂, same data but iii (ANSP); 1 ♂, Corumbá, iv (ANSP); 1 ♂, [Belém do] Pará (BMNH); 1 ♂, [Belém do] Pará (Baker) (USNM); 1 ♂, Pará, Tucuruí, i.1979 (Alvarenga) (FRITZ); 1 ♂, Pará, Belém, 1930 (Horvath) (NRS); 1 ♂, Braz[il] 4, [Rio] Tocantins, Cameta (ETHZ); 1 ♂, Pará, P. de Pedras, 3.iii.1979 (Tadeu) (MPEG); 1 ♂, Pará, Marabá, 3.vii.1978 (Ramos) (MPEG); 1 ♂, Pará, Cachimbo, vi.1962 (Alvarenga & Oliveira) (WASBAUER); 3 ♂♂, Pará, Mocajuba, Mangabeira, iv.1953 (Rego) (MNRJ); 2 ♂♂, same data (BMHN); 2 ♂♂, Pará, Belém, Utinga 4.ii.[19]63 (Mielke, Roppa) (MNRJ); 1 ♂, S[ão] P[aulo], Teodoro Sampaio, xi.1977 (Alvarenga) (AEIG); 2 ♂♂, Brazil (N.F.D.) (UMOX); 1 ♂, Brasília, 747.171 (TMB); 1 ♂, [Venezuela] “Caracas” (Sichel) (NRS); 1 ♂, no locality (BMNH).

Etymology.— This species is named after its very close resemblance to its sister-species, *P. ianthina*.

Description.— ♂ (figs 165-170). BL 12-20. Body and legs black with deep green metallic sheen. Antenna black with 0.5-3.0 apical segments orange. Wings with rather more than the apical half fairly strongly infuscate, also the base of the forewing very narrowly (at most a thorax-width) and occasionally the hindwing, but much less so. The remainder of the wings is whitish to ochre-yellow. S.4 with narrow but fairly dense, apical band of hairs about twice as long as SGP width, most of them curved slightly inwards and backwards; those in the centre very slightly shorter than the rest. S.5 with an extremely narrow, apical band of very weak hairs, up to about half the height of those on S.4. SGP with an extremely weak median ridge in the basal half, very slightly

bent down just where the ridge ends at about the mid-length, slightly convex beyond that to the rounded to truncate apex, which has a fairly dense fringe of hairs up to about as long as apical SGP width. Paramere short, slightly longer than rest of genitalia; slightly broader to about 2/3 of its length, then very steeply truncate on the inner side, ending in a blunt point on the outer. Inner projection of digitus apex ending in a slender point, quite strongly directed distad.

♀. Not recognized (see Distinctions below).

Variation.— A male from Rio Tocantins (ETHZ) has the S.4 hairs slightly longer than usual.

Biology.— At least the males belong to the *atripennis* mimicry-group.

Distinctions.— The male of this species closely resembles that of *P. ianthina* in structure; however, that species is distantly allopatric, being found only in Central and north-western South America; it is always black-winged, and the antennal orange is much more extensive (usually AS3 onwards is orange). The female is apparently indistinguishable from that of *P. atripennis*. The distinctive colours of wings and antenna in female *P. ianthina* distinguish it from that of *P. atripennis*, but the short AE index and broad MPN furrow, although differing on average from those of *P. atripennis*, overlap the variation found in that species. Since *P. ianthoides* structural variation is likely to parallel that in *P. ianthina*, and the former species lacks the colour differences, this leaves no good distinctions. Although *P. ianthina* female has a few, weak femoral setae, that of *P. ianthoides* may have lost them totally.

Distribution.— Known only from an area extending from the Lower Amazon south-westwards (i.e. inland only) to the southern Mato Grosso; a single male bears the locality “Caracas”, but this probably represents a labelling error; inhabits low altitudes only. Map fig. 683.

Material depositories.— 41 ♂♂; AEIG, ANSP, BMNH, CMNH, EMMSU, ETHZ, FRITZ, INPA, MNHNPS, MNRJ, MPEG, NRS, TMB, UMOX, USNM, WASBAUER.

Pepsis nana Mocsáry, 1885

(figs 134-142, 553-555, 684)

Pepsis nana Mocsáry, 1885: 258, no. 31. Lectotype ♂ (TMB), here designated [examined].

Pepsis mapiriensis Lucas, 1919: 81. ♀, Bolivia: Mapiri (lost). **Syn. nov.**

Pepsis vinciens Lucas, 1919: 88. ♀, Bolivia (lost). **Syn. nov.**

Pepsis ilione Banks, 1946: 358. Lectotype ♀ (MCZ), here designated [examined]. **Syn. nov.**

Pepsis moesta Banks, 1946: 358. Lectotype ♀ (MCZ), here designated [examined]. **Syn. nov.**

Pepsis orestes Banks, 1946: 359. Holotype ♀ (CUNY) [examined]. **Syn. nov.**

Pepsis amautas Banks, 1946: 389. Holotype ♂ (MCZ) [examined]. **Syn. nov.**

Pepsis inaequalis Haupt, 1952: 346, no. 15. Lectotype ♀ (MLU), here designated [examined]. **Syn. nov.**

Type material.— *P. nana*: I have seen a single type-material ♂ and labelled it lectotype. *P. ilione*: I have seen 6 syntype ♀♀; I have labelled as lectotype the one in MCZ with locality Valle Chanchamayo, Peru, 800 m. The remaining 5 are paralectotypes and are conspecific with the lectotype; one is in MCZ, another in AMNH, and the rest in CUNY. *P. moesta*: I have seen a single type-material ♀ and labelled it lectotype. *P. orestes*: the ♀ paratype in MCZ is conspecific with the holotype. *P. inaequalis*: I have seen all 3 ♀ syntypes, and labelled one of them lectotype. Both paralectotypes are conspecific with it.

Description.— ♂ (figs 134-142). BL 13-19(-24). Body and legs black with deep blue or green, sometimes violet, metallic sheen. Antenna black with half to 11 apical segments orange. Wings black, sometimes with blue-violet reflections; sometimes with sub-basal yellow to whitish transverse band extending to about 0.4 of wing length. S.4 with a thin, transverse, apical band of hairs 1.5-2.5 times SGP width, slightly shorter laterally, the outline formed by their apexes very even. S.5 with a single line of thin hairs about half the height of those on S.4; laterally a sparse tuft of longer hairs which are directed backwards. SGP short, very slightly expanded laterally and bent back in the middle, apex rounded-truncate and often narrowly translucent. Paramere very short, slightly shorter than rest of genitalia, almost parallel-sided and apically rounded-truncate. Apical projection of digitus narrowed to a blunt point and slightly turned distad.

♀ (figs 553-555). BL 16-26(-30). AE index 82-103. Colour as in male except more antennal segments orange on average. Head in dorsal view scarcely swollen. MT variable, weak to strong. MPN equal to or slightly shorter than PST, its furrow narrow, often more-or-less expanded apically; carinae fine to very fine, matt. Propodeum: MG very weak, sometimes double, usually replaced by a broadly-rounded ridge. APT and PPT weak to moderate, the former occasionally strong. DTC moderate to weak, regular, variably distant. Propodeal hair about half PST length. Posterior face: VR weak or absent, PFC usually beginning moderately strong, becoming weaker and more shining below; sometimes a little weaker in mid-line. Lateral groove of propodeum usually **markedly sinuate anteriorly**. Lateral extension of S.2 groove strong. Femora below with variably **abundant long hair**, but most on the middle one, least on the fore. Hind tibia: teeth rather low, the subtending spines 2-3 times as high; in fresh specimens a row of rather long, strongly backwardly-curved bristles on the inner side of the teeth; inner spur reaching to 0.25-0.4 basitarsus length (equal to tarsal segment 3 or slightly longer), and 1.2-1.5 times as long as outer spur.

Variation.— Structural details vary in both sexes, including the degree of sinuation of the propodeal lateral groove. In both sexes, the wing-colour varies also: at the northern end of the species' range in Colombia the wings have a sub-basal yellow band, and a similar but whitish band in the southern part of its range in Bolivia. In north-central Perú (western Amazonas and eastern Cajamarca) and in the Apurimac valley in southern Perú the body sheen becomes violet and the antennal orange is at its maximum; in these specimens the wings sometimes exhibit quite strong blue-violet reflections.

In a male from Bolivia: Pando, Porvenir (BMNH) the paramere is obliquely truncate, thus more pointed on the inner side of the apex and rounded on the outer. In a white-banded male from Bolivia: Santa Cruz city (FRITZ) the reverse is true; the paramere is rounded on the inner side and bluntly pointed on the outer.

Distinctions.— The male is distinguished by its S.4 hair configuration, but strongly resembles that of *P. viridis* with which it is virtually sympatric at the southern end of its range; the highly distinctive paramere must be dissected out in cases of doubt.

The female is distinguished by its small size, abundant femoral hair and anteriorly sinuate propodeal lateral groove.

Biology.— Both sexes sometimes belong to the *atripennis* mimicry-group and some males to the *completa* mimicry-group.

Distribution.— Widespread in the eastern Andean foothills from Colombia to extreme northern Argentina, also extending into Venezuela and western Brazil (Upper

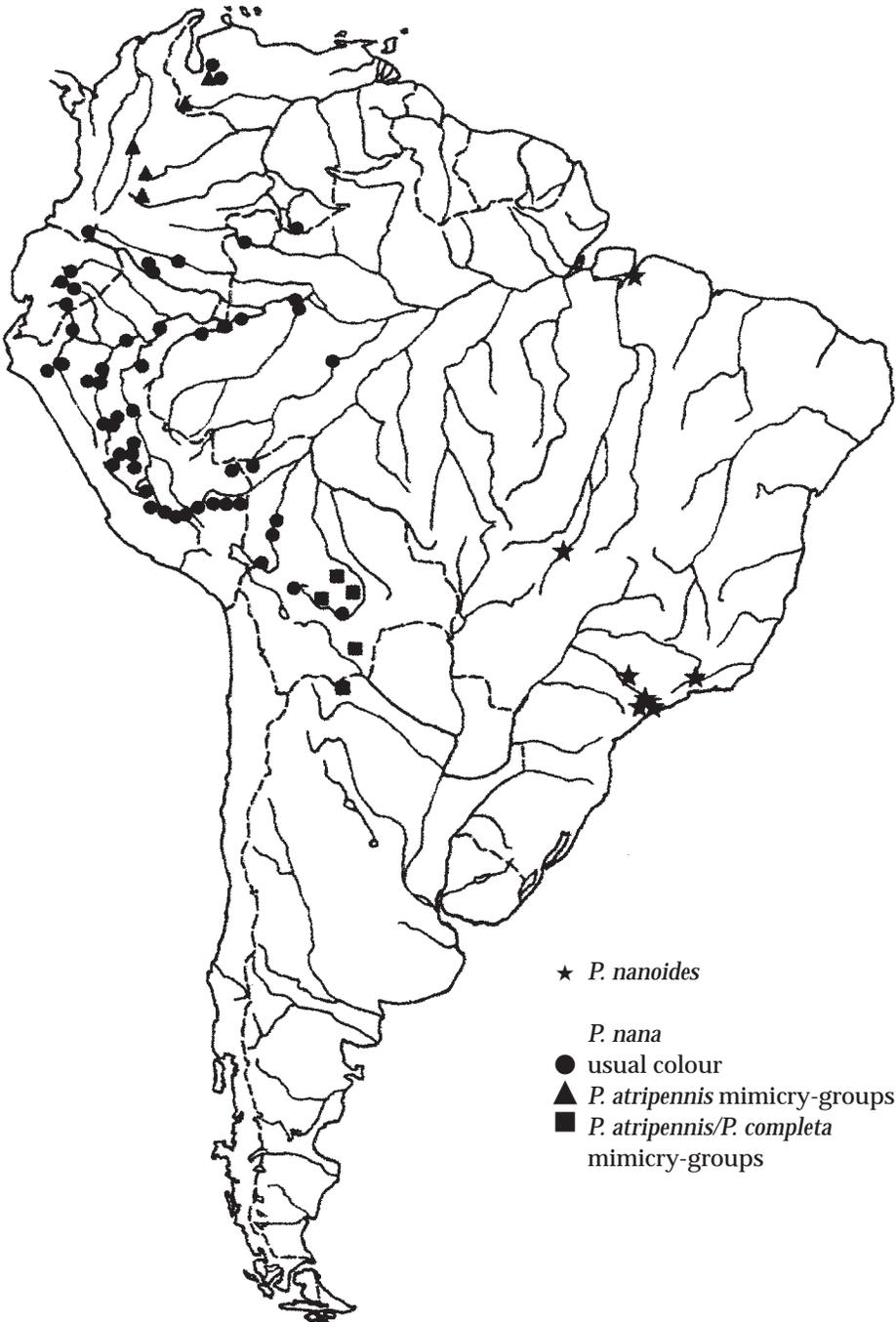


Fig. 684. Collection localities of *Pepsis nana* and *P. nanoides*.

Amazon); ascending to 1,900 m near Ayacucho and in the Apurimac valley, both in the Peruvian Andes; 2 ♀♀ from Haiti (TMB) are probably mislabelled. Map fig. 684.

Material depositories.— 238 ♂♂, 119 ♀♀; AEIG, AMNH, BMNH, BONELLI, BRIO, CARRASCO, CAS, CMNH, CUNY, FDA, FRITZ, HENSEN, IMLT, LACM, MCZ, MEM, MHNLM, MIZAM, MLU, MNHNPS, MNS, MZUSP, OCHOA, PORTER, PUCEQ, SMF, TMB, UNCUS, UNLAMB, UNPBOG, UPAN, USNM, WAHIS, WASBAUER, ZSM.

Pepsis nanoides spec. nov.
(figs 143-148, 634, 684)

Type material.— Holotype ♂, **Brazil**: Pará, Benevides, x.1918 (Klages) (CMNH). Paratypes: 3 ♂♂, 2 ♀♀, same data as holotype (CMNH, BMNH); Brazil: Pará: 1 ♂, Belém, Utinga forest, 22-23.iv.1968 (Jeanne) (MCZ); 1 ♂, Belém, Utinga, 17.iii.1964 (Ross) (CAS); 1 ♂, 1 ♀, Belém, v.1924 (Williams) (MCZ); 1 ♂, Bujarú, 16.iv.1982 (Overal) (MPEG); 1 ♀, (N.F.L.) (Baker) (USNM). Mato Grosso: 1 ♀, Barra do Garças, 23.vii.1976 (Negrett) (UBRAS). Minas Gerais: 1 ♂, Passa Quatro, 1898 (Zikan) (ETHZ). São Paulo: 1 ♀, Campinas, iii.1924 (Williams) (BMNH); 2 ♂♂, Campinas, 1903 (Hempel) (BMNH, ETHZ); 1 ♀, Itú, Faz[enda] Pau d'Alho, ii.1963 (Werner & Martins) (MZUSP); 1 ♀, Rio Claro, Navarro de Andrade, Horto Florestal, 30.vi.87, coletado no barranco (Martins) (MZUSP); 1 ♀, Corumbataí, 7.vii.1983, no. 193, 09.14h. Cerrado. Visiting *Didymopanax vinosus* [Araliaceae] (Mehi) (USPRIB); 3 ♀♀, Jundiahy (MZUSP, BMNH).

Etymology.— This species is named after its close resemblance to its sister-species, *P. nana*.

Description.— ♂ (figs 143-148). BL 12-20. Body and legs black with deep green metallic sheen. Antenna black with 0.5-1.5 apical segments orange. Base of forewing strongly infuscate for a distance about equal to thorax-width, the hindwing much less (almost none); just over apical half of both wings moderately to strongly infuscate. Rest of wings bright yellow-ochre. Femora, especially the middle one, with some fairly long but thin and sparse hairs below. S.4 with a narrow, apical band of short hairs, about 1.5 times as long as SGP width, the apex slightly incurved. S.5 with an extremely narrow, apical line of very weak hairs about half the height of those on S.4. SGP virtually parallel-sided, very weakly bent down about the middle, the basal half slightly flattened, the apical more convex; the apex rounded-truncate. Paramere very short, only about as long as rest of genitalia, very broad, the apex almost squarely truncate. Apical projection of digitus slender, turned slightly distad.

♀ (fig. 634). BL 19-22. AE index 79-94. Colour as in male but 4-6 apical antennal segments orange, and basal infuscation of forewing sometimes more extensive, equalling the width of the yellow band. Head in dorsal view rather transverse, with temple and vertex scarcely swollen. MT moderate to strong. MPN equal to or slightly longer than PST, its furrow either gradually expanded apicad over its whole length, or broad and abruptly expanded posteriorly; carinae usually fine and very fine mixed, occasionally a few stronger ones as well, matt. Propodeum: MG scarcely indicated anteriorly, otherwise replaced by a broad, flat-topped ridge. APT moderate to strong, PPT weak to strong, PTC weak to moderate. DTC moderately strong, usually slightly stronger and distinctly more distant apicad, partly covered but not much obscured by pubescence. Propodeal hair as long, or almost as long, as PST. Posterior face: VR absent or very weak and more-or-less strongly divergent from PTC; PFC beginning about as strong as DTC

above, weaker in mid-line, rapidly obsolescent apicad; wherever weaker, replaced by almost matt microsculpture. Lateral extension of S.2 groove well-developed. All femora with abundant long hair below (most on the middle one, least on the front), the longest about equal to the maximum width of the respective femur. Hind tibia: teeth a little small and distant, the subtending spines 2.0-2.5 times as high; with a line of more-or-less alternating bristles and short spines, all backwardly-directed, on the inner side of the teeth; inner spur reaching to 0.25-0.3 basitarsus length (about equal to tarsal segment 3 or slightly longer), and 1.2-1.4 times as long as outer spur.

Variation.— Only as given above.

Biology.— Both sexes belong to the *atripennis* mimicry-group; see also the flower record mentioned in the above type-material.

Distinctions.— This species is distantly allopatric from its sister-species *P. nana*, which is found along the east Andean foothills, and is usually black-winged. The male of the present species is distinguished by its slightly longer SGP, slightly more obliquely truncate paramere, and more slender inner projection of digitus apex. The female of the present species is distinguished from that of *P. atripennis* by its very hairy femora, more slender AS3, less swollen temple and shorter SMC3. The combination of the first character and wing-pattern will distinguish it from those of all other eastern species; however, it cannot be distinguished from the (distantly allopatric) form of *P. nana* from Colombia with yellow-banded wings.

Distribution.— Known only from low altitudes in eastern Brazil; from the Lower Amazon to São Paulo, inland as far as the Mato Grosso (Barra do Garças). Map fig. 684.

Material depositories.— 11 ♂♂, 12 ♀♀; BMNH, CAS, CMNH, ETHZ, MCZ, MPEG, MZUSP, UBRAS, USNM, USPRIB.

Pepsis hirtiventris Banks, 1946
(figs 128-133, 559-560, 681)

Pepsis hirtiventris Banks, 1946: 357. Lectotype ♀ (CUNY), here designated [examined].

Pepsis viridaurea Haupt, 1952: 344, no. 10. Lectotype ♂ (MLU), here designated [examined]. **Syn. nov.**

Pepsis aequalis Haupt, 1952: 346, no. 14. Holotype ♀ (MLU) [examined]. **Syn. nov.**

Type material.— *P. hirtiventris*: A total of 4 localities were mentioned by Banks; although he did not specify the sex, he described only the ♀. I have seen 3 syntype ♀♀ labelled by Banks, pertaining to all the localities except Perú: Achinamiza. Although I have also seen a ♂ and 2 ♀♀ from that locality (from MCZ), they do not bear Banks' labels, neither do the dates of collection correspond with the one he gives; therefore they may not be type-material. I have labelled as lectotype a ♀ from Perú, Iquitos, San Rogue [= Roque] (CUNY); all remaining specimens are conspecific, including the 2 paralectotypes and 3 non-type specimens.

P. viridaurea: I have seen 5 of the 6 ♂ syntypes, and all 3 ♀♀; all the specimens bear a white, printed label "Nord-Peru, Mishuyacu, Maranon-Gebiet" and Haupt's identification label, while some also bear a green, handwritten label [denoted GL in following] "Nord-Peru, Mishuyacu". I have labelled ♂ no. 3 below as lectotype; all remaining specimens are paralectotypes. Further details of individual specimens are as follows: ♂

1, ♂ 2 [GL], ♀ ♀ 1 & 2, all = *P. nana* Mocsáry; ♂ 3 [lectotype] & ♂ 4 [both GL], ♂ 5, ♀ 3 [GL] all = *P. hirtiventris*.

Description.— ♂ (figs 128-133). BL 17-21. Body and legs black with metallic, deep blue-green sheen; wings dark brown; antenna black with 1-2 apical segments orange. In fresh specimens, S.2 in posterior half and S.3 with fairly abundant thin, straight, mostly decumbent hairs about half the height of those on S.4 and most persistent postero-laterally. S.4 hairs rather long, 2-3 times as long as maximum width of the SGP (about equal to maximum width of middle tibia), forming a fairly dense, transverse band along the posterior one-third (approximately) of the segment; the central hairs curved slightly backwards apically, the laterals inwards, all about the same height except the extreme laterals which are abruptly shorter. S.5 with a very thin band of rather short, weak hairs like those on S.3 but upright. SGP with rather more than basal half flattened, with slightly expanded and upturned edges; at the end of this part, the rest of the SGP is slightly bent back and transversely convex. The apex is truncate, slightly rounded, and narrowly but distinctly transparent pale yellowish; along the base of this area (i.e. pre-apically) are some hairs longer than those covering the rest of the SGP, about half as long as apex width. Paramere short, about as long as rest of genitalia. Inner projection of digitus apex rather slender, bluntly pointed and slightly turned distad.

♀ (figs 559, 560). BL 21-32. AE index 100-112. Colour as in male, but 5-7 apical antennal segments orange. Head in dorsal view slightly swollen behind eyes. **PPV usually very short**. MPN equal to or very slightly shorter than PST, its furrow more-or-less strongly expanded apicad; carinae very fine, with a few stronger ones. Propodeum: APT moderate to strong, PPT weak to moderate; DTC often quite strong. PTC moderately strong but very long. No long hairs on propodeum. Posterior face: VR weak or very weak, not clearly connected to the PTC and wide apart (about 1/3 of face-width), usually absent from lower half of face. PFC: most commonly the top 2-3 complete and as strong as DTC; below that, weaker apicad, especially in the mid-line, often leaving a matt, finely sculptured area without carinae; but all these features are variable. The gaster in dorsal view is **markedly constricted at the junction of T.1 & 2**; the S.2 groove lacks lateral extensions; **from this groove distad the entire underside is covered with long, dense but comparatively fine hairs**, whose apexes are often slightly curved; only on the last sternite are also dense, shorter hairs. The front femur has abundant, rather short hair below; there is progressively less on the other femora. Hind tibia: teeth small, sharp and distant, the subtending spines 3.0-3.5 times as high and directed strongly backwards; on the inner side is a sparse line of hairs of equal length, also directed backwards but scarcely curved; inner spur reaching to 0.3-0.35 length of basitarsus (about equal to tarsal segment 3) and 1.20-1.25 as long as outer spur.

Variation.— Only as given above.

Distinctions.— The male is distinguished by its rather long S.4 hairs and unusual SGP (in *P. ianthina*, with similar S.4 hairs, the SGP is expanded apicad, not only in the basal half. It is also very like *P. nana*, but that species has the SGP more-or-less parallel-sided and S.4 hairs much shorter (only about 1.5 times maximum SGP width); the male of *P. atripennis* has the S.4 hairs extremely short and denser. The female is unique among the smaller species of the genus, with its abundant, long sternal hair and constriction between gastral segments 1 and 2.

Distribution.— Found only in the east Andean foothills from Colombia to Bolivia,

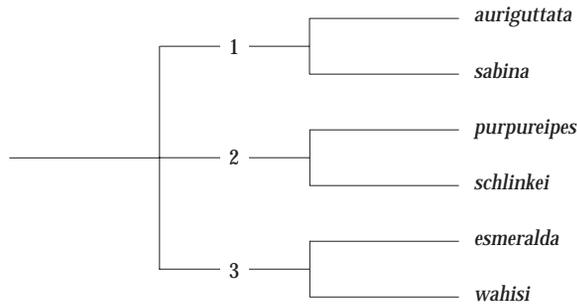
ascending to 300 m. Map fig. 681.

Material depositories.— 12 ♂♂, 18 ♀♀; AMNH, ANSP, BMNH, CAS, CUNY, MCZ, MLU, OSUC, SMF, TMB.

The *Pepsis auriguttata*-group

Description.— The six species of this group are small and slender (BL males 12-21, females 14-28). The body is black with blue, green or occasionally violet sheen. Some males and females are brilliant, light green. The wings are clear or amber with a sometimes poorly-defined dark, apical band; sometimes the wings are entirely dark, sometimes with more-or-less distinct amber spots or patches. Some of these forms belong to the *atripennis* or *completa* mimicry-groups. Structurally, both sexes are very diverse; modified hairs occur on S.4 and 5, and are extremely varied. Most males have an elongate SGP, sometimes strongly expanded apicad and with very long apical hairs. The paramere is usually very narrow, pointed, often obtusely angulate on its inner side towards the base, but is sometimes very short and blunt. Both the SGP and paramere have a long, apical hair fringe. The inner, apical projection of the digitus is usually rounded, but occasionally sharply pointed. The female AS3 is usually rather long, and the head in dorsal view either scarcely swollen behind the eyes, or the entire head more or less globular. The PPV is very short and almost transverse; the SMC3 varies from very short anteriorly, to very elongate. The MT is weak to very sharp. MPN and propodeal structure likewise vary considerably, but all the tubercles are usually weak. In several species the hind tibial teeth are absent or vestigial.

Cladogram for the *Pepsis auriguttata*-group



Characters:

1. SGP fairly broad, moderately expanded apicad, scarcely curved, concave centrally, with weak median keel; S.5 with short, dense hairs. Female head in dorsal view scarcely swollen behind eyes; SMC3 very short anteriorly; hind tibial teeth vestigial or absent.
2. Outer hairs of S.4 hooked apically; wings partly dark; body colour brilliant golden-green. Female head more or less globular; SMC3 very elongate; MPN furrow very narrow anteriorly; propodeum very broad, dorsally flattened, tubercles weak, posterior face concave medially; hind tibial teeth distant.
3. SGP strongly convex, with keel.

Internal relationships.— A very heterogeneous group, in which a closely related pair is formed only by *P. auriguttata* and *P. sabina*; despite the radically different male sternal hairs, both sexes are very similar in most other ways. The remaining species of the group are less closely related; the male sternal hairs likewise show great differences, as sometimes also do the SGP and internal genitalia.

External relationships.— Despite its great diversity, this group appears closest to the *viridis*-group by virtue of the small size of its species, and by the very strong resemblance between certain females.

Biology.— Some sexes belong to the *atripennis* or *completa* mimicry-groups.

Biogeography.— The distributional range of this group is rather restricted, comprising Amazonia (including the Guianas); three species are transandean, while one reaches central Argentina. To judge from its extreme diversity, a considerable amount of speciation and extinction has occurred. Concordant with this, reduction in size of individuals seems to have occurred at an early stage. The group is also unusual in that no less than half (three species) are transandean, a very high proportion; furthermore, these lack clear counterparts forming species-pairs; conversely, so also do the two species with mainly south-eastern ranges. Perhaps the most puzzling aspect is that one or other species of this group display many characters in common with almost all other groups in Part 3, which may be due to early, multiple character reversals.

Pepsis auriguttata Burmeister, 1872
(figs 99-104, 538, 685)

Pepsis auriguttata Burmeister, 1872: 234, no. 9. Lectotype ♀ (MACN), here designated [examined].

Pepsis aurimacula Mocsáry, 1885: 262, no. 39. Lectotype ♀ (TMB), here designated [examined]. **Syn. nov.**

Pepsis flavicornis Mocsáry, 1894: 7, no. 12. Lectotype ♂ (TMB), here designated [examined]. **Syn. nov.**

Pepsis aurimacula var. *guttata* Lucas, 1895: 532, ♀, Brazil (lost). **Syn. nov.**

Pepsis incendiaria Lucas, 1895: 654, no. 85. Lectotype ♀ (MNHU), here designated [examined]. **Syn. nov.**

Pepsis pubiventris Lucas, 1895: 677, no. 102. Lectotype ♂ (MNHU), here designated [examined]. **Syn. nov.**

Pepsis planifrons Lucas, 1895: 684, no. 108. Lectotype ♀ (MNHU), here designated [examined]. **Syn. nov.**

Pepsis lestes Lucas, 1895: 691, no. 112, ♀, Brazil (lost). **Syn. nov.**

Pepsis villosa Brèthes, 1908: 238. Lectotype ♀ (MLP), here designated [examined]. **Syn. nov.**

Type material.— *P. auriguttata*: I have seen a single type-material ♀ and labelled it lectotype; the name is spelt “*auroguttata*” on the original label. *P. aurimacula*: I have seen a single type-material ♀ and labelled it lectotype. *P. flavicornis*: I have seen three ♂ syntypes, one of which lacks the genitalia; of the other two, I have labelled the larger specimen as lectotype. *P. incendiaria*: I have seen only one of the ♀ syntypes, and labelled it lectotype. *P. pubiventris*: I have seen only a syntype ♂, and labelled it lectotype. *P. planifrons*: I have seen 3 ♀ syntypes and have labelled the one with the locality “Brazil”, as lectotype. Of the two paralectotypes, the one labelled Muzo [in Colombia] is conspecific with the lectotype, but the one from “Bogota” is a specimen of *P. sabina* Mocsáry. *P. villosa*: I have seen a single type-material ♀ and labelled it lectotype.

Description.— ♂ (figs 99-104) BL 13-18. Body and legs black with bright yellow-green to dull blue-green sheen. Antenna varying from entirely black to mainly yellow-orange. Wings heavily infuscate to black, with blue-violet reflections.

Sternal hair modifications very unusual: S.1-3 with rather strong, dense hairs slight-

ly curved at apex; **S.4 and 5 entirely covered with short, fairly dense hairs**. SGP expanded towards the rounded apex; with very long hairs, as long as maximum width of SGP, projecting beyond the apex. Paramere narrow, sharply pointed, also with hairs of similar length. PPV of forewing short and strongly transverse. Inner projection of digitus apex rounded.

♀ (fig. 538). BL 14-25. AE index 85-133. Colour as in male, except body colour darker on average (more often blue than green), wings often with amber patches (see Variation). Head in dorsal view strongly transverse, temple strongly constricted. **AS3 with a few bristles**. MT moderate to very strong, often sharp. Forewing with PPV very short, transverse, and SMC3 anteriorly narrow. MPN furrow rather broad, deep, more or less expanded posteriorly; sometimes obsolete, flattened-out and shining anteriorly. Carinae fine, occasionally 2-3 coarser than others. Propodeum: MG usually indicated anteriorly. APT moderate to strong, PPT and PTC usually weak to moderate, sometimes strong. DTC quite strong, often coarser posteriorly, usually more or less irregular; often developed along median ridge only. Propodeal hair about 1/2-3/4 PST length, occasionally more. Posterior face: VR usually strong near PTC but broken by very strong upper PFC; the latter becoming weaker apicad, surrounded by fine sculpture which becomes more shiny apicad as the PFC disappears. Lateral extension of S.2 groove very short and weak. Hairs on last gastral segment erect. Legs very slender, **femora with short, rather dense hair below** (least on hind femur, where it is mainly basal), Hind tibia: **teeth totally absent**, spines about as long as minimum (basal) tibia width. Inner spur long, slender, slightly curved at extreme apex and reaching to 0.3-0.4 basitarsus length (about equal to tarsal segment 3, occasionally as long as 2) and 1.3-1.4 times as long as outer spur.

Variation.— Antennal colour varies in both sexes: in the male, usually 1-2 apical segments are yellow or orange, or sometimes only an apical spot remains; in Amazon specimens, however, the entire antenna except AS1-2 is lemon-yellow. Females display similar variation, but the colour is darker (always orange) and it does not affect as many segments as in males from the same locality. Unlike males, however, females in southern Brazil and northern Argentina exhibit also variation in wing colour. A specimen from São Paulo, Rio Claro, has only a small amber spot around the junction of the medial and first discoidal cells in the forewing; in a specimen from Santa Catarina, further south, this spot is expanded into a rather narrow, sub-basal band, and has a small amber spot in the base of SMC3. In specimens from Brazil, Paraná, and Argentina, Santa Fé and Tucuman, the sub-basal band is wider still, extending out to the mid-point of the wing, while the distal spot is expanded into an X-shaped mark. A specimen from Argentina, Córdoba, has the most amber of all: the only infuscation remaining is a dark base, a band at the apex, and another separated from the latter by an amber band of about equal width to both. In the hindwing, a central amber patch increases in proportion to the amount of amber in the forewing. The female AE index appears to be higher on average in the northern and western parts of the species' considerable range, but it was not possible to separate the species into two groups on this basis; note also that the closely-related *P. sabina* exhibits almost as much variation, despite many fewer specimens having been seen.

Distinctions.— This species is one of the most easily distinguished of all *Pepsis*. Both sexes are very small; the male modified sternal hairs are unlike any other; the female



Fig. 685. Collection localities of *Pepsis auriguttata*.

has the unique combination of bristles on AS3, total lack of hind tibial teeth, and dense hairs on the femora. However, the female of *P. sabina* is quite similar, but has vestigial hind femoral teeth and virtually no femoral hair.

Biology.— Some females in southern Brazil and north-east Argentina tend to belong to the *completa* mimicry-group.

Distribution.— A very wide-ranging species, found in Panamá (a single record from Nicaragua (1 ♂, BMNH) needs confirmation), and the whole of South America east of the Andes (including the Guianas) south to central Argentina and Uruguay. There are no records from Ecuador or Paraguay; probably this small, inconspicuous species is under-collected. One label (1 ♂, IRSNB) reads “St. Mart.”; this may be St. Martin, W Indies, and if so, probably represents a labelling error; ascends to 1,250 m in Perú. Map fig. 685.

Material depositories.— 126 ♂♂, 180 ♀♀; AEIG, ANSP, BMNH, BRIO, CAS, CMNH, CUNY, EMMSU, FRITZ, IMLT, INPA, IRSNB, MACN, MCZ, MHNGV, MLP, MNCN, MNHNPS, MNHU, MNRJ, MNS, MPEG, MZEL, MZUSP, NRS, OLLD, OSUC, RMNH, RSM, SCHWARTZ, SEMKU, SMF, TMB, UCALB, UFPCUR, UMBREM, UMOX, UPAN, USNM, USPRIB, UZMC, WAHIS, WILLIAMS, ZMHEL, ZMMOSC, ZSM.

Pepsis sabina Mocsáry, 1885
(figs 337-345, 539, 540, 686)

Pepsis sabina Mocsáry, 1885: 265, no. 45. Lectotype ♀ (TMB), here designated [examined].
Pepsis astioles Banks, 1946: 355. Holotype ♀ (MCZ) [examined]. **Syn. nov.**

Type material.— *P. sabina*: I have seen two conspecific ♀ syntypes and have labelled the larger one as lectotype.

Description.— ♂ (figs 337-345). BL 12-17. Body and legs black with deep blue-green sheen. Antenna black with 2-11 apical segments orange. Wings usually entirely heavily infuscate with blue-violet reflections, but sometimes with yellow band (see Variation). S.4 hairs forming a pair of small but very dense brushes directed strongly inwards and backwards, strongly hooked apically, those of opposite sides scarcely touching; with a band of much finer, straighter, paler interstitial hairs between them. S.5 mostly covered by very short, fine, pale hairs (easily overlooked and sometimes abraded), longer in a small patch at each side, often strongly curved forward, but otherwise unmodified. SGP strongly expanded towards the rounded apex, which has apical hairs almost as long as its maximum width; paramere very long, about twice as long as rest of genitalia; pointed apically, and with very long hairs, up to twice its maximum width. Inner, apical projection of digitus very blunt.

♀ (figs 539, 540). BL 14-23(-28). AE index 83-113. Colour as in male, except body often with blue-violet tinge. Antenna with 4-9.5 apical segments orange; the boundary usually diffuse. Wings mainly orange to entirely infuscate (see Variation). Head in dorsal view with temple scarcely swollen and vertex not at all, so that the head is strongly transverse. MT strong, often extremely sharp, more-or-less size-related. PPV very short, SMC3 anteriorly short. MPN equal to (sometimes scarcely shorter than) PST, its furrow narrow anteriorly, usually strongly expanded posterad, sometimes only posteriorly; carinae very fine, sometimes a few moderate or coarse. Propodeum: MG replaced by strong ridge, flattened anteriorly. All tubercles rather strong, especially

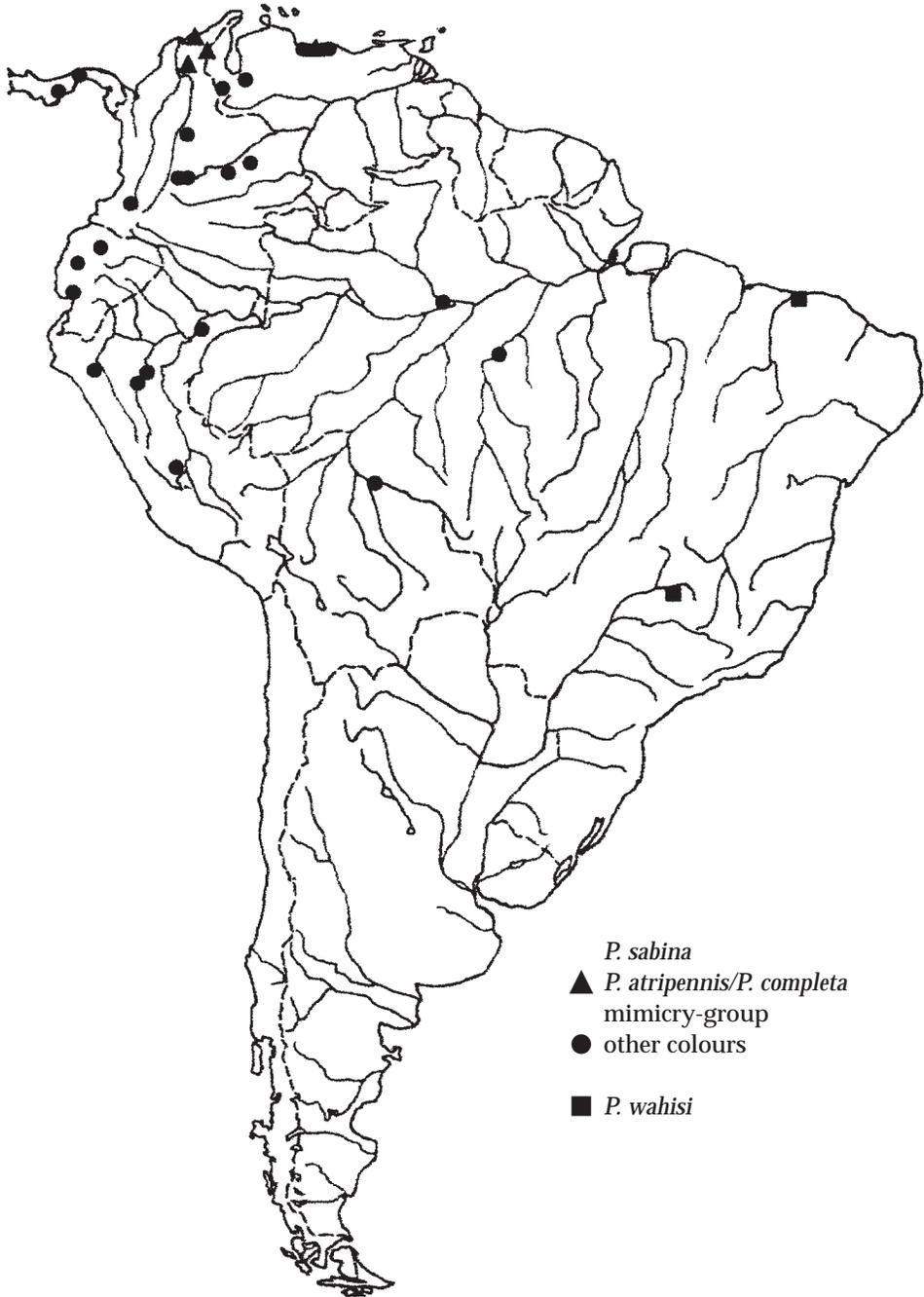


Fig. 686. Collection localities of *Pepsis sabina* and *P. wahisi*.

PTC (tooth-like in smaller specimens); DTC often very coarse. Propodeal hair extremely sparse, shorter than PST. Posterior face: VR absent; a very few PFC near upper edge, absent from centre, weakening rapidly apicad. Lateral extension of S.2 groove distinct though sometimes rather short. Anterior femur often with a few hairs below. Hind tibia: teeth very weak to vestigial, distant; the subtending spines very short, 3-5 times as high as teeth, and about as long as minimum width of tarsal segment 2; inner spur reaching 0.3-0.45 basitarsus length, (about equal to tarsal segment 2); 1.5-1.6 as long as outer spur.

Variation.— Antennal colour as noted above (on average, the paler the wing-colour, the darker the antenna). Wing colour: a male from Colombia: Cacagualito (CMNH) has a rather narrow, transverse, yellow band across the centre of the forewing and two small patches on the hindwing; the forewing has a white apex. In females, wing-colour varies as follows: three females, one from each of the Venezuelan localities Maracaibo, Merida, and Aragua, El Limon all have the wing-base and a narrow apical band infusate; two females from Colombia: Santa Marta black with a basal yellow band of variable width; one female from Peru: Cajamarca, Jaen has only a poorly-defined amber patch in mid-forewing; while in all other females seen (including another from Maracaibo) the wings are entirely infusate.

A male from Colombia: Gaviotas has the S.4 interstitial hairs much shorter (possibly worn); the SGP is more deeply cupped than usual and the apex more truncate.

Distinctions.— The male is distinguished by its colour, S.4 hairs and SGP, but the female is easily confused colour-wise with *P. montezuma*, *P. chrysothemis*, *P. menechma* and *P. terminata*, all sympatric. The best distinction from all of them is the extremely weak and distant hind tibial teeth of *P. sabina* (but caution in distinguishing *P. menechma* in Central America; see Structural Variation under that species).

Biology.— Some specimens of both sexes belong to the *completa* mimicry-group; some females belong to the *atripennis* mimicry-group.

Distribution.— Panamá; transandean in Colombia, Ecuador and northern Perú; coastal Venezuela; Amazonian Perú; a few records from the middle Amazon (Manaus and Río Tapajos 280k se Manaus); ascending to 1,500 m in Colombia. Map fig. 686.

Material depositories.— 24 ♂♂, 51 ♀♀; AMNH, BMNH, CAS, CMNH, CUNY, FDA, FRITZ, IMLT, INPA, MACN, MCZ, MEM, MHNGV, MIZAM, MNCN, MNHNPS, MNHU, MNRI, MZEL, MZFIR, MZUSP, TMB, UNCBG, UNPBOG, UPAN, USNM, UZMC, WASBAUER, ZMMICH, ZSM.

Pepsis purpureipes Packard, 1869
(figs 187-196, 597, 687)

Pepsis purpureipes Packard, 1869: 61. Lectotype ♀ (MCZ), here designated [examined].

Pepsis chlorana Mocsáry, 1885: 262, no. 40. Lectotype ♀ (TMB), here designated [examined]. **Syn. nov.**

Pepsis antennalis Cameron, 1893: 217, no. 4. Lectotype ♀ (BMNH), here designated [examined]. **Syn. nov.**

Pepsis sulcifrons Cameron, 1903: 226. Lectotype ♀ (BMNH), here designated [examined]. **Syn. nov.**

Pepsis carinata Brèthes, 1914: 311, no. 87. Holotype ♂ (MZUSP) [examined]. **Syn. nov.**

Pepsis equatoriana Brèthes, 1914: 315, no. 93. ♂, Ecuador: "Santa Inez" (lost). **Syn. nov.**

Pepsis angusta Banks, 1946: 390. Holotype ♂ (AMNH) [examined]. **Syn. nov.**

Type material.— *P. purpureipes*: I have seen a single type-material ♀ and labelled it

lectotype. *P. chlorana*: I have seen only a single ♀ syntype from "Columbia [= Colombia] Vallis Cauca" and labelled it lectotype. The ♀ syntype from "Brasília, São Paulo" is unlikely to be conspecific if that provenance is correct. *P. antennalis*: I have seen a single type-material ♀ and labelled it lectotype. *P. sulcifrons*: I have seen a single type-material ♀ and labelled it lectotype.

Description.— ♂ (figs 187-196). BL 15-21. Body and legs black with brilliant yellow-green to blue-green metallic sheen. Antenna black with 0-4 apical segments orange. Wings pale to very dark brown (sometimes not unicolorous - see Variation). S.4 with a lateral "brush" of long hairs, not very dense, rather narrowly-based, directed weakly inwards but more strongly backwards, the apex more-or-less strongly curved. S.5 with similar hairs, but fewer, and often with some shorter hairs on the inner sides of the brushes. S.6 often with a transverse, pre-apical band of thin but dense hairs about half the height of those on the preceding sternites (apparently very variable and frequently abraded). SGP very elongate, very broad and more-or-less flattened basally, suddenly narrowed and strongly upturned sub-basally, then strongly expanded towards the strongly rounded apex; the latter with a fringe of very long hairs (about 1.5 times maximum SGP width). Paramere long, narrow, rather sharply pointed apically, about 1.5 times as long as rest of genitalia. Apical projection of digitus obtusely pointed on inner side.

♀ (fig. 597). BL 15-26. AE index 94-113. Colour as in male, except antenna with 0-7.5 apical segments orange; wing-colour also more variable (see Variation). Head in dorsal view with temple moderately swollen. Thorax and propodeum rather elongate, slightly flattened dorsoventrally. MT moderate to very strong. Forewing with PPV often short and quite transverse, SMC3 elongate and bulging postero-distally, M-a spur-vein usually absent or vestigial. MPN equal to, to much shorter than, PST, its furrow evenly broad or more-or-less expanded posterad, frequently incomplete anteriorly; carinae fine, or fine and moderate mixed, matt. Propodeum: MG replaced by a very broad, flattened ridge. APT and PPT both weak to strong, largely size-related. DTC rather coarse, even, often coarser posterad and leaving a gap between last DTC and the PTC. Propodeal hair about as long as PST. PTC weak to strong. Posterior face: VR usually very weak or absent; occasionally fairly strong, near PTC only, parallel; PFC usually weak above and virtually absent below, but somewhat obscured by pubescence. Femora, especially anterior and middle, with fairly abundant hair below, up to as long as the maximum femoral thickness. Lateral extension of S.2 groove strong, weaker in small specimens. Sometimes females have a slight constriction between tergites 1 and 2 in dorsal view. Hind tibia: teeth sometimes rather small and distant, the subtending spines 2-3 times as high; inner spur reaching to 0.3-0.45 basitarsus length (about equal to tarsal segment 3), and 1.2-1.5 times as long as outer spur.

Variation.— In both sexes, body colour varies as given above; also the wing colour varies more in the female, from entirely pale amber to orange-amber, when there is sometimes a variably wide apical infuscate band, to entirely very dark; often dark with a very irregular and variable amber patch in centre of forewing, sometimes also hindwing. The much greater than usual range of structural variation (see Description above) may be connected with the species' largely montane habitat.

Distinctions.— The male is at once distinguished by its unique sternal hairs and curved SGP; the female by its slender build, the presence of subfemoral hair, the often

incomplete MPN furrow, and usually brilliant body colour; wing colour, although variable, is some help. Its distributional range also helps to confirm the identity. However, specimens with unicolorous wings could be confused with *P. gracillima*, but that species never displays the same brilliance of colour, it is more slender, the head in dorsal view is less swollen behind the eyes and has a more globular shape overall; also the AE index is larger, the hind tibial teeth are relatively smaller, and in fresh specimens there is weak hair below the front femur only, and no hair on the inner side of AS3.

Distribution.— Transandean; from Panamá to Venezuela and Perú, ascending to 1,500 m. Map fig. 687.

Material depositories.— 13 ♂♂, 24 ♀♀; AMNH, BMNH, CUNY, EMMSU, MACN, MCZ, MNHNPS, MZUSP, NMV, OSUC, PUCEQ, TMB, UNPBOG, USNM.

Pepsis schlinkei Lucas, 1897
(figs 352-357, 645, 687)

Pepsis schlinkei Lucas, 1897: 293, no. 3. Lectotype ♀ (CMNH), here designated [examined].

Type-material.— *P. schlinkei*. I have seen a single type-material ♀ and labelled it lectotype.

Description.— ♂ (figs 352-357). BL 15-21. Body (except MPN) and much of legs black with brilliant green-yellow metallic sheen. Antenna black with 1-2 apical segments orange (possibly sometimes more: very few intact specimens have been seen). Forewing dark amber, scarcely infuscate basally, but with a broad, weakly infuscate apical band covering about a quarter of the wing-length and a much darker band along the costal margin; hindwing with similar apical infuscation. S.4 with a semicircle of hairs, the laterals long, at extreme base directed strongly backwards, then more erect but directed inwards, apically more-or-less strongly hooked, scarcely touching those of opposite side, forming a dense but rather narrow "brush"; inwards, there is an abrupt transition to sparser but similar hairs, which become gradually shorter and straighter until in the centre they are about half the length (but nearly as high) as the outermost. S.5 with only a sparse lateral tuft of weak hairs. SGP long, narrow, parallel-sided, the apex rounded with a fringe of very long hairs, including some up to 1.5 times SGP width. Paramere very narrow, sharply pointed, with an apical hair-fringe as long as maximum SGP width and (including hairs) about twice as long as the rest of the genitalia. Apex of digitus with inner projection weakly pointed.

♀ (fig. 645). BL 17-28. AE index (83-)88-102. Colour as in male except antenna with 5.5-9.0 apical segments orange; forewing off-white to orange-amber with basal infuscation stronger but apical weaker, covering up to 3/4 of the wing-length (see Variation). Head in dorsal view of very unusual shape: although the temple is scarcely swollen, the head is very deep from front to back, producing a semi-globular shape; the groove running from the anterior ocellus to between the antennal sockets is very deep. The AS3 has a few coarse hairs on the inner side in fresh specimens. Entire thorax and propodeum somewhat elongate and dorsoventrally flattened. Forewing with the PPV usually very short and strongly transverse; 1r-m is strongly outslowing and 2r-m very strongly inslipping, so that the anterior vein of the SMC3 is very short; this also makes the cell strongly bulging postero-distally. MT weak to moderate (occasionally strong). MPN

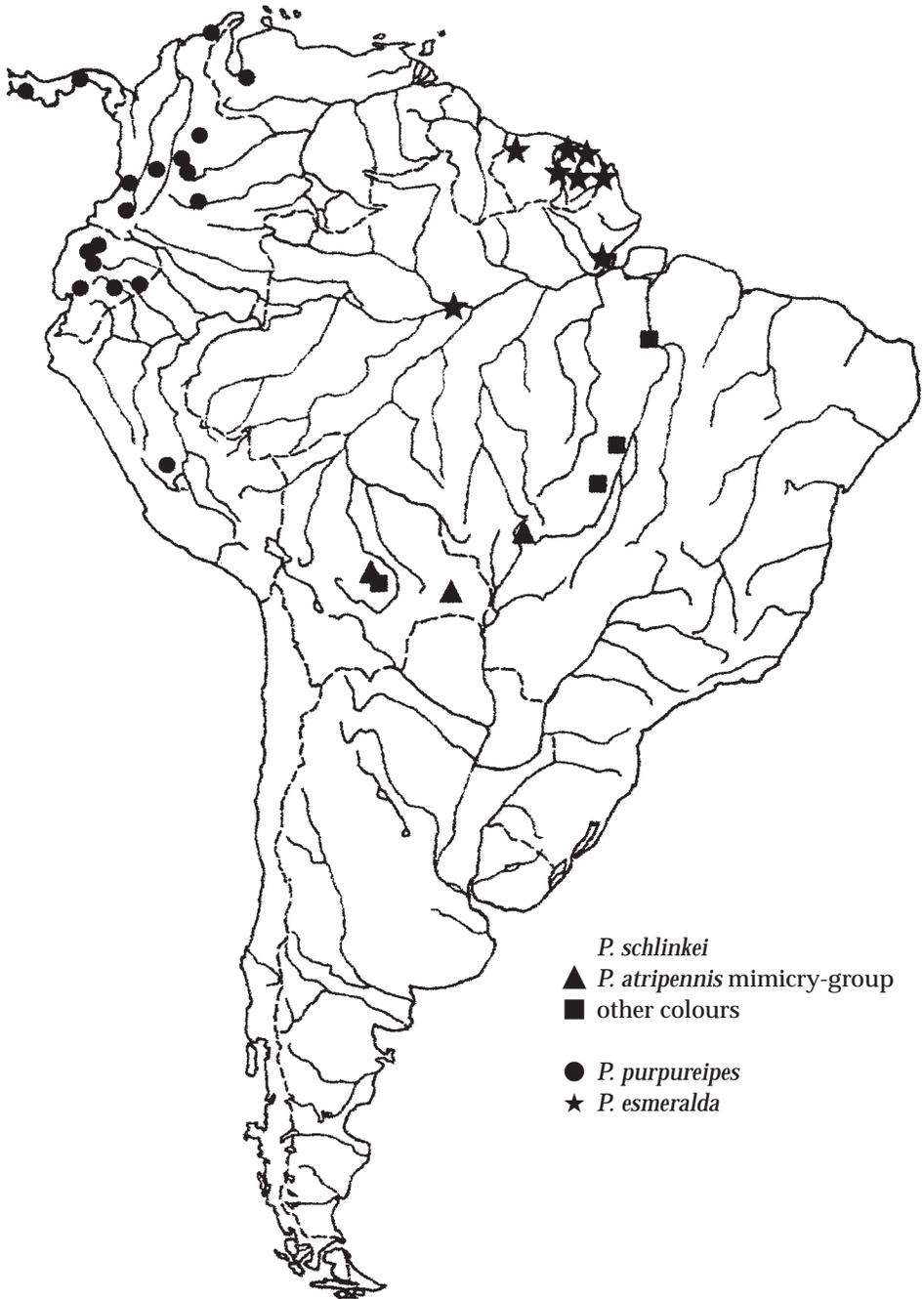


Fig. 687. Collection localities of *Pepsis schlinkei*, *P. purpureipes* and *P. esmeralda*.

equal to or slightly shorter than PST, its furrow broad and deep, more-or-less expanded posterad; carinae usually fine, often with also some coarser ones, which can be concentrated anteriorly. Propodeum: APT weak, PPT weak to moderate (occasionally strong); DTC moderate but irregular, often coarser posteriorly. Propodeal hair usually almost as long as PST. PTC absent to moderate. Posterior face: VR usually moderately strong, rather wide apart (almost 1/3 of face-width), slightly divergent above, then re-convergent below, but obsolete before reaching petiole-socket. PFC weak to fairly strong above, weaker in median line and apicad. Lateral extension of S.2 groove distinct. Hind tibia: teeth sometimes rather low, subtending spines 1.0-2.0 times as high; a sparse line of backwardly-directed setae on inner side of teeth; inner spur reaching to 0.2-0.3 basitarsus length (about equal to tarsal segment 3, occasionally slightly longer) and 1.5-1.6 times as long as outer spur.

Variation.— The wing-colour, especially in the female, varies in the extent to which the apical infuscation invades proximad; when only moderate, the veins sometimes remain orange-amber; when extensive the specimens tend to belong to the *atripennis* mimicry-group (as do some males) save that the infuscation is usually stronger in that group.

Distinctions.— The male has S.4 hairs very similar to those of *P. gracilis*; also the SGP is long, with a very long apical hair-fringe in both species. However, in *P. gracilis* the SGP is strongly expanded apicad and the paramere is very broad. Female *P. schlinkei* resembles only its close ally *P. purpureipes* in structure; but the latter has abundant coarse hair below the front femur, and *P. purpureipes* is distantly allopatric, found only in the northern Andes.

Biology.— See under Variation.

Distribution.— Known only from a restricted area, forming a shallow arc which extends from south of the Amazon delta, through central Brazil, to central Bolivia; always at low altitude. Map fig. 687.

Material depositories.— 4 ♂♂, 23 ♀♀; AEIG, ANSP, BMNH, CAS, CMNH, CUNY, MCZ, MPEG, UCALB, UFPCUR, WASBAUER.

Pepsis esmeralda spec. nov.
(figs 263-268, 562, 687)

Type material.— Holotype ♂, **French Guiana**: Mana River, vi.1917 (CMNH). Paratypes. 1 ♂, 1 ♀, data as holotype (BMNH, CMNH); 1 ♀, Oyapok River, Pied Saut, xii.1917 (Klages) (CMNH); 1 ♀, Gourdonville, x.1914 (Benoist) (MNHNPS); 1 ♂, Saül, Pont Belvédère, i.2001, Malaise trap (Tarin, Braet) (WAHIS); 1 ♀, no further data (UZMC); **Suriname**: 2 ♀♀, Marowijne, Lawa, Anapaike, 19 & 25.xi.1963 (Ligorie) (BMNH, RMNH); 1 ♀, Coppename River, Raleigh Falls, 12.vii.1963 (v.d. Vecht) (RMNH); **Brazil**: 1 ♀, Amapá, Serra do Navio, 25.v.1964 (Ross) (CAS); 1 ♂, Amazonas, Manaus, vi.1972 (Oliveira) (AEIG); 1 ♀, no data (RMNH).

Etymology.— This species is named after the Spanish word for emerald, referring to its brilliant green colour.

Description.— ♂ (figs 263-268). BL 16-18. Body and legs black with brilliant green metallic sheen, but many patches, especially on sides, of pale yellowish-silver hair. Antenna black with 2 apical segments partly or wholly orange. Wings clear or pale amber with about the apical 1/4 moderately infuscate. S.4 with a very broad but sparse band of medium-brown hair, most of the outermost laterals curved inwards apically; along

the apical margin of the sternite is a much denser band of short, paler hair reaching about 1/2-1/3 the height of the remainder. S.5 with similar hairs, but all are sparser. SGP slightly narrower in the basal half, where it also has a fairly strong but not carinate ridge; apex weakly upcurved, with a fringe of dense, short hairs (about 1/3 maximum SGP width) and sparse hairs about twice as long. Paramere about as long as rest of genitalia, broad, apically obliquely rounded-truncate. Inner projection of digitus apex strongly rounded, without a point.

♀ (fig. 562). BL 18-27. AE index 109-128. Body and legs black with weak, dark blue to blue-violet metallic sheen. Antenna black with orange colour beginning, often irregularly, on AS3-4. Wings fairly heavily infuscate, with moderately strong blue-violet reflections. Head in dorsal view quite strongly transverse, with temple slightly swollen. Antenna slender, AS3 appearing rather long. MT weak to moderate, occasionally strong, but often quite pointed. Forewing with PPV very short and transverse; 1r-m strongly sloping anterodistad, strongly curved anteriorly, 2r-m curved over most of its length, but more sharply posteriorly; posterior vein of SMC3 more-or-less arcuate outwards; thus SMC3 more rounded postero-distally than usual. MPN slightly shorter than PST, its furrow narrow, expanded anteriorly but stopping abruptly before anterior margin; carinae extremely fine, with a few stronger ones mainly in posterior half. Propodeum: **entirely evenly rounded in profile. MG present throughout, strong except anteriorly, running straight through right to distal part of posterior face.** APT very weak, PPT weak to moderate, **PTC absent.** DTC weak, irregular, often stronger posterad in MG, general surface with fine, matt microsculpture. Propodeal hair about as long as PST. Posterior face: VR strong, obsolescent posterad; PFC only on VR above, weak. Lateral extension of S.2 groove well-developed. Hind tibia: teeth large, the subtending spines only about 1.5 times as high; a sparse row of strongly backwardly-directed bristles on their inner side. Inner spur reaching to 0.3-0.35 (equal to tarsal segment 3 or slightly longer) and 1.2-1.4 times as long as outer spur.

Variation.— The paratype male from French Guiana lacks the dense, apical hairs of S.4 found in the holotype; the specimens are otherwise identical.

Distinctions.— The male is somewhat similar to that of *P. purpureipes* but in that species the S.4 hairs are all aggregated into lateral brushes, i.e. without intervening hairs. The female is very distinctive, as it is one of the few species always totally lacking the PTC; it is very like many specimens of *P. infuscata*, but in that species the distance between the VR is much greater than the MG width, and the MPN and PST are of equal length; in *P. esmeralda* the MPN is at least a little shorter. It is also somewhat similar to that of *P. viridisetos* in that the MPN furrow stops short of the anterior margin, but in that species the DTC are moderately strong over the whole of the propodeal dorsum (in *P. esmeralda* extremely weak to absent except in posterior part of MG), the PTC is usually fairly strong, often represented by more than a single carina (PTC absent). Also, *P. elongata* has a similar propodeum but is at once distinguished by its flattened, polished gaster and other strong group-characters.

Distribution.— Known only from Suriname, French Guiana and the middle and lower Amazon, at low altitudes. Map fig. 687.

Material depositories.— 4 ♂♂, 9 ♀♀; AEIG, BMNH, CAS, CMNH, MNHNPS, RMNH, UZMC, WAHIS.

Pepsis wahisi spec. nov.
(figs 105-110, 543, 686)

Type material.— Holotype ♂, [Brazil]: Minas [Gerais], Araguary, 25.ii.1930 (Seitz) (SMF). Paratype ♀, Brazil, Piauhy. 747; 172. (TMB).

Etymology.— This species is named after Raymond Wahis.

Description.— ♂ (figs 105-110). BL 15. Body and legs black with dark blue-green sheen. Antenna entirely black. Wings quite strongly infusate with a broad, yellowish-white transverse band at the mid-length of the forewing and close to the apex of the hindwing but not quite reaching its posterior margin. S.4 with a broad patch of short, sparse, very dark hairs becoming denser and slightly shorter towards the posterior margin. S.5 with a patch of very short and sparse hairs towards the posterior margin. SGP basally rather broad, rather strongly convex and forming a slight median ridge, gradually broadening still more and flattening-out towards the smoothly rounded apex, which has a slight central emargination. Extreme apex narrowly translucent reddish-brown. Surface covered with fairly dense, rather short hair; apex without a distinct fringe of longer hair (no body parts show signs of wear). Paramere slender, pointed, about half as long again as rest of genitalia; apical hair about equal to maximum paramere width. Inner projection of digitus apex very slender, pointed.

♀ (fig. 543). BL 24. AEI 106. Body colour as in male except that the metallic sheen is darker. Antenna black with last segment brown. Wings amber-brown with a slightly darker, rather narrow, apical band. Head in dorsal view scarcely swollen behind eyes. MT weak. PPV very short, SMC3 elongate. MPN as long as PST, furrow narrow, not reaching anterior margin, carinae very fine, matt. Propodeum: rather evenly convex, MG absent, DTC moderately fine, regular. APT and PPT weak, PTC little stronger than DTC. Propodeal hair about 3/4 PST length. Posterior face: VR distinct, divergent posterad. PFC as DTC. **Hind tibia without teeth**, spines lightly shorter than basal width of tibia; inner spur reaching to about 0.3 length of basitarsus (about equal to tarsal segment 3) and about 1.5 times as long as outer spur. Lateral extension of S.2 groove present.

Note.— The sexes are only tentatively associated.

Variation.— None known (only one of each sex seen).

Biology.— The only known male belongs to the *completa* mimicry-group, which see.

Distinctions.— The small body size; very short hairs of S.4 in a continuous patch; and the shape of the SGP and its lack of a long hair-fringe serve to distinguish this male. The female head, MPN and propodeum are identical to those of *P. infuscata*; but that species rarely has amber wings or totally lacks hind tibial teeth.

Distribution.— Known only from two localities in eastern Brazil, at low altitudes. Map fig. 686.

Material depositories.— 1 ♂, 1 ♀; SMF, TMB.

Species excluded from *Pepsis*, with current placement

Lectotypes are designated for *P. gigas* and *P. chrysobapta*. The name *P. collaris* is newly synonymized under *Entypus caeruleus*. New combinations are made for the following names (except *P. ichneumoneus*, which see) by the persons indicated; the word “teste” indicates a personal communication (sometimes by a label in the BMNH collection), unpublished at the time the note was made: *atrox*, *chrysobapta*, *collaris*, *dahlbomi*, *decolorata*, *dedjaz*, *gigas*, *heros*, *ichneumoneus*, *lusca* and *severa*. “Wahis, 2003” refers to notes received by e-mail in March of that year.

The following are given:

1. the original description, and type depository if confirmed;
2. first placement of the species in *Pepsis*, if different;
3. the current valid name of the species where known.

Note. Some older dates have been corrected using Ward et al. (1996).

abbreviata

Pelopoeus abbreviatus Fabricius, 1804: 204 [UZMC].

Pepsis abbreviatus; Hurd, 1952: 324. [This combination not found elsewhere].

Eremnophila binodis (Fabricius, 1798); Bohart & Menke, 1976: 147.

albifrons

Sphex albifrons Fabricius, 1793: 207 [UZMC] (not Villers, 1789).

Pepsis albifrons; Fabricius, 1804: 212.

Sphex fumicatus Christ, 1791; van der Vecht, 1973: 344.

amethystina

Sphex amethystina Fabricius, 1793: 210. [UZMC].

Pepsis amethystina; Fabricius, 1804: 215.

Anoplius amethystinus; Evans, 1951: 229.

arenaria

Sphex arenaria Fabricius, 1787: 273 [UZMC] [not Linnaeus, 1758].

Pepsis arenaria; Fabricius, 1804: 207.

Podalonia hirsuta (Scopoli, 1767); van der Vecht, 1961: 41.

argentatus

Sphex argentatus Fabricius, 1787: 274 [UZMC].

Pepsis argentatus; Fabricius, 1804: 209.

Sphex argentatus; van der Vecht, 1961: 28.

atrox

Sphex atrox Drury, 1782: 57.

Pepsis atrox; Westwood, 1837: 56.

Hemipepsis atrox (Drury, 1782) **comb. nov.** (teste M.C. Day).

auripennis (see also *caerulea*)

Sphex auripennis De Geer, 1773: 585 [not 583 as given by most authors] [Replacement name for *Sphex caerulea* Linnaeus, 1758: 571, not Linnaeus, 1763: 412].

Pepsis auripennis; Fabricius, 1804: 214 [as junior synonym of *Pepsis caerulea* Linnaeus, 1758].

Sphex caerulea Linnaeus, 1758: 571 [Synonymy confirmed by van der Vecht, 1959: 131; not Linnaeus, 1763: 412].]

Entypus caerulea; Day, 1979: 53.

avitula

Pepsis avitula Cockerell, 1941: 355. Holotype, ?female (UCMB) [examined].

Miocene Shales of Florissant, Colorado.

Fig. 688 shows the following characters: 1. Vein "A" is postfurcal by more than its own length. 2. The PPV (vein "B"), is too long for a normal *Pepsis*. 3. The pattern of two infusate bands is unknown in *Pepsis*. These characters exclude it from *Pepsis*; altogether, but especially the first one, they suggest a placement near the modern genus *Chirodamus* (teste M.C. Day). Further evidence that the fossil does not belong to the genus *Pepsis* is that it originates in the Upper Miocene of Colorado, but the "Great American Land Bridge" (linking the two Americas), which would have allowed this neotropical genus to spread north, was not formed until much later, in the Pliocene Epoch. The specimen is probably female because: six gastral tergites are visible, the last still quite large; the very abrupt taper of the gaster (allowing for flattening during fossilization) is characteristic of females; the transverse rugae (DTC) of the propodeum are probably too coarse to be those of a male. Other aspects of the fossil are: at least the hind femora, and the entire body except the propodeum, have dark pigment; the first gastral tergite is the darkest part of all, possibly due to pigment left by dense hair formerly covering the posterior face of the propodeum. Approximately the anterior quarter of each of tergites 2-6 appears paler than the remainder, but this could be due to abnormal exposure of the intersegmental membranes caused by compression. The more central parts of the two infusate bands on the forewing consist mainly of numerous, fine, closely-spaced dark lines, perhaps due to matted microtrichia. The opposite wing lacks the apical half, so that only the proximal band is visible.

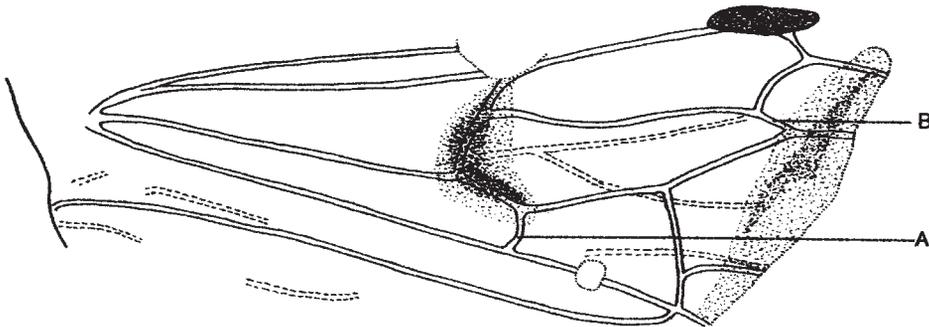


Fig. 688. Left wing [apparent right, because it is an imprint of the dorsal surface, i.e. upside-down] of "*Pepsis*" *avitula*. Single dotted lines are the edges of missing areas; double dotted lines are indistinct hindwing veins; dotted areas are pigmented.

bonariensis

Pepsis bonariensis Lepeletier, 1845: 476 [MIZSU].

Pepsis ferruginipennis (Haliday, 1837). [Synonymized by Brèthes, 1923: 126].

Entypus ferruginipennis; Roig, 1982: 315.

caerulea

Sphex caerulea Linnaeus, 1758: 571 [NRS]; [not 1763: 412 [NRS] = *Chalybion californicum* (de Saussure); Day, 1979: 53].

Pepsis caerulea; Fabricius, 1804: 214.

Sphex coerulea; Hurd, 1952: 324 [error for *Sphex caerulea* [sic] Linnaeus, 1758: 571; Fabricius, 1775: 352].

Entypus caerulea; Day, 1979: 53.

castanea

Pepsis castanea Palisot de Beauvois, 1809: 95, S. Domingo.

The venation and colour given in Palisot de Beauvois' illustration exclude this species from *Pepsis*; it may belong to the genus *Entypus* (teste M.C. Day).

chrysobapta

Pepsis chrysobapta Smith, 1855: 191, Lectotype female, Brazil, Pará. (UMOX) [examined]. I have seen a single type-material female and labelled it lectotype; it belongs to the pompilid genus *Entypus* and probably is *Entypus gigas* (Fabricius) (teste M.C. Day) (see below).

Entypus chrysobapta (Smith, 1855) **comb. nov.** teste M.C. Day.

Entypus gigas (Fabricius, 1804); teste Wahis, 2003.

cincta

Sphex cincta Fabricius, 1793: 205 [type lost; see van der Vecht, 1961].

Pepsis cincta; Fabricius, 1804: 212.

?*Sphex cincta*; van der Vecht, 1961: 32.

coerulea see *caerulea***coeruleans**

Sphex coeruleana Drury, 1773: 74.

Pepsis coerulea; Fabricius, 1804: 219.

Sphex caeruleanus; Bohart & Menke, 1976: 114.

collaris

Pepsis collaris Kirby, 1884: 408 [BMNH].

Pepsis collaris; Hurd, 1952: 318.

Entypus collaris = *E. caeruleans* Lepeletier, 1845, **comb. nov.** and **syn. nov.** teste R. Wahis, 2003.

crucis

Pepsis crucis Fabricius, 1804: 209 [UZMC].

Prionyx thomae (Fabricius, 1775); Kohl, 1890: 358.

cyanea

Sphex cyanea; Fabricius, 1775: 346, not *S. cyanea* Linnaeus, 1758.

Pepsis cyanea; Fabricius, 1804: 211.

Chalybion californicum (de Saussure, 1867); Bohart & Menke, 1976: 102.

cyanipennis

Sphex cyanipennis Fabricius, 1793: 200 [type lost; see van der Vecht, 1961, "The specimen in coll. Bosc [MNHNPS] strongly disagrees with the original description"].

Pepsis cyanipennis; Fabricius, 1804: 209.

Isodontia cyanipennis; van der Vecht, 1961: 32.

dahlbomi

Pepsis dahlbomi Stål, 1857: 64.

Hemipepsis dahlbomi (Stål, 1857); **comb. nov.** (teste R. Wahis, 2003).

decolorata

Pepsis decolorata Lepeletier, 1845: 474.

Entypus decoloratus (Lepeletier, 1845); **comb. nov.** (teste R. Wahis, 2003).

dedjaz

Sphex dedjaz Guérin-Ménéville, 1849: 355, pl. 8, f. 2. [MCSNGO; see Guiglia, 1948: 178. 1 specimen (without head, abdomen with only the first four segments)].

Pompilus (Pepsis) Dedjaz; Guérin in Lefebure, 1848: 355, pl. 8, f. 2.

Hemipepsis dedjaz (Guérin-Ménéville, 1849) **comb. nov.** [Type male "in cattivo stato" [in poor condition]; virtually no identical specimens exist; unusual Eritrean locality; teste M.C. Day].

diselene

Pepsis diselene Smith, 1855: 200. [UMOX].

Hemipepsis specularifer diselene; van der Vecht, 1953: 16.

femorata

Sphex femorata Fabricius, 1782: 443 [UZMC(K)].

Pepsis femorata; Fabricius, 1804: 212.

Hemichalybion femoratum; van der Vecht, 1961: 42.

ferruginipennis (see also *bonariensis*)

Sphex ferruginipennis Haliday, 1837: 326 [BMNH].

Pepsis ferruginipennis; Smith, 1855: 192.

Entypus ferruginipennis; Roig, 1982: 314.

fervens (see also *johannis*)

Sphex fervens Linnaeus, 1758: 569; Fabricius, 1775: 347 [MUSLUU].

Pepsis fervens; Fabricius, 1804: 209.

Prionyx fervens; Bohart & Menke, 1976: 133.

flavicornis

Sphex flavicornis Fabricius, 1782: 450 not Villers, 1789; not Mocsáry, 1894.

Pepsis flavicornis; Fabricius, 1804: 216 (Malabararia).

Cyphononyx flavicornis; Day, 1979: 50 (suggested = *Sphex antarctica* Linnaeus, 1767).

flavipennis

Sphex flavipennis Fabricius, 1793: 201; Kohl, 1890: 434 [UZMC].

Pepsis flavipennis; Fabricius, 1804, 210.

fuscipennis

Pepsis fuscipennis Fabricius, 1804: 210 [UZMC].

Isodontia fuscipennis; van der Vecht, 1961: 33.

gigas

Pepsis gigas Fabricius, 1804: 213. Lectotype female (UZMC), here designated [examined]. I have seen 2 syntype females referable to this name. The one I have labelled lectotype (in concurrence with van der Vecht's unpublished opinion) belongs to the genus *Entypus*; the other, a paralectotype, is a specimen of *Pepsis plutus* Erichson. According to Petersen (pers. comm.) there is a third specimen in UZMC(K); it is very much damaged and is not a *Pepsis*.

Entypus gigas (Fabricius, 1804) **comb. nov.** (teste M.C. Day). [cf. *chrysobapta* Smith, above].

haemorrhoidalis

Sphex haemorrhoidalis Fabricius, 1782: 443 [BMNH (Banks)].

Pepsis haemorrhoidalis; Fabricius, 1804: 209.

Sphex haemorrhoidalis; van der Vecht, 1961: 31.

heros

Pompilus heros Guérin-Ménéville, 1849: 354, pl. 7, f. 9. [MCSNGO; see Guiglia, 1948: 178: 1 female (only thorax and first abdominal segment)].

Salius heros; Kohl, 1884: 45.

Hemipepsis heros (Guérin-Ménéville 1849) **comb. nov.** (teste M.C. Day). [N.B. Has been confused with *Sphex* [= *Pepsis*] *heros* Fabricius, 1798].

hirtipes

Sphex hirtipes Fabricius, 1793: 207; Kohl, 1890: 445.

Pepsis hirtipes; Fabricius, 1804: 212.

Sphex hirtipes; Kohl, 1890: 445.

?*Sphex obscurus* (Fabricius, 1804); van der Vecht, 1961: 32 [UZMC].

ichneumoneus

Pepsis ichneumoneus Guérin-Ménéville, 1831: 258, pl. 8, f. 13. [The text gives "*Pompilus*" but the figure is labelled "*Pepsis*"; however, the figured venation is not that of a *Pepsis*. Furthermore, in a footnote on p. 257 the name is "corrected" to *Pompilus chilensis*!] [MCSNGO; see Guiglia, 1948: 178: 1 female, New Guinea].

Pompilus ichneumoneus Guérin-Ménéville, 1838 [= *ferruginea* Smith, 1860; "type in Saunders coll." teste M.C. Day].

Hemipepsis ichneumonea; van der Vecht, 1953: 10.

Hemipepsis ichneumonea ichneumonea; Wahis, 1960: 53.

johannis

Pepsis johannis Fabricius, 1804: 208 [UZMC].

Prionyx fervens (Linnaeus, 1758) [MUSLUU; see Day, 1979]; van der Vecht, 1959: 132.

lepeletieri [see also *pelterii*]

Pepsis lepeletieri Guérin-Ménéville, 1831: 257, pl. 8, f. 12 Chile [not pl. 9, f. 2. Amboina, = *Heterodontonyx* Banks] [teste Wahis, 2003] [MCSNGO; see Guiglia, 1948: 179: 1 female (head deteriorated, abdomen with only the first segment)].

Entypus lepeletierii [sic]; Roig, 1982: 322.

Entypus of *unifasciatus*-group (teste M.C. Day).

lusca

Pepsis lusca Fabricius, 1804: 215. (Tranquebaria). [UZMC].

Hemipepsis lusca (Fabricius, 1804) **comb. nov.** (teste van der Vecht) & (Wahis, in prep.).

lutaria

Sphex lutaria Fabricius, 1787: 273 [UZMC].

Pepsis lutaria; Fabricius, 1804: 208.

Psen (*Mimesa*) *lutaria*; van der Vecht, 1961: 27.

luteipennis

Pepsis luteipennis Fabricius, 1804: 210 [UZMC].

Podium luteipenne; van der Vecht, 1961: 43.

Penepodium luteipenne; Bohart & Menke, 1976: 38 [type-species of new genus].

macula

Pepsis macula Fabricius, 1804: 210. [MNHNPS].

Sphex macula; Kohl in Dalla Torre, 1897: 430.

Prionyx macula; van der Vecht, 1961: 34.

maxillaris

Sphex maxillaris Palisot de Beauvois, 1805: 38.

Pepsis maxillaris; Palisot de Beauvois, 1811: 38.

Chlorion maxillosum ciliatum (Fabricius, 1787); Bohart & Menke, 1976: 90.

maxillosus

Sphex maxillosa Fabricius, 1793: 208 [UZMC] not Poirlet, 1787.

Pepsis maxillosa; Fabricius, 1804: 213.

Sphex rufocinctus Brullé, 1863; Bohart & Menke, 1976: 116.

nigrita

- Sphex nigrita* Fabricius, 1782: 449 [BMNH (Banks)].
Pepsis nigrita; Fabricius, 1804: 216.
Chyphononyx [sic] *nigrita*; Meade-Waldo, Morley and Turner, 1915: 333.
Cyphononyx nigrita; teste van der Vecht.
Java nigrita nigrita (Fabricius, 1781); Wahis, 2000: 62.

obscurus

- Pepsis obscura* Fabricius, 1804: 213 [UZMC] (not Lepeletier).
Sphex obscurus; van der Vecht, 1961: 31.

ocellata

- Sphex ocellata* Fabricius, 1782: 450.
Pepsis ocellata; Fabricius, 1804: 215.
Hemipepsis ocellata; Meade-Waldo, Morley & Turner, 1915: 332.

pelterii see *lepeletieri***pensylvanica**

- Sphex pensylvanica* Linnaeus, 1763: 412 [NRS].
Pepsis pensylvanica; Fabricius, 1804: 211.
Sphex pensylvanicus; Bohart & Menke, 1963: 129.

pictipennis

- Pepsis pictipennis* Mocsáry, 1894: 4.
Salius pictipennis; Lucas, 1895: 827.

plumbea

- Sphex plumbea* Fabricius, 1787: 278. [UZMC].
Pepsis plumbea; Fabricius, 1804: 215.
Pompilus cinereus (Fabricius, 1775: 350) [BMNH]; Day, 1981: 12.

pubescens

- Sphex pubescens* Fabricius, 1793: 205 [UZMC].
Pepsis pubescens; Fabricius, 1804: 212.
Prionyx viduatus (Christ, 1791); van der Vecht, 1961: 33.

quadripunctata

- Sphex quadripunctata* Fabricius, 1787: 278. [UZMC].
Pepsis quadripunctata; Fabricius, 1804: 215.
Pompilus quadripunctatus; Dahlbom, 1843: 53, no. 28.
Batazonus quadripunctatus; Berland, 1925: 247.
Batozonus lacerticida Pallas, 1771: 472; Haupt, 1927: 254.

ruficeps

- Pepsis ruficeps* Lepeletier, 1845: 489, no. 34, female. Cape of Good Hope.
Hemipepsis indica (Linnaeus, 1758); [= *H. brunniceps* Taschenberg] [teste Wahis, 2003].

rufipennis

Sphex rufipennis Fabricius, 1793: 200 [UZMC] [not *rufipennis* De Geer, 1778].

Pepsis rufipennis; Fabricius, 1804: 210.

Prionyx crudelis (Smith, 1856); van der Vecht, 1961: 34.

rufipes

Pepsis rufipes Lepeletier, 1845: 472, not Linnaeus, 1758.

Sphex resinipes (Fernald); Bohart & Menke, 1976: 116.

rufipes var[iety].

Pepsis rufipes var[iety]. Lepeletier, 1845: 473. [Type lost. Identity unknown].

sericeus

Pepsis sericea Fabricius, 1804: 211 [UZMC].

Sphex sericeus; van der Vecht & Krombein, 1955: 41.

serricornis

Pepsis serricornis Fabricius, 1804: 215. [UZMC].

Pompilus serricornis; Dahlbom, 1845: 447. 3 male syntypes in UZMC; are the same as *Poecilopompilus mixtus* Fabricius; lectotype designation and synonymy necessary (teste M.C. Day).

severa

Sphex severa Drury, 1782: 58.

Pepsis severa; Westwood, 1837: 57.

Hemipepsis severa (Drury, 1782) **comb. nov.** (teste M.C. Day); probably the senior name for the type-species of *Hemipepsis*, *H. errabunda* Dalla Torre, 1897 (teste M.C. Day).

sulphureicornis

Pepsis sulphureicornis Palisot de Beauvois, 1809: 95, pl. 2, f. 6. If this does not belong to *Pepsis*, then to *Entypus* (teste M.C. Day).

t[au]

Pepsis t[au] Palisot de Beauvois, 1811: 117, pl. 3, f. 5.

Podium tau; Bohart & Menke 1976: 96.

thomae

Sphex thomae Fabricius, 1775: 346 [UZMC].

Pepsis thomae; Fabricius, 1804: 209.

Prionyx thomae; van der Vecht, 1961: 35.

tibiale

Sphex tibialis Fabricius, 1782: 444 [BMNH (Banks)].

Pepsis tibialis; Fabricius, 1804: 212.

Chalybion tibiale; van der Vecht, 1961: 41.

tomentosus

Sphex tomentosus Fabricius, 1787: 274 [UZMC].

Pepsis tomentosus; Fabricius, 1804: 211.

Sphex tomentosus; van der Vecht, 1961: 29.

unifasciata

Pepsis unifasciata Radoszkowski, 1881: 214 [Type-material in Lisbon destroyed in fire? Syntype material in BMNH? (teste M.C. Day)].

Hemipepsis unifasciata; Arnold, 1932: 331.

violacea

Sphex violacea Fabricius, 1775: 346 [UZMC] [not Scopoli, 1763].

Pepsis violacea; Fabricius, 1804: 211.

Chalybion bengalense (Dahlbom, 1845); van der Vecht, 1961: 41.

**Names in *Pepsis* whose type material is lost, and which have not been
interpreted from original descriptions**

Note.— See also “Types of Lucas, 1919” in the Introduction of this Part; and in Part 1, p. 27 of this work.

apollonis Brèthes, 1908: 240. Female, Argentina: Chaco, Libertad.

bruchii Brèthes, 1908: 242. Male, Argentina: La Plata.

capitata Haupt, 1952: 366, no. 15. Female, Brazil: Rio de Janeiro.

exornata Haupt, 1952: 323 (fig. only). The author “describes” this species only as a figure of a pair of claws (evidently hind, in dorsal view) referred to in couplet 5 (the rest of this couplet evidently pertains to *Chrysopepsis* as a whole). The name *exornata* is not given in the text (pp. 400-402) on the subgenus, nor does it appear in the index. Several females of the *sumptuosa* group are the only *Pepsis* species which possess such a claw configuration (see Part 2), but without further information it is not possible to place *exornata* more precisely.

floralis Lepeletier, 1845: 490, no. 36. Female, Brazil.

fluorescens Lucas, 1895, 661, no. 89. Female, Brazil.

fusca

Sphex fusca Linnaeus, 1761: 412; Christ, 1791: 256, T.25, F.1 [LSL].

Pepsis fusca; Kohl in Dalla Torre, 1897: 254; Hurd, 1952: 319.

Note.— Linnaeus’ name applied to mixed species (as he evidently later realized), but they were all of Palaearctic origin (see Day, 1979: 63, 76 for a full discussion). Christ did not describe a new species, he merely cited Linnaeus’ name. However, he gave Suriname as provenance for his material; this indicated a gross misidentification. His material appears to be lost, and from his description and figure it is not possible confidently to assign his material to any taxon. Dalla Torre accepted Kohl’s (previously unpublished) opinion that Christ’s material belonged in *Pepsis*, but apart from the provenance, it is difficult to know the basis for that opinion. Since no other reference to the placement of this name in *Pepsis* has been found, this would appear to be the reason for Hurd’s placement. Given the above circumstances, and since it cannot be demonstrated that the name does not belong in *Pepsis*, the name has to remain unplaced.

lahillei Brèthes, 1908: 238. Male, Argentina: Santiago del Estero, Loreto.

mixta Brèthes, 1908: 239. Female, Brazil: Jundiahy.

nemesis Lucas, 1919: 112. Male, female, Argentina.

persephone Schrottky, 1903: 41, no. 5. Female, [Brazil:] São Paulo State.

prudentopolitana Lucas, 1919: 99. Female, Brazil: Paraná.

pulchricornis Haupt, 1952: 329, no. 1. Male, North Peru: Mishuyacu in Marañon-Gebiet [near Iquitos]. The description of this species appears distinctive but does not apply well to any known species.

sericata marginata var. *sericata* Cresson, 1872: 209. Female, U.S.A.: Texas. (See “Unusual pubescence” in Part 1, p. 18 of the present work; note that Cresson also described *Pompilus philadelphicus* var. *sericatus* in the same paper.

thracis Brèthes, 1914: 271, no. 10. Female, [Brazil:] Minas Geraes.

victrix Lucas, 1895: 614, no. 70. Female, “Afrika: Angra Pequena”. This locality is on the southern coast of Namibia and, as Lucas himself points out, the specimen must be mislabelled [because *Pepsis* does not occur in the Old World].

virescens Lepeletier, 1845: 484, no. 24. Male, Brazil.

zelotarum Lucas, 1919: 69. 3 females, [Brazil:] São Paulo and Espirito Santo. [Probably a mixed series].

Nomen nudum in *Pepsis*

Pepsis decipiens Campos, 1929: 13.

References

Note 1.— Priority of publication.

1845: Dahlbom, manuscript finished 12th. June, probably published later than Lepeletier; Lepeletier, must have been published shortly before 12th. July (teste Verhoeff, 1948: 183).

The following dates are printed on the journal-part covers:

1894: Gribodo, 1st. January; Mocsáry, 30th. June.

1921: Montet, February; Banks, April.

1952: Hurd and Haupt, but no clash of priorities, as no new species were described in the former.

Note 2.— Dates of references marked * have been checked with Ward et al., 1996.

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Addendum for previous parts

Part 1

P. 9. With reference to variations in wing structure, readers who are interested in following this theme further may like to refer to Wootton (2003).

P. 26. In Costa Rica, “avispa calentador” (“heater wasp”) is used for species of *Pepsis*, presumably because of the extreme pain caused by the sting.

P. 29. Females of the *rubra* and *grossa* groups usually display a very strong PTC. The importance of this character was previously underestimated due to variation. However, it serves to confirm that the *grossa*-group is more closely related to the *rubra*-group than to the *elevata*-group. The character is found only fortuitously in other species-groups.

P. 74. Add MICR to the list of depositories for *Pepsis inbio*.

Part 2

P. 17. Discussion of lowland and montane populations of *Eucalyptus gunnii*: Schilt-huizen (2001, chapter 8: Ecotone) gives an interesting and detailed discussion on this matter.

P. 22. It was suggested that “the temperature-sensitivity of enzyme systems might be responsible for ... finely-tuned [altitude] zonation”. McKie (2003: 59) refers to the work of R. Etter and his colleagues (of Boston University of Massachusetts), who discovered that the enzymes used by certain aquatic Crustacea and Mollusca to metabolize nutrients are affected by pressure; this is related to the depth at which each species lives. This prompts the question, “Could air pressure affect terrestrial creatures likewise?”.

P. 59. In the map of *Pepsis grossa* the southernmost (queried) record is from [the Río] Huallaga (AMNH). A female labelled “Chanchamayo” (NMBB – see Addendum for Part 3) substantiates this record.

P. 65. Omitted from *Pepsis elevata*:

Material.— 197 males, 86 females; AEIG, AMNH, ANSP, BMNH, CARRASCO, CMNH, CUNY, EMMSU, FRITZ, INPA, LACM, MACN, MCZ, MLP, MLU, MNHNPS, MNRJ, MNS, MPEG, MZUSP, NHMBAS, NMV, NRS, OCHOA, OSUC, PAGLIANO, RMNH, RSM, SEMKU, SMF, TMB, UCALB, UFPCUR, UMOX, UNPBOG, USNM, UZMC, WASBAUER, WILLIAMS, ZSM.

P. 81. Fig. 237. Add Chanchamayo record to the map of *Pepsis marthae* (see modified map fig. 689 herewith).

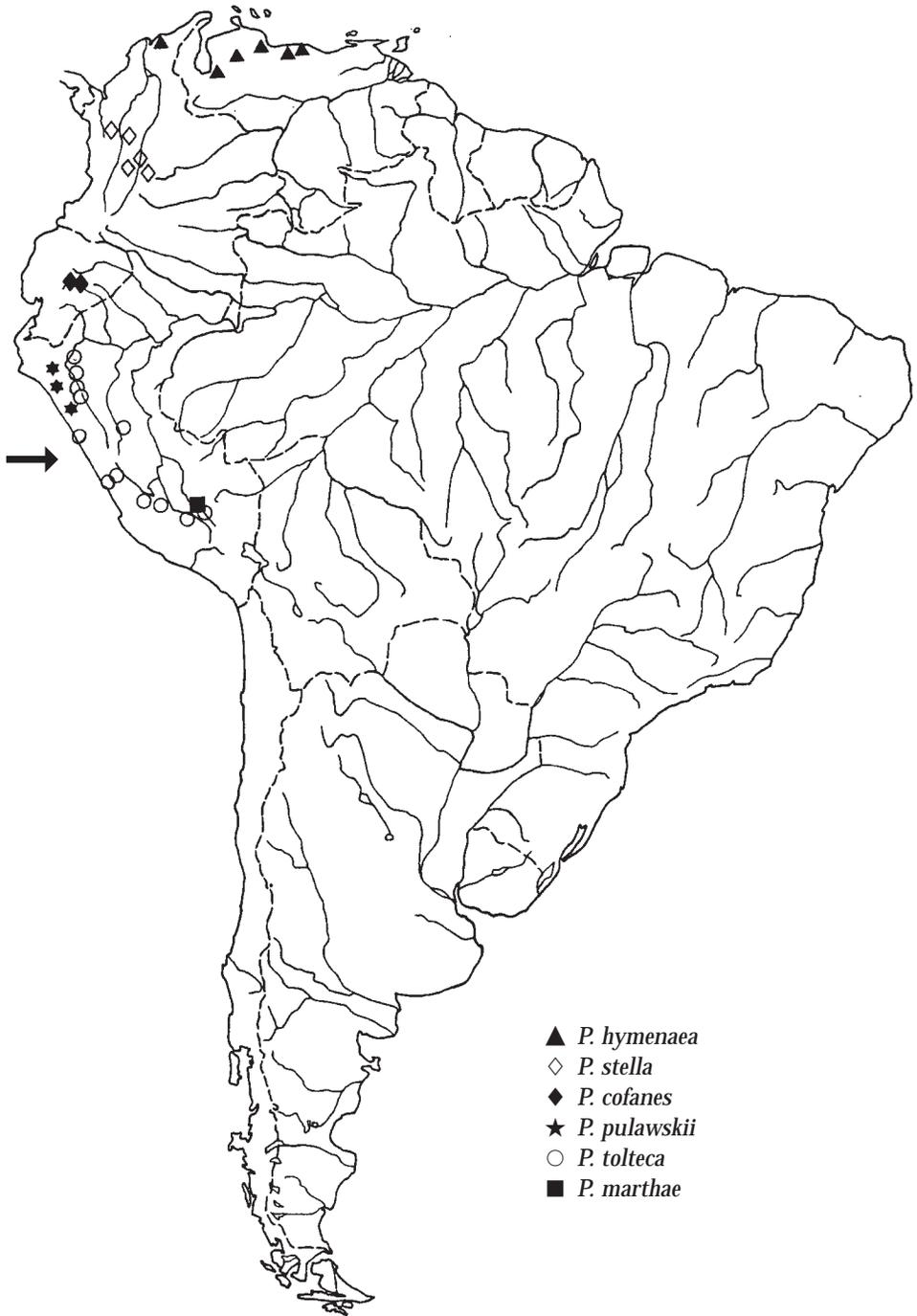


Fig. 689 (modified 237 from Part 2). Collection localities of *Pepsis hymenaea* Mocsáry, *P. stella* Montet, *P. cofanes* Banks, *P. pulawskii* spec. nov., *P. tolteca* Lucas and *P. marthae* spec. nov.

P. 103. Fig. 241. Transpose sex signs for *aurifex* (males are mimics, not females).

P. 106. Fig. 242. Sex signs should read:

black circle: males

[half-black circle: correct]

white circle: males

black diamond: females

P. 113. Fig. 243. Legend for *tricuspidata* should read:

open diamond: females and dark males

half-black diamond: intermediate males

black diamond: *P. plutus* mimicry-group males.

P. 115. Fig. 244.

Transpose sex signs for *pulszkyi* (males are mimics, not females).

P. 121. Williams (e-mail 17 Jul 2004) has said that he will probably deposit his paratypes in LACM.

P. 130. *Pepsis frivaldszkyi*. A prey record has been published, the first for this species (or indeed for any of its close relatives) (Rego et al., 2004). In November 2003, the wasp was observed dragging a juvenile spider, *Avicularia* spec., upside-down for 30 m along the forest floor, to a hole between the roots of a tree. The locality is in central Amazonia: Itacoatiara, in a floodplain (várzea); here the flood usually peaks in July and reaches about 1.5 m in depth at this point. It is interesting that the wasp evidently catches its prey in a tree (all the species of *Avicularia* are arboreal (teste Paul Hillyard, BMNH). Nevertheless, the wasp evidently still inters its prey in the ground, like other species of its genus. *Pepsis xanthocera* (Part 3) is the only other species found taking an arboreal spider, but in that case no further details could be ascertained. Although the authors used Vardy, 2002 (*Pepsis* revision Part 2) to identify the wasp (Cristina Rheims, pers. comm.), they used generic statistics from Fernández (2000) rather than from the later published *Pepsis* Part 1 (Vardy, 2000).

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Part 3

Additional collection

While this Part was in press, a collection was received from:

NMBB = Naturhistorisches Museum der Burgergemeinde Bern, Switzerland (Dr Hannes Baur).

It included an interesting new record for *Pepsis grossa* (see Addendum for Part 2), and further paratypes in the *viridis*-group, as follows:

ianthoides

♂, Pará. 2.xii.99. Ducke; *Pepsis dimidiata* F. ♂. Det. A. Ducke (NMBB).

nanoides

♀, Mus. Goeldi. Obidos. Pará. Janvier (NMBB).

♀, Brasil, Pará. 19.iv.1900. Ducke; *Pepsis dimidiata* F. ♀ det. A. Ducke (NMBB).

martini

♂, Mus. Goeldi. Obidos. Pará. Janvier. (NMBB)

♂, Mus. Goeldi. Obidos. Pará. Janvier. (BMNH)

♂, M.H. de Mathan. Obidos. 1904/1905. Mus. Goeldi. Pará. (NMBB).

These records are significant extensions of range, especially as they considerably extend the zone of sympatry of *martini* and *atripennis*, whose females cannot be distinguished.

Additional publications

The following further papers have been published recently:

Schmidt (2004) gives an interesting account on defensive mechanisms of tarantula hawk wasps (*Pepsis* and *Hemipepsis*), particularly the constituents and effects of their venom on different creatures. However, he states, "The genera contain several hundred mostly tropical species, with *Hemipepsis* distributed widely in both Old and New World regions ...". In fact there are no described species south of Panamá. There are 133 species of *Pepsis* (Vardy, 2000) and (teste Mick Day, pers. comm.) about 50% more species in *Hemipepsis*. He further suggests that the defensive systems of tarantula hawk accounts for their great longevity, but it seems at least equally possible that it is due to their large size compared with that of other Pompilidae. After all, the largest species in many groups of creatures are usually the longest-lived.

Schmidt kindly also sent papers concerning venom:

Conniff, R. 1996. The King of Sting.— *Outside* 21 (4): 82-84, 147. [Features Justin O. Schmidt; figure is probably of *Pepsis grossa*].

Odell, G.V., Fenton, A.W., Ownby, C.L., Doss, M.P. & Schmidt, J.O. 1999. The role of venom citrate.— *Toxicon* 37: 407-409.

Leluk, J., Schmidt, J.O. & Jones, D. 1989. Comparative studies on the protein composition of hymenopteran venom reservoirs.— *Toxicon* 27: 105-114.

Piek, T., Schmidt, J.O., de Jong, J.M. & Mantel, P. 1989. Kinins in ant venoms – a comparison with venoms of related Hymenoptera.— *Comp. Biochem. Physiol.* 92C (1): 117-124.

Schoeters, E., Schmidt, J.O. & Billen, J. 1997. Venom gland morphology in *Pepsis pallidolimbata* and biological use and activity of *Pepsis* venom.— *Can. J. Zool.* 75: 1014-1019.

Snelling & Torres (2004) gave keys in English and Spanish to species, with illustrations. The authors stated that “Vardy notes that all the records [of *Pepsis rubra*] from Puerto Rico pertain to the eastern half of the island.” Although both of their localities are also found in the eastern half, they unfortunately didn’t say so. Could this odd distribution pattern really reflect “distribution of collectors”?

The authors also mention the suspected prey in common of *Pepsis rubra* and *ruficornis*, but Snelling recorded different hunting habits for these two species, suggesting they prey on different spiders (see Vardy, 2000: 65). Indeed, it would be surprising if they did take the same species, as the two *Pepsis* are not closely related. At most they might prey on different stages of the same spider species. The distribution of *P. ruficornis* is given as Greater Antilles to northern South America; in fact it does not occur in the latter area; this is based on an erroneous assertion by Banks, which is discussed in the present Part.

Colour clines

Further to the discussion of east-west colour clines in Part 1: 20-21 (see also in the present Part, p. 133 *P. menechma* and p. 195 *P. discolor*), Ohl (2001: 242-243) mentions an east-west colour cline in *Handlirschia scoliaeformis* in Southern Africa. In that case, although the cline concerns body rather than wing colour, the phenomena may nevertheless be connected.

Mislabelling

Attention is drawn to a further important case of mislabelling concerning confusion between the Mato Grosso and Belem do Pará in the collections of O.W. Richards and A.G.A. Matthews, both on the Mato Grosso expeditions of 1967-1969; note that several different groups of creatures may be involved. Details are given under *Pepsis infuscata*, p. 215.

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- Schmidt, J.O., 2004. Venom and the Good Life in Tarantula Hawks: How to Eat, Not be Eaten, and Live Long.— *J. Kansas ent. Soc.* 77: 402-413.
- Vardy, C.R., 2000, 2002 [see main list of references in the present Part].

