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THE SPECIES OF THE *NEPHROTOMA DORSALIS*-GROUP IN THE PALAEARCTIC (DIPTERA, TIPULIDAE)

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ABSTRACT

A taxonomic revision of the 29 palaearctic species of the *dorsalis*-group is presented. For most taxa the following data are included: references, type-material, material examined, diagnostic notes, (brief) description, detailed drawings of male and female copulatory organs, biology and distribution; for some others reference is made to recent literature. Six new species are described (*cirrata*, *difficilis*, *gaganboi*, *koreana*, *pjotri* and *spicula*), one is given new status (*sachalina*) and one species is new for the Palaearctic region (*occipitalis*). One new synonymy is proposed (*stejnegeri* = *scurra*) and one name is taken out of synonymy (*microcera*). The taxonomic information is summarized in a checklist.

CONTENTS

INTRODUCTION

The worldwide crane-fly genus *Nephrotoma* Meigen, 1803, contains several species-groups with holartic distributions. The most extensive is the *dorsalis* species-group, which has 20 representatives in the Nearctic and 29 in the Palaearctic region with an overlap of two species. Therefore, the *dorsalis* species-group is very suitable for an analysis of the faunal exchange between these two regions, especially by way of Beringia; the more so as *Nephrotoma*, just like the Tipulidae in general, is well suited for phylogenetic (cladistis) reconstructions.

Before this is possible, the taxonomy has to be settled so the revision of the nearctic species of the *dorsalis* group (Tangelder, 1983) is followed here by a taxonomic review of the palaearctic species of this group. Contrary to the nearctic

species, knowledge of the palaearctic species is still very poor, the distribution data are scanty and the literature is limited. The most comprehensive papers are those of Savchenko (1973) and Oosterbroek (1979b), who deals only with the western palaearctic species. Nevertheless a taxonomic review is useful because important new material was available for study and several confusions and errors have been discovered and resolved after study of most of the type-material. Once more much attention is paid to the illustration of the male and female copulatory organs, on the basis of which the species can be separated and relationships recognized. In this revision 29 valid palaearctic species are recognized as belonging to the *dorsalis* species-group. Six of these are new species, *cirrata*, *difficilis*, *gaganboi*, *koreana*, *pjotri* and *spicula*, and one species, *occipitalis*, was hitherto only known from the Nearctic region. A survey of the other palaearctic species of *Nephrotoma* will be presented by Oosterbroek (in preparation).

MATERIAL

Within the scope of this revision the two following institutions were visited to study material:

The United States National Museum, Washington D.C., where the C. P. Alexander-collection is preserved, containing a lot of type-material of the eastern palaearctic species and, besides this, large quantities of unmounted material, among which several new species and many new eastern palaearctic localities of the other species were discovered.

The Academy of Sciences, Leningrad, where most of the material studied and described by Savchenko is preserved.

Other material examined originated from the British Museum (Natural History), London, from the Kyushu University, Japan, from the Museum of Comparative Zoology, Cambridge, from the Academy of Natural Sciences, Philadelphia, from the University of Kansas, Lawrence, from the Museum Alexander Koenig, Bonn, from the Magyar Nemzeti Muzeum, Budapest, from the Naturhistoriska Riksmuseet, Stockholm, from the Zoologisches Museum der Humboldt Universität, Berlin and from the Instituut voor Taxonomische Zoölogie (Zoölogisch Museum), Amsterdam.

Most of the type-material of the species concerned could be examined during this study as indicated in the checklist (Table 1). The information on the labels of the holotypes and lectotypes is exactly copied when possible, without the use of diagonals to separate lines. The terminology used for the eidetic and genital structures is explained in Tangelder (1983). All drawings are original, those of the genital structures are made on the basis of macerated material. The magnification of the drawings is always the same for the same elements, except for the lateral view of the ovipositor.

ABBREVIATIONS

The following abbreviations are used in text and figures:

adm	adminiculum
ant	antenna
biol	biology
C.	Central
comp	comparison
cont.	continent
descr	description
diag notes	diagnostic notes
distr	distribution
E.	East
fig(s).	figure(s)
hypop	hypopygium
I(s).	Island(s)
id	inner dististyle (males)
loc(s)	locality(ies)
N.	North
NE.	Northeast
obl.	oblast (province in the USSR)
od	outer dististlye (males)
ovipos	ovipositor
pl.	plate
pref.	prefecture (province in Japan)
refs	references
S.	South
sh descr	short description
sp2	sclerotized clasp, lateral part of genital bridge (males)
syn	synonymy
type mat	type material
W.	West
ANSP	Academy of Natural Sciences, Philadelphia, USA

ASL	Academy of Sciences, Zoological Institute, Leningrad, USSR
BMNH	British Museum (Natural History), London, England
CAS	California Academy of Sciences, San Francisco, USA
KU	Kyushu University, Biological Laboratory, Kyushu, Japan
MAK	Museum Alexander Koenig, Bonn, West Germany
MCZ	Museum of Comparative Zoology, Cambridge, Massachusetts, USA
MNHNP	Muséum National d'Histoire Naturelle, Paris, France
MNM	Magyar Nemzeti Muzeum, Budapest, Hungary
NRS	Naturhistoriska Riksmuseet, Stockholm, Sweden
UKaL	University of Kansas, Lawrence, USA
USNM	United States National Museum, Washington D.C., USA
USNMA	United States National Museum, Washington D.C., USA, Alexander-collection
UZMH	Universitets Zoologiska Museum, Helsinki, Finland
ZIL	Zoological Institute, University of Lund, Sweden
ZMA	Instituut voor Taxonomische Zoölogie (Zoölogisch Museum), Amsterdam, The Netherlands
ZMHU	Zoologisches Museum an der Humboldt Universität, Berlin, East Germany

THE GENUS *NEPHROTOMA* MEIGEN, 1803

References, a historic review and general information on the genus can be found in Oosterbroek (1978) and Tangelder (1983). The diagnosis of *Nephrotoma* is based on wing-venation, as defined in Tangelder (1983): "the radial sector (Rs) is very short and oblique; the vein CuA1, or if present cross-vein m-cu, meets vein M before or at the anterior corner of the discal cell, the veins of the discal cell are never (partly) fused with m-cu or CuA1; cell m1 is sessile to distinctly petiolate" (see also fig. 182).

Descriptions of the genus are presented in Oosterbroek (1978) for the western palaearctic species and in Tangelder (1983) for the nearctic species. These descriptions also apply to the palaearctic species of *Nephrotoma* with the following exceptions and additions: The body length ranges from 8-20 mm in males, from 10-24 mm in female. The yellow body colour is usually varied with light brown to black markings, that sometimes almost completely supersede the yellow colouration. The antennae are usually 13-segmented, ranging down to 11 segments in *microcera* and up to 17-20 segments in males of *dorsalis*, *sachalina* and *spicula*. The thorax is usually largely polished, frequently with limited opaque areas, sometimes partly dusted grey. The abdomen is long and slender, usually in males somewhat shorter, in females as long as or slightly longer than the lanceolate wings. In males tergite 9, which is never completely fused with sternite 9, has a differentiated black-spined posterior extension; the outer dististyle is fleshy or partly sclerotized, flattened and more or less lobe-shaped. In females the cerci are longer than the hypovalvae, apically pointed or ending bluntly; the hypovalvae are broad and elongate or largely reduced, tapering or parallel-sided.

THE *DORSALIS*-GROUP

The *dorsalis*-group (Mannheims & Pechlaner, 1963) is a species-group with a well-defined monophyletic origin based mainly on male genital characters (Oosterbroek, 1980). The group largely coincides with the *scurra*-group of Savchenko (1973). The palaearctic species of the *dorsalis*-group possess the same set of genital characters mentioned in Tangelder (1983) for the nearctic species: the inner dististyle with a dorsal crest; both inner and outer dististyles with a narrow prolongation at their base; a large, rounded and folded sp2; a weakly to deeply incised hind margin of sternite 8 in males; a broad, laterally more or less sprouted membranous area on caudo-ventral surface of sternite 9 in males, with a variable appearance of lateral plates and a medisternal appendage; gonapophyses with dorsally curved tips, or further modified, and confluent with sternite 9 at their lower posterior corners; absence of adminicular rods; semen pump with converging posterior appendages and a bifid compressor apodeme; a thin and completely tubular in-

tromittent organ; a membranous connection between the fused valvulae and the coxopodite of tergite 9 in females; broad and blunt hypovalvae with two internal ridges and basally a spined area and a variably developed internal shell.

Most of the palaearctic species of the *dorsalis*-group possess the characteristic set of external features found in the nearctic species of the group: a largely to completely shining vertex; straight lateral stripes on scutum 1; a nearly completely (sub)shining thorax, including the areas between the stripes and the katatergite; longitudinal ventral abdominal markings. Some palaearctic species of the group differ from this general image in the following way:

a. *ramulifera* and *libra* both have a largely opaque vertex and *ramulifera* has sometimes weakly downcurved lateral stripes on scutum 1
b. *gaganboi*, *pamirensis*, *perobliqua*, *pjotri* and *violovitshi* have the lateral stripes on scutum 1 anteriorly downcurved; in *pjotri* these flexures are more or less opaque, in the other four species they are shining
c. *electripennis*, *kaulbacki* and *nigricauda* also have a largely opaque vertex and the lateral stripes on scutum 1 downcurved anteriorly into a velvety spot and they have a partly shining thoracic surface with limited opaque areas, such as the mediotergite (all three), the katatergite and dorsal part of meron (all three), the lateral parts of prescutum (*kaulbacki*) and the central area of scutum 2 (*electripennis*)

So only a part (19 out of 29 species) of the palaearctic *dorsalis*-group can be separated from the other *Nephrotoma* species by means of external features. This limits the usefulness of the diagnostic key presented here when only females are available or when the males cannot be macerated. Therefore, the species of the *dorsalis*-group will also be recorded in the keys in the papers of Oosterbroek, one concerning the Japanese species and one concerning the remaining palaeartic species of *Nephrotoma* (both in preparation).

At present the holarctic *dorsalis*-group consists of 47 species, of which 20 species occur in the Nearctic region and 29 species in the Palaearctic region with an overlap between these two regions of two species (*occipitalis* and *ramulifera*). The distribution of the 29 palaearctic species dealt with in this study is as follows (see also the checklist of the species in Table 1):

- Five species are distributed throughout the Palaearctic, three of them (*dorsalis*, *lunulicornis* and *quadristriata*) show a distinct east-west disjunction, while in *scurra* the distribution looks more or less continuous; in *ramulifera* the data are too scanty for a conclusion.
- Two species (*austriaca* and *helvetica*) are confined to the western Palaearctic region.
- All the other 22 species are only found in the Asian part of the Palaearctic region:

a. six species occur on the Far Eastern Islands only and are not known from the continent: four are endemic to Japan (*angustistria*, *cirrata*, *electripennis* and *gaganboi*) and two can also be found on the Kuril Islands (*nigricauda*) and Sakhalin (*minuticornis*)
b. three species occur in the Far East on both the islands and the continent: *difficilis* is distributed from northern Japan and Sakhalin westward to central Asia, *microcera* from northern and central Japan to central Korea and *sachalina* from northern Japan, Sakhalin and the Kuril Islands northeastward to Kamchatka
c. *barbigera* and *occipitalis* both are known from central as well as eastern continental Asia
d. five species are confined to central Asia (*laticrista*, *pamirensis*, *pjotri*, *sublunulicornis* and *violovitshi*)
e. *koreana* and *spicula* are only found on the eastern side of the Asiatic continent (Manchuria, N. Korea, S. Primorye)
f. the remaining four species (*kaulbacki*, *libra*, *perobliqua* and *profunda*) are known only from the southern half of China and Tibet

Table 1: Checklist of the palaearctic species of the *Nephrotoma dorsalis*-group. Ht = Holotype, Pt = Paratype(s), Lt = Lectotype, Plt = Paralectotype(s), T = Type(s), Ex = Examined by the author, between brackets partly. Remaining abbreviations see p. 16.

Name of species and synonym(s)	Type material	Institute(s)	Ex	Distribution
angustistria Alexander, 1925	Ht♂, Pt2♂,3♀	USNM	(+)	N. + C. Japan
austriaca (Mannheims & Theowald, 1959)	Ht♂, Pt5♂, 2♀	MAK, ASL	(+)	C. Europe
barbigera (Savchenko, 1964)	Ht♂	ASL	+	C. + E. Asia (cont.)
cirrata spec. nov.	Ht♂, Pt2♂, 1♀	USNM, ZMA	+	N. Japan
difficilis spec. nov.	Ht♂, Pt1♂, 2♀	USNM, ZMA	+	C. + E. Asia, Sakhalin, N. Japan
dorsalis (Fabricius, 1781)	T?	? lost	—	Europe, C. + NE. + E. Asia (cont.)
electripennis Alexander, 1953	Ht♀	USNM	+	S. Japan
gaganboi spec. nov.	Ht♂	KU	+	C. Japan
helvetica (Mannheims & Theowald, 1959)	Ht♂, Pt4♂, 1♀	MAK, ASL	+	C. Europe
kaulbacki Alexander, 1951	Ht♂	BMNH	+	Tibet
koreana spec. nov.	Ht♂, Pt12♂, 8♀	USNM, ZMA, ASL	+	E. Asia (cont.)
laticrista Savchenko, 1966	Ht♂	ASL	+	C. Asia
libra Alexander, 1951	Ht♂	BMNH	+	Tibet
lunulicornis (Schummel, 1833)	T?	? lost	—	Europe, C. Asia
= *picta* (Meigen, 1838)	Ht♀	MNHNP	—	———
microcera Alexander, 1921	Ht♂, Pt5♂, 3♀	USNM, ASL	(+)	Japan, Korea
minuticornis Alexander, 1921	Ht♂	USNM	+	Sakhalin, Kuril Is., Japan
nigricauda Alexander, 1925	Ht♂, Pt♂♂	USNM	(+)	Kuril Is.., N. + C. Japan
occipitalis (Loew, 1864)	Ht♀	MCZ	+	C. + NE. Asia, N. America
= *snowii alternata* (Dietz, 1918)	Ht♂, Pt1♂	ANSP	+	———
pamirensis (Enderlein, 1933)	Lt♀, Plt3♀	ZMHU	(+)	C. Asia
perobliqua Alexander, 1934	Ht♂	NRS/USNM	+	China
pjotri spec. nov.	Ht♂, Pt8♂, 6♀	ASL, ZMA	+	C. Asia
profunda Alexander, 1935	Ht♂, Pt♂♂,♀♀	USNM, BMNH	+	China
quadristriata (Schummel, 1833)	T 6♂, 2♀	? lost	—	Europe, C. Asia
= *schummeli* (Riedel, 1910)	Lt ♂, Plt 2♂	ZMHU, UZMH	—	———
= *duchazaudi* Alexander, 1925	Ht♂	MNHNP, USNM	—/+	———
ramulifera Tjeder, 1955	Ht♂, Pt 1♂	ZIL	—	N. Europe, C. + E. Asia(cont.), Alaska
sachalina Alexander, 1924	Ht♂, Pt1♂	USNM	+	NE. Asia, Sakhalin, Kuril Is., N.-Japan
scurra (Meigen, 1818)	Ht♂	MNHNP	—	Europe, C. + E. + NE. Asia, Sakhalin
= *nodulosa* (Brullé, 1832)	Ht♂	MNHNP?	—	———
= *stejnegeri* Alexander, 1918	Ht♂	USNM	+	———
spicula spec. nov.	Ht♂, Pt5♂, 2♀	USNM, ZMA	+	E. Asia (cont.)
sublunulicornis (Savchenko, 1957)	Lt♂, Plt9♂, 7♀	ASL	+	C. Asia
violovitshi (Savchenko, 1967)	Ht♂, Pt1♂	ASL	+	C. Asia

KEY TO THE PALAEARCTIC SPECIES OF THE *NEPHROTOMA DORSALIS*-GROUP

0. Sternite 8 in ♂ with a weak to distinct median incision; the posterior extension of tergite 9 without lateral hornlike projections; id with an extended dorsal crest; gonaphyses usually with dorsally curved tips; sp2 large and folded. Cerci in ♀ ending blunt, hypovalvae broad and blunt; connection between the fused valvulae and coxopodite of tergite 9 membranous. Dorsal and ventral abdominal spots longitudinally arranged ..... *dorsalis* species-group 1

— Without this combination of characters .... non-*dorsalis* species-groups

1. Species combining the following characters: vertex largely to completely shining, thorax nearly completely (sub)shining, inclusive the areas inbetween the stripes, the katatergite and the mediotergite, lateral stripes on scutum 1 straight 11

— Lateral stripes on scutum 1 distinctly downcurved into a dark spot anteriorly, if not so then vertex largely opaque 2

2. Antero-lateral corners of scutum 2 velvety dark brown to black. Lateral part of pronotum, mediotergite and katatergite opaque 3

— Antero-lateral corners of scutum 2 weakly to dark brown tinted. Thorax largely and evenly (sub)shining without the opaque areas as mentioned above 5

3. Black occipital marking extended to top of tubercle. Lateral parts of prescutum opaque. Tibet ..... *kaulbacki*

— Occipital marking not reaching to top of tubercle, usually small, ranging from pale brown to black. Lateral parts of prescutum shining. Japan and Kuril Is 4

4. Antennal flagellum brown-yellow. Occipital marking pale. Central area of scutum 2 opaque. Postero-median corners of sternite 8 in ♂ abundantly set with small black spines (fig. 45). S. Japan . *electripennis*

— Antennal flagellum ranging from yellow-brown to black. Occipital marking shortly triangular, usually black. Central area of scutum 2 shining. Extended top of posterior corners of sternite 8 in ♂ set with black spines (fig. 59). N. + C. Japan, Kuril Is..... ..... *nigricauda*

5. Vertex largely opaque. Lateral stripes on scutum 1 straight or only weakly downcurved anteriorly 6

— Vertex largely to completely shining. Lateral stripes on scutum 1 distinctly downcurved anteriorly into a brown to black spot 7

6. Mediotergite with a completely yellow anterior part. Tarsal claws untoothed. Tibet ..... *libra*

— Mediotergite with a broad, dark brown median stripe on anterior part. Tarsal claws of ♂ toothed. Medisternal appendage of sternite 9 in ♂ stout, bifid and sclerotized. Northern Holarctic ..... *ramulifera*

7. Rostrum yellow dorsally. Dark brown occipital marking more or less half oval-shaped. Mediotergite with a dark brown anterior stripe. Tarsal claws untoothed. Incision of sternite 8 in ♂ closed by a short-hairy membrane. C. Japan ..... *gaganboi*

— Rostrum with a blackish spot dorsally. Occipital marking black and more or less onion-shaped (fig. 13). Mediotergite without a median stripe, anterior part completely yellow or with darkened sides. Tarsal claws of ♂ toothed. Continental Palaearctic 8

8. Anterior flexures of lateral stripes on scutum 1 opaque. Strongly interrupted dorsal stripe on abdomen obliterated anteriorly, tergite 1 unspotted. C. Asia ..... *pjotri*

— Anterior flexures of lateral stripes on scutum 1 shining, sometimes subshining. Dorsal stripe on abdomen not obliterated anteriorly, tergite 1 with a dark spot 9

9. Head and thorax extensively coloured with brown and black (fig. 1), sides of mediotergite (dark)brown. Tergite 1 with a broad, black-brown transverse marking. C. Asia ..... *pamirensis*

— Head and thorax (bright) yellow with brown and black markings, sides of mediotergite darkened or yellow. Tergite 1 with a dark brown spot dorsally 10

10. Occipital marking anteriorly prolonged into a narrow line. Sides of mediotergite darkened. Wings with brown shades at bases of cells r3, r4 + 5 and wingtip. Caudo-ventral surface of sternite 9 in ♂ without lateral plates and with a slender medisternal appendage (fig. 28). China .... also keyed out in couplet 15... *perobliqua*

— Occipital marking not prolonged anteriorly. Mediotergite with yellow sides and dorsal surface. Wings not shaded. Caudo-ventral surface of sternite 9 in ♂ with distinct lateral plates and a sclerotized medisternal appendage (figs. 35, 36). C. Asia..... *violovitshi*

11. Antennae with 17-20 segments in ♂ and 15-16 segments in ♀. Caudal corners of sternite 8 in ♂ strongly extended and lobe-shaped (figs. 90, 103, 104, 113)..... 12

— Number of antennal segments not exceeding 15 in ♂ and 14 in ♀. Caudal cor-

ners of sternite 8 in ♂ otherwise..... 14

12. Caudo-dorsal corners of sternite 9 in ♂ without projections. Longest verticillar hairs of antennae in ♀ more than twice as long as segments. (Sub)terminal blackening extensive in both sexes, usually comprising abdominal segments 7 (largely), 8 and 9 and in ♀ also tergite 10. NE. Asia, Sakhalin, Kuril Is., N. Japan..... *sachalina*
— Caudo-dorsal corners of sternite 9 in ♂ with a distinct projection (figs. 91, 114). Longest verticillar hairs of antennae in ♀ not more than twice as long as segments. (Sub)terminal darkening of abdomen usually on segments 7 (partly) and 8 in both sexes, sometimes also some darkening on segment 9..... 13
13. Caudo-dorsal corners of sternite 9 in ♂ with a tooth-like projection (fig. 91). Antero-lateral corners of scutum 2 light to dark brown. Occipital marking fig. 87. W. + E. Palaearctic (continent) ..... *dorsalis*
— Caudo-dorsal corners of sternite 9 in ♂ with a pointed-tapering projection (fig. 114). Antero-lateral corners of scutum 2 dull brown to black. Occipital marking fig. 89. E. Asia (continent) ..... *spicula*
14. Region between large black occipital marking and dorsal eye-margins completely (dark)brown coloured. Apices of cells r4 + 5, m1 and m2 of the wing usually with macrotrichia. C. Europe..... *helvetica*
— Lateral parts of vertex yellowish or tinted with isolated brown spots. Wings without macrotrichia as mentioned above (except in *quadristriata*) 15
15. Occipital marking broader than lateral stripes on scutum 1, more or less onion-shaped. Sides of mediotergite darkened. Tarsal claws of ♂ toothed. China..... also keyed out in couplet 10..... *perobliqua*
— Occipital marking not broader than lateral stripes on scutum 1, not onion-shaped. Sides of mediotergite not darkened. Tarsal claws untoothed 16
16. Antero-lateral corners of scutum 2 dark brown to black. Lateral parts of vertex frequently with pale to dark brown spots... 17
— Antero-lateral corners of scutum 2 yellow or pale brown. Lateral parts of vertex without dark spots 24
17. Antennae 11-segmented in both sexes. No distinct occipital marking. Pterostigma pale yellow, wingtip narrowly brown shaded. Membranous area on caudo-ventral surface of sternite 9 in ♂ plain (fig. 191). Japan, Korea ..... *microcera*
— Antennae 13-segmented in both sexes. Occipital marking distinct or indistinct. Pterostigma (dark)brown, if pale, than no brown shade along wingtip..... 18
18. Pterostigma faint, sometimes brown; wings without brown shades. Dark to pale brown occipital marking usually shortly triangular, sometimes hardly indicated. Lateral parts of vertex without brownish spots. Continental Palaearctic, Sakhalin.... ..... *scurra*
— Pterostigma brown to dark brown; wings with brown shades at bases of cells r3, r4 + 5 and wingtip. Occipital marking variably or absent. Lateral parts of vertex usually with grey-brown to dark brown spots 19
19. Occipital marking absent or only a small dash in centre of vertex; elongated grey-brown spots along dorsal and caudal eye-margins. Thoracic stripes red-brown to dark brown. Sternite 8 in ♂ with a dense tuft of incurved golden hairs midventrally (fig.273). China..... *profunda*
— Brown to black occipital marking ranging from shortly triangular to broadly or narrowly elongated; brownish spots on lateral parts of vertex not extended to postgenae. Thoracic stripes ranging from brown to black..... 20
20. Antennal flagellum more or less uniformly dark brown to black. Pleura usually with (dark)brown to black markings..... 21
— Antennal flagellum bicoloured, segments brownish with yellow bases. Pleura with dark yellow to red-brown markings..... 22
21. Dark brown occipital marking usually reaching to top of tubercle. Pterostigma dark brown. (Sub)terminal abdominal

segments conspicuously darkened in both sexes. Medisternal appendage of sternite 9 in ♂ flattened and directed ventrally (fig. 127). W. + C. Palaearctic ..... *lunulicornis*

— Dark brown occipital marking triangular, sometimes small, frequently reaching beyond midlength of vertex. Pterostigma light to grey-brown, sometimes dark brown. Abdomen with a rather narrow subterminal darkening. Sternite 9 in ♂ without a medisternal appendage (fig. 233). W. + C. Palaearctic ..... *quadristriata*

22. Occipital marking more or less elongated triangular (fig. 124). Medisternal appendage of sternite 9 in ♂ directed ventrally (fig. 138). Cerci of ♀ rather short and broad (fig. 145). C. + E. Asia, Japan .... *difficilis*

— Occipital marking a narrow stripe or spot (figs. 125, 126). Medisternal appendage of sternite 9 in ♂ directed caudally. Cerci of ♀ long and slender 23

23. Abdominal dorsal stripe as broad as scutellum. Subterminal darkening of abdomen strong. Tips of the hypovalvae somewhat pointed (fig. 167). N. + C. Japan ..... *angustistria*

— Abdominal dorsal stripe about as broad as lateral stripes on scutum 1. Subterminal darkening of abdomen weak or absent. Tips of hypovalvae rounded off (fig. 158). E. Asia (continent) ..... *koreana*

24. Antennae 14-segmented in both sexes; flagellum uniformly black-brown. Pterostigma dark brown, bases of cells r3, r4 + 5 and wingtip brown shaded. C. Europe ..... *austriaca*

— Not with this combination of characters 25

25. Brown to black occipital marking elongated, reaching to base or top of frontal tubercle. Pleura usually with some dark brown or black markings 26

— Occipital marking absent, vague or shortly triangular, not reaching beyond midlength of vertex. Pleura without dark brown or black markings 28

26. Antennae in ♂ 14/15-, in ♀ 13/14-segmented, flagellum brownish, bases of segments sometimes more pale. Thoracic stripes red-brown to black-brown, colours fading caudally. C. + NE. Asia, Alaska ..... *occipitalis*

— Antennae 13-segmented with a completely black-brown flagellum. Thoracic stripes uniformly blackish 27

27. Rostrum with a brown dorsal surface and yellow sides. Caudal part of paratergite with a black dash. Mediotergite with a narrow (dark)brown stripe on antero-dorsal part. Pterostigma light brown. Sternite 9 in ♂ without a medisternal appendage (fig. 285). C. Asia ..... *sublunulicornis*

— Rostrum with brown dashes dorsally and dark brown spots on sides. Paratergite without black dashes. Mediotergite with a broad, dark yellow stripe on antero-dorsal part. Pterostigma dark brown. Sternite 9 in ♂ with a solid, sclerotized medisternal appendage (fig. 269). C. Asia ..... *laticrista*

28. Antennal flagellum completely black from second segment, in ♂ these segments strongly incised (fig. 255). Pterostigma dark brown; wings without shades. Sternite 8 in ♂ with a membranous finger-like extension and bundles of long hairs ventrally (fig. 257). C. + E. Asia (continent) .... *barbigera*

— Antennal flagellum dark yellow to brown, segments not strongly incised. Pterostigma yellow-brown or dark brown, if dark brown than wings with distinct shades 29

29. Pterostigma yellow-brown; wings without distinct shades. Median stripe on scutum 1 frequently with a yellowish capillary line. Anterior stripe on mediotergite dark yellow or vague. Sternites 8 and 9 in ♂ both with a finger-like extension ventrally, sternite 8 with long curved yellow hairs (figs. 201, 202). Sakhalin, Kuril Is., Japan .... *minuticornis*

— Pterostigma dark brown; distinct shades at bases of cells r3, r4 + 5 and along wingtip. Median stripe on scutum 1 without a yellow line. Anterior stripe on mediotergite broad and (dark)brown. Sternite 8 in ♂

with bulbously extended posterior corners and a deep incision, closed by a short-haired membrane; medisternal appendage of sternite 9 solid and bifid (fig. 173). N. Japan ..... *cirrata*

DIVISION INTO SECTIONS

The species studied in this paper are divided into sections for practical reasons. Although the studied phylogenetic relationships will be subject of a following paper, the clustering of the species is based partly on relationship and similarity and partly on distributional records. The sections and species will be treated in the following sequence:

Section 1: The four closely related species *pamirensis*, *pjotri*, *perobliqua* and *violovitshi*, primitive members of the *dorsalis*-group, externally characterized by the anteriorly downcurved lateral stripes on scutum 1 and the broad, onion-shaped occipital marking ..... p. 23

Section 2: The three related species *electripennis*, *nigricauda* and *kaulbacki*, all considered more primitive members of the *dorsalis*-group and sharing the largely opaque vertex and the velvety black spots on antero-lateral parts of scutum 1 and 2 ..... p. 32

Section 3: The two species *libra* and *ramulifera*, combining the largely opaque vertex with the straight lateral stripes on scutum 1..... ..... p. 39

Section 4: The *dorsalis*-group s.s., containing the three closely related species *dorsalis*, *sachalina* and *spicula*, all having polymerous antennae in both sexes and strongly extended caudal lobes at the male sternite 8 ..... p. 42

Section 5: The *lunulicornis*-group with the four species *lunulicornis*, *difficilis*, *koreana* and *angustistria*, closely related and characterized by the strongly modified adminiculum without dorsally curved gonapophyses, exceptional within the *dorsalis*-group ..... p. 51

Section 6: The four species *cirrata*, *gaganboi*, *microcera* and *minuticornis*, which are all confined to Japan and nearby regions (Sakhalin, Kuril Islands, Korea) ..... p. 61

Section 7: The two species *austriaca* and *helvetica*, which are endemic to central Europe... ..... p. 70

Section 8: The two species *quadristriata* and *scurra*, both occurring in the western Palaearctic as well as central and/or eastern Asia ..... p. 73

Section 9: A final group of five species, *barbigera*, *laticrista*, *profunda*, *sublunulicornis* and *occipitalis*, all confined to the eastern palaearctic continent except for *occipitalis* which occurs also in the Nearctic region ..... p. 79

Section 1

Nephrotoma pamirensis (Enderlein, 1933)

Figs. 1, 2-11, map 1

Enderlein, 1933: 146, descr (as *Pachyrhina*); Savchenko & Violovich, 1967: 330, comp, 357, 365, key (as *Pales*); Savchenko, 1973: 107-09, descr, figs. hypop, locs (= partly *pjotri*), distr, biol (as *Pales*); Oosterbroek, 1980: 368, distr.

Material examined

Type material: The original description of *Pachyrhina pamirensis* Enderlein, 1933 was based on 2 ♀ from "Muskol (nördl. Pamire, 25), 4200 m, 15. VI., (Typus)" and 2 ♀ from "Aksu (Murgab-becken, 33), 3800 m, 24. VII.". The complete type-series is preserved in the ZMHU, two of them are studied here. One ♀ is labelled: "Zentral-Pamir VII.-VIII. 28 leg. Reinig" "Muskol 15.7. 4150 m" "CoTypus" "Pachyrhina pamirensis cotype Enderl. ♀ Dr. Enderlein det. 1932" "LECTOTYPE Nephrotoma pamirensis (Enderlein) I. Tangelder 1984". Although labelled 'cotype', this specimen is designated as lectotype because 'Muskol' has to be considered the type-locality (according to the original description). The other ♀ is labelled: first label as lectotype, "Ak-sŭ 3700 m 24.7." "Typus" "Pachyrhina pamirensis Type Enderl. ♀ Dr. Enderlein det. 1932" and paralectotype-label; condition of both types fair to good. The type-locality, Muzkol mountains, as well as Ak-sŭ at the Murgab river are situated in the centre of the Gorno-Badakhshanskaya A.O. in the U.S.S.R.

Other material: 36 ♂, 21 ♀ (ASL, USNMA, ZMA), from the USSR: Uzbekskaya

SSR: Syr-Dar'inskaya obl. (1 ♀); Kazakhskaya SSR: Alma-Atinskaya obl. (Zailiyskiy Alatau, 2 ♀); Kirkizskaya SSR (Susamyr, 1 ♀; Irkeshtam, 1 ♂); Tadzhikskaya SSR, Gorno-Badakhshanskaya A.O. (Pamir: Chechekty pass, Murgab river, 8 ♂, 4 ♀; Tacktakorum pass, 3 ♂, 7 ♀; near Pshart pass, 21 ♂, 3 ♀; Baljandkiik, 2 ♂, 1 ♀; Zorkul Lake, 1 ♂, 2 ♀).

Diagnostic notes

In general appearance as well as hypopygial characters the four species *pamirensis*, *pjotri*, *perobliqua* and *violovitshi* are close to each other. They can be recognized by the black antennal flagellum, the brown-black dorsal surface of the rostrum, the more or less onion-shaped black occipital marking, the black thoracic stripes with the lateral ones on scutum 1 slightly to distinctly downcurved at anterior ends, the shining mediotergite with the dorsal surface always yellow, the toothed tarsal claws of the males and some hypopygial characters (shortly incised hind margin of sternite 8, ventrally directed medisternal appendage of sternite 9 and a strongly extended crest of the inner dististyle). The somewhat similar species *libra* differs from them in having straight lateral stripes on scutum 1, a more narrow occipital marking and untoothed tarsal claws in males; the related species *kaulbacki* differs from these four species in having a narrow and elongate occipital marking, opaque dark brown antero-lateral corners of scutum 2, opaque surfaces on lateral prescutum and pleural parts and a largely opaque mediotergite. *N. pjotri* can easily be distinguished from *pamirensis*, *perobliqua* and *violovitshi* by the velvety-black, sometimes subopaque, downcurved parts of the lateral stripes on scutum 1 (shining in the other three species), and the narrow and discontinuous, anteriorly obliterated abdominal dorsal stripe. *N. pamirensis* is characterized by the extensive brown and black colour of head and thorax (fig. 1), including the (dark)brown sides of the mediotergite, the brown tinting of sternite 1 and the rather poor (sub)terminal darkening. Some differences between *perobliqua* and *violovitshi* are

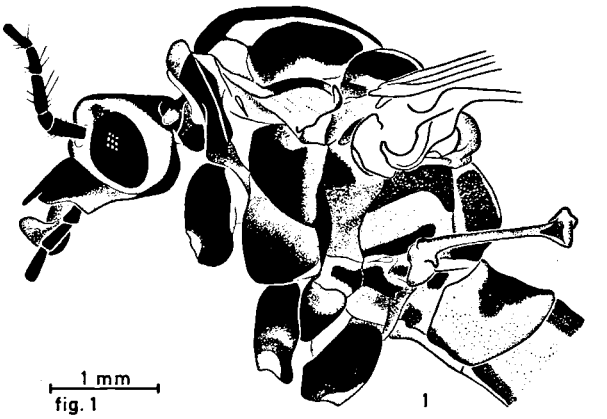


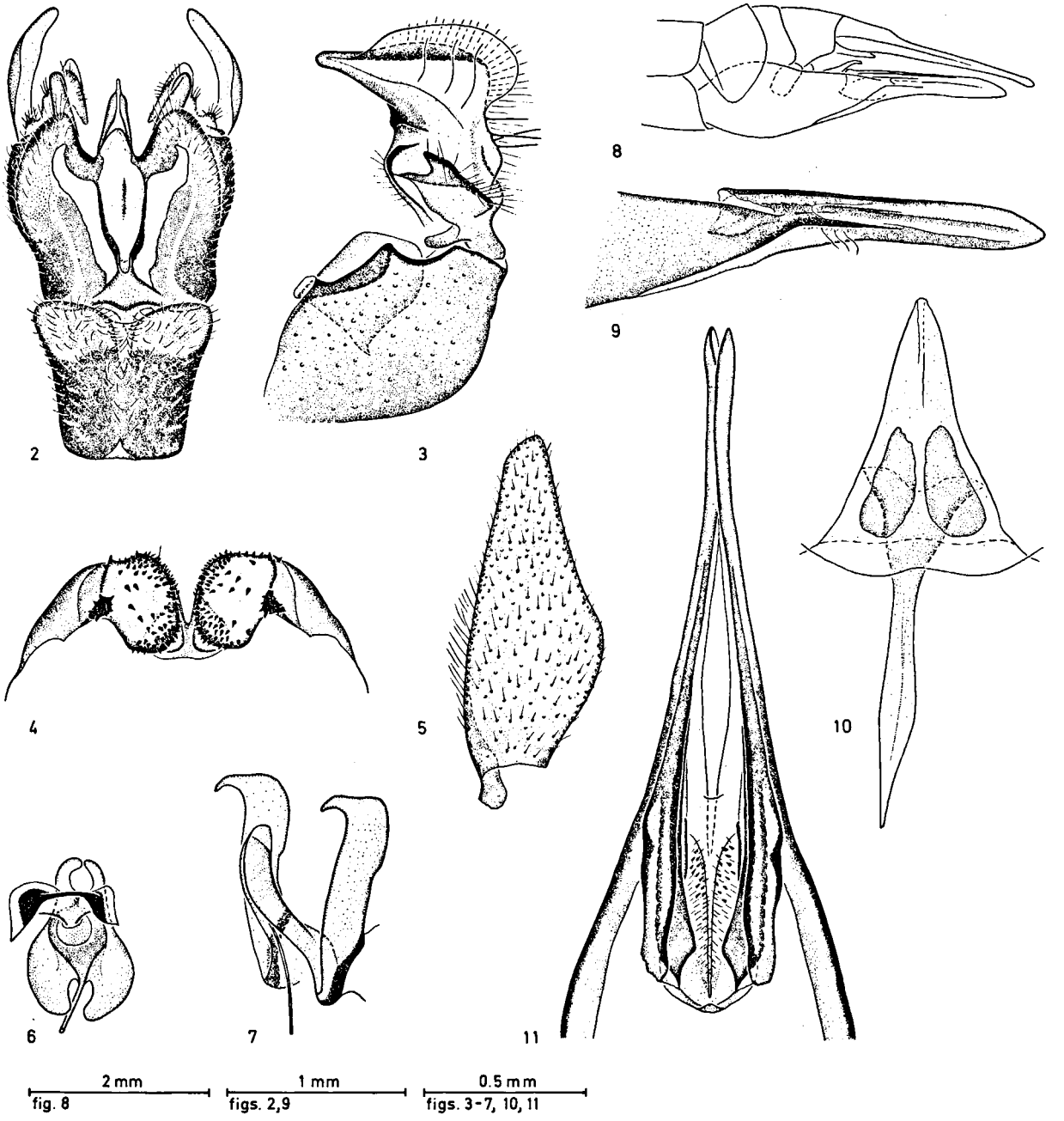
Fig. 1. *N. pamirensis*; ♀ from Pamir, USSR, head and thorax, lateral view.

the shape of the occipital marking (anteriorly prolonged into a narrow brown line in *perobliqua*, not prolonged in *violovitshi*), the tinting of the mediotergite (dorsal surface and sides yellow in *violovitshi*, sides darkened in *perobliqua*) and the numerous macrotrichia on the pterostigma and lack of shades on the wings of *violovitshi* (a few macrotrichia on pterostigma and a brown shade at bases of cells r3, r4 + 5 in *perobliqua*).

Brief description

Body length 12-15.5 mm (♂), 17-19.5 mm (♀), wing length 12.5-15 mm (♂), 14-15 mm (♀), body colour dark yellow. Antennae of both sexes 13-segmented, length 5.0-6.0 mm (♂), 3.1-3.7 mm (♀); scape dark brown, pedicel and flagellum uniformly dark brown to black, second and following flagellar segments in ♂ slightly incised beneath. Nasus and dorsal part of rostrum shining black, lower sides yellow-brown to dark brown; palps black-brown; frons dull yellow with a black-brown spot in the middle, tubercle and anterior part of vertex opaque dark yellow with two large black-brown orbital spots, remainder of vertex and postgenae more or less shining, black occipital marking broad, onion-shaped and anteriorly prolonged into a (dark)brown spot reaching up to top of tubercle; medio-ventral parts of postgenae blackish. Median part of pronotum

dull yellow-brown to brown, sides largely black; remainder of thorax shining; stripes black, lateral ones on scutum 1 anteriorly downcurved into a large, (sub)shining dark brown spot; transverse suture not or weakly tinted, antero-lateral corners of scutum 2 brown to dark brown, caudo-lateral parts of scutum 2 with (dark)brown spots; scutellum yellow-brown, mediotergite with (dark)brown sides, a narrow yellow dorsal portion and a broad black-brown posterior marking; pleura abundantly marked with brown to black spots (fig. 1). Coxae largely



Figs. 2-11. *N. pamirensis*; 2-7, ♂; 8-11, ♀. 2. hypopygium, caudo-ventral view; 3. id, outside; 4. tergite nine, ventral view; 5. od, outside; 6. semen pump, dorsal view; 7. adminiculum, lateral view; 8. ovipositor, lateral view; 9. left hypovalva, lateral view; 10. fused valvulae and furca, dorsal view; 11. hypovalvae, dorsal view.

black-brown, tarsal claws of ♂ toothed. Wings with a hyaline brown tinge, pterostigma (dark)brown, wings not shaded or only weakly at bases of cells r3, r4 + 5. Abdomen bright dark yellow; tergite 1 with a broad black-brown transverse marking, dorsal stripe black-brown, nor or slightly interrupted, usually not broader than scutellum, frequently more narrow; black-brown dashes on sides of tergites usually forming a continuous stripe; sternite 1 partly to largely dark brown, ventral stripe on sternites broad and nearly continuous; segment 8 basally and tergite 9 completely black-brown, remainder of (sub)terminal segments yellow-brown to brown in both sexes. Hypopygium and internal structures figs. 2-7; caudo-ventral surface of sternite 9 with narrow lateral plates and a ventrally directed medisternal appendage. Ovipositor and internal structures figs. 8-11.

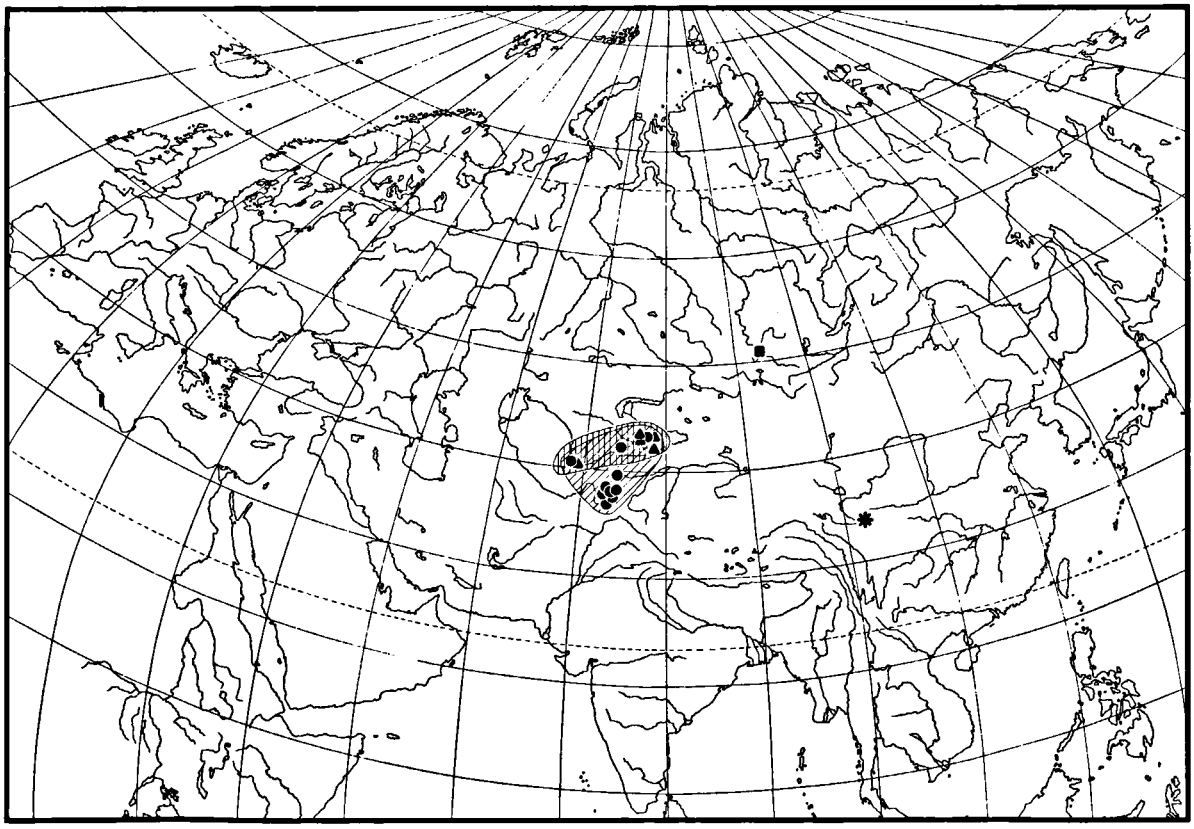
Biology and distribution (map 1)

N. pamirensis is found most frequently at altitudes between 2600 to 4300 m. The flight-period ranges from June 6 till August 10. The species is known from the southwestern Siberian mountains in central Asia (Pamir, Alayskiy Mountains). Some localities mentioned for *pamirensis* in Savchenko, 1973 (among others Kamenki, Alma-Ata; Kazatsche, Zailiyskiy Alatau and Dzhetyoguz, Lake Issyk-Kul) refer to *pjotri*, a largely sympatric close relative of *pamirensis*.

Nephrotoma pjotri spec. nov.
Figs. 12-13, 14-26, map 1

Material examined

Type material: Holotype ♂, labelled: "Zailiyskiy Alatau, usjt. Kazatsche 1400-3200



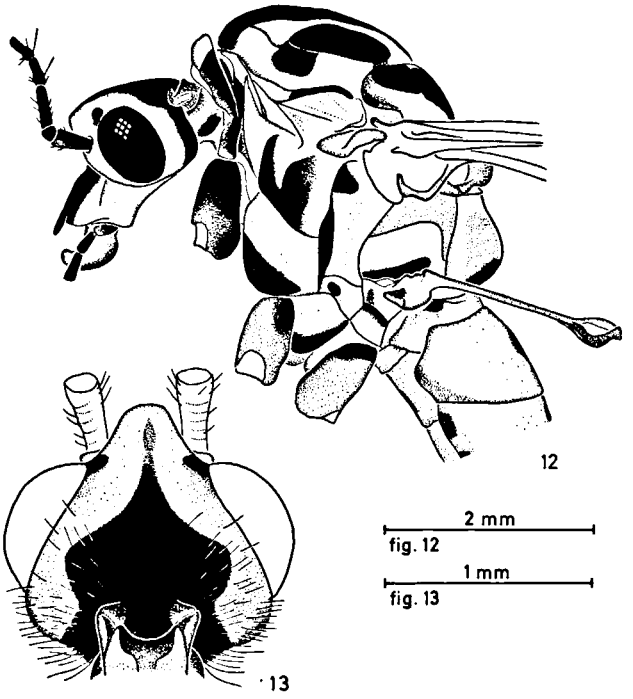
Map 1. Distribution of *N. pamirensis* (dots and oblique hatching), *N. pjotri* (triangles and vertical hatching), *N. perobliqua* (asterisk) and *N. violovitshi* (square), based on material examined.

m. P. Ler 1.VIII.954" (translation, label in Russian) "HOLOTYPE Nephrotoma pjotri I. Tangelder", condition good, preserved in the ASL. Paratypes as follows: 1♂, 2♀ topotypic, ASL; 1♂, 1♀ topotypic, ZMA; 1♂ topotypic, 1200-3000 m, 10-VIII-1952, ASL; 2♀ from Zailiyskiy Alatau, Polosa, Yelnikov, 13-VI-1952, ASL; 1♂ from Kamenki, Alma-Ata, 26-VII-1952, ASL; 2♂, 1♀ from Zailiyskiy Alatau, Talgar, 1650 m, 3-6-VII-1977, ZMA; all situated in the Kazakhskaya SSR, Alma Atinkskaya obl.; 1♂ from the Kirkizskaya SSR, Dzhetyoguz, Lake Issyk-Kul', 28-VI-1930, ASL; 1♂ from the Uzbekskaya SSR, Syr-dar'inskaya obl., Tsjai-Sandyk, 19-VI-1910, ASL.

Other material: 3♂, 3♀ from the Kazakhskaya SSR, Zailiyskiy Alatau, Alma-Arasan, 2000-3400 m, 2-3-VII-1953, ASL.

Diagnostic notes

N. pjotri can be recognized by the black dorsal surface of the rostrum, the black onion-shaped occipital marking, the velvety to subopaque spots at antero-lateral ends of the lateral stripes on scutum 1, the dark yellow to brown sides of the mediotergite, the orange-yellow abdomen with the anteriorly obliterated dorsal markings and the strong black-brown (sub)terminal darkening. The species is closely related to *pamirensis*, *perobliqua* and *violovitshi*. For further differentiating characters see the diagnostic notes of *pamirensis*.



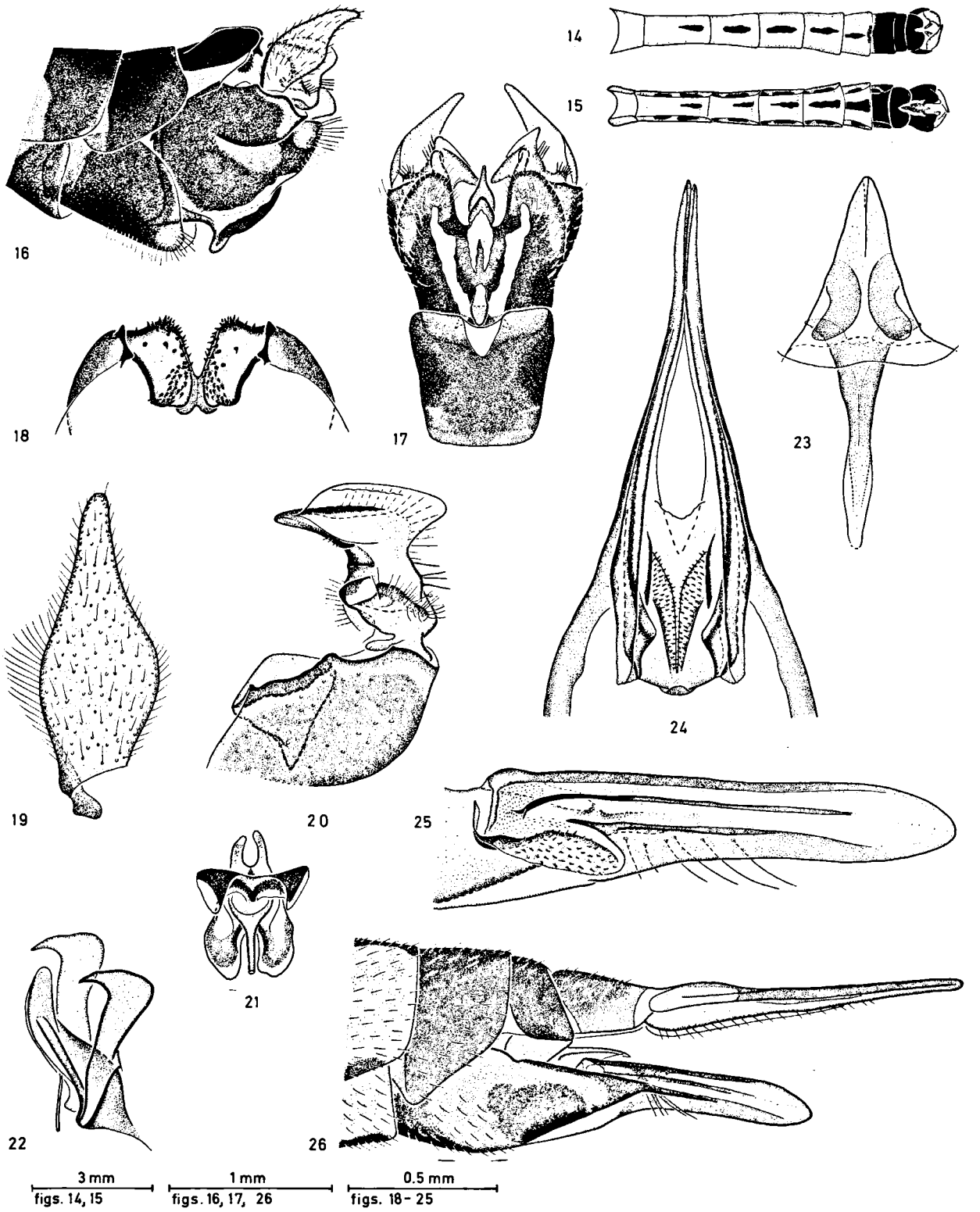
Figs. 12-13. *N. pjotri*; ♀ from Zailiyskiy Alatau, USSR, 12. head and thorax, lateral view; 13. head, dorsal view.

Description

Body length 12.5-15 mm (♂), 16-18 mm (♀), wing length 12.5-15 mm (♂), 14-15.5 mm (♀). Thorax bright yellow, head and abdomen dark to orange-yellow.

Head: Antennae of both sexes 13-segmented, length 4.8-5.4 mm (♂), 2.9-3.6 mm (♀); scape dirty yellow with large black-brown spots or nearly completely darkened, pedicel yellow-brown to dark brown, flagellum uniformly black-brown; flagellar segments two and beyond in ♂ with weakly thickened basal nodes, verticillar hairs short, not reaching beyond two-third length of segments; flagellar segments in ♀ more or less cylindrical, longest verticillar hairs about as long as segments. Rostrum shining, nasus and dorsal surface blackish, sides yellow to yellow-brown. Palps black-brown. Remainder of head orange-yellow, frons dull with a brown spot in the middle, tubercle and anterior part of vertex opaque, two small black orbital spots aside; remainder of head shining; black occipital marking broad, onion-shaped, reaching beyond half length of vertex; postgenae with two large black spots on both sides of neck-attachment (fig. 13).

Thorax (fig. 12): Median part of pronotum dull yellow, sides subshining with black-brown markings; remainder of thorax largely shining. Scutal stripes black, frequently with narrow velvety areas at anterior margin of median stripe and posterior ends of the stripes on scutum 2; lateral stripes on scutum 1 anteriorly downcurved into a velvety, sometimes subopaque black-brown spot. Transverse suture weakly tinted, scutum 2 with yellow-brown to brown antero-lateral corners and sometimes brownish



Figs. 14-26. *N. pjotri*; 14-22, ♂; 23-26, ♀. 14. abdomen, dorsal view; 15. abdomen, ventral view; 16. hypopygium, lateral view; 17. hypopygium, caudo-ventral view; 18. tergite nine, ventral view; 19. od, outside; 20. id, outside; 21. semen pump, dorsal view; 22. adminiculum, lateral view; 23. fused valvulae and furca, dorsal view; 24. hypovalvae, dorsal view; 25. right hypovalva, inside; 26. ovipositor, lateral view.

spots on caudo-lateral parts. Scutellum largely (light) brown; mediotergite with dark yellow to brown sides, a light yellow central portion and a broad, black-brown posterior marking. Pleura whitish yellow with black-brown markings, including an opaque black dash on posterior part of paratergite; anatergite yellow-brown to brown. Legs dark yellow, coxae with black-brown spots, femora with broadly darkened apical parts, tibiae brown, tarsi dark brown, claws of ♂ toothed. Wings with a brownish tinge, veins dark brown; pterostigma (dark)brown, frequently with a few macrotrichia; wings without distinct shades; cell m1 sessile to subsessile. Halteres yellowish.

Abdomen: Tergite 1 sometimes with a weak brown dorsal spot; dorsal stripe on tergites 2-6 (♂) or 2-7 (♀) narrow and discontinuous (fig. 14), frequently obliterated anteriorly. Tergites laterally marked with black dashes. Ventral stripe on sternites narrow, weakly to strongly interrupted in ♂ (fig. 15), much broader and nearly continuous in ♀. In ♂ segment 7 darkened on dorsal and ventral surfaces and segments 8 and 9 largely black-brown (figs. 14, 15); in ♀ segment 8 and tergites 9 and 10 largely black-brown, remainder of ovipositor yellow- to red-brown.

Hypopygium: External and internal structures figs. 16-22. The rather short median incision of hind margin of sternite 8 closed by a yellow membrane and lined with yellow hairs. Caudo-ventral surface of sternite 9 with broad lateral plates and a ventrally directed medisternal appendage. Outer dististyle yellow; inner dististyle with a strongly extended crest.

Ovipositor: Cerci long and slender, hypovalvae parallel-sided with rounded tips (fig. 26). Internal structures figs. 23-25; internal bases of the hypovalvae, just around the anterior end of the major ridge, with a distinct rugosity.

Biology and distribution (map 1)

Most frequently *pjotri* is found at altitudes between 1200 to 3400 m. The flight-period ranges from June 13 till August 10. The species is known from the southwestern Siberian mountains in central Asia (Alayskiy Mountains) and is sympatric with the closely related *pamirensis*.

Etymology

This species is named after my colleague and *Nephrotoma* specialist Pjotr Oosterbroek.

Nephrotoma perobliqua Alexander, 1934
Figs. 27-34, map 1

Alexander, 1934: 16-17, descr. pl. I, fig. wing, pl. III, figs. hypop; Wu, 1940: 5, distr; Savchenko & Violovich, 1967: 330, comp, 357, 365, key (as *Pales*); Savchenko, 1973: 109, descr, fig. tergite 9, distr, biol (as *Pales*).

Material examined

Type material: *Nephrotoma perobliqua* Alexander, 1934 was described from one ♂ in alcohol, labelled: "Kina, S. Kansu Valley, Minshan 3028 met. VI-20, '30 (D. Hummel)" "Nephrotoma perobliqua Al. Holotype" (the original description adds to this "Kung-tze-tagga, Tsaluk Valley"), condition bad, legs, antennae and wings broken off, colours largely faded, hypopygium in a micro-vial, preserved in the NRS. A slide of the holotype, containing one antenna, one wing and one leg is preserved in the C. P. Alexander-collection, no. 5416, USNM. The type-locality is situated in the Min-shan mountains in south Kansu, China.

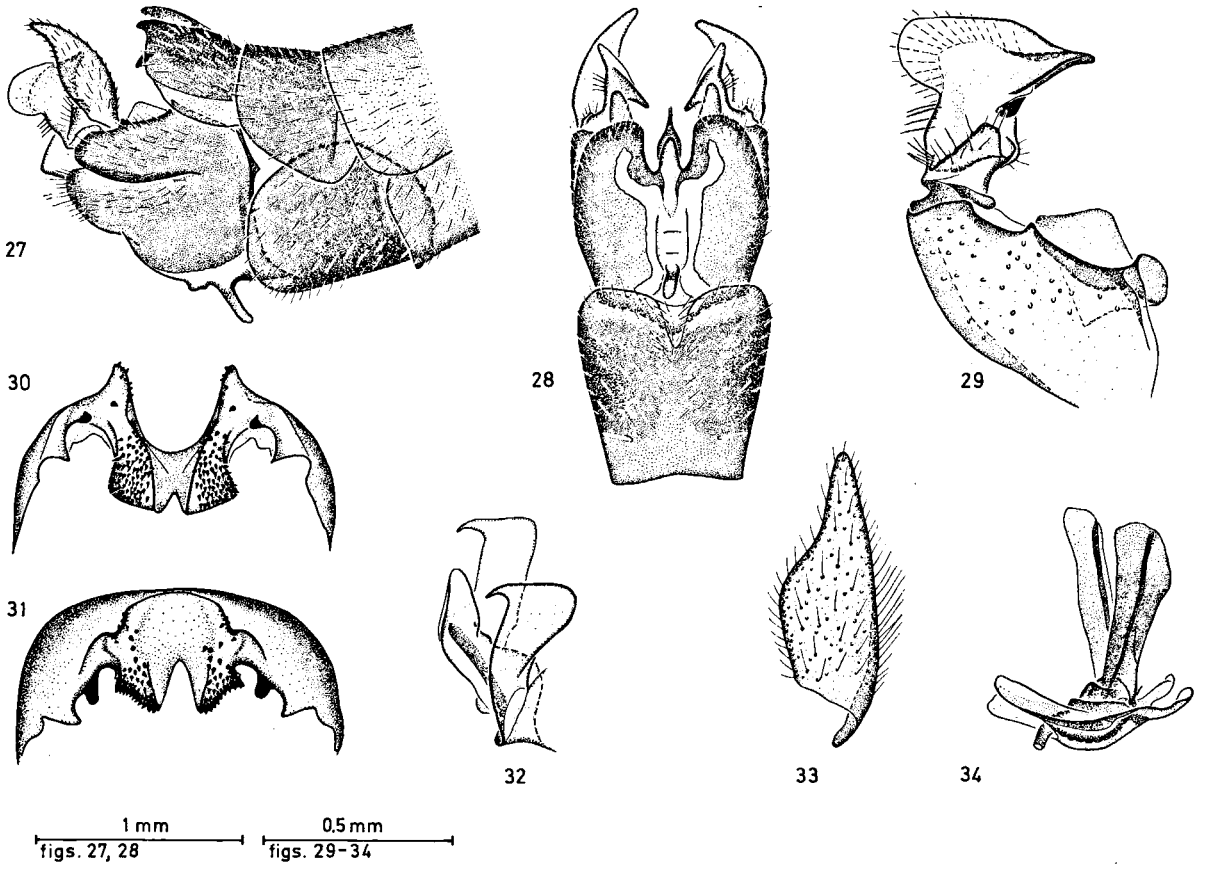
Diagnostic notes

Characteristics of *perobliqua* are the black dorsal surface of the rostrum, the onion-shaped occipital marking with the narrow anterior prolongation,the weak brown spots at the antero-lateral ends of the lateral stripes on scutum 1, the darkened sides of the mediotergite and the strong black-brown darkening of the (sub)terminal segments 7, 8 and 9. The species is closely related with *violovitshi*, *pamirensis* and *pjotri*. Further differentiating features can be found under the diagnostic notes of *pamirensis*.

Brief description

Because the only known specimen of *perobliqua* is a damaged and strongly faded spirit-preserved ♂, this description is based on both the original description and the available holotype.

Male: Body length about 12 mm, wing length 11.5 mm, body colour yellow. Antennae 13-segmented, length 4.2 mm; scape and pedicel yellow, flagellum uniformly blackish, first segment partly paler, flagellar segments two and beyond slightly incised beneath. Rostrum shining with a black nasus and dorsal surface; palps black-brown; frontal tubercle with two small orbital spots aside, posterior part of vertex and postgenae presumably shining, black-brown occipital marking broadly triangular, reaching beyond half of vertex, anteriorly prolonged into a narrow dark line; postgenae more or less darkened and with two blackish spots on both sides of neck-attachment. Median part of pronotum yellow, sides darkened; thorax presumably largely shining; stripes black, lateral ones on scutum 1 straight with only a weak brown suffusion at antero-lateral ends; antero-lateral corners of scutum 2 presumably darkened; scutellum brown-yellow, mediotergite with darkened sides and posterior part and a yellowish central portion; pleura variably marked with dark spots, in the alcoholic specimen distinct markings left at posterior margin of pronotal side, on posterior part of paratergite, on ventral parts of katepisternum and meron, along suture between anepisternum and anepimeron and on caudal part of katatergite. Tarsal claws toothed. Wings with a (pale) yellow tinge, pterostigma



Figs. 27-34. *N. perobliqua*; ♂. 27. hypopygium, lateral view; 28. hypopygium, caudo-ventral view; 29. id, outside; 30 tergite nine, ventral view; 31. tergite nine, caudal view; 32. adminiculum, lateral view; 33. od, outside; 34. semen pump lateral view.

dark brown with a few macrotrichia, bases of cells r3, r4 + 5 brown shaded, wing tip broadly but insensibly darkened. Dorsal abdominal stripe on tergites 1-6 blackish and narrowly interrupted; tergites laterally marked with dark brown dashes; sternites ventrally marked with a nearly continuous, blackish narrow stripe; (sub)terminal segments 7, 8 and 9 largely brown-black. Hypopygium and internal structures figs. 27-34; posterior extension of tergite 9 with a wide U-shaped incision at hind margin and produced lateral corners; medisternal appendage of sternite 9 long and slender, directed ventrad.
Female: unknown.

Biology and distribution (map 1)

The only known specimen of *perobliqua* is recorded from June 20, at an altitude of about 3000 m in central China (Kansu).

Nephrotoma violovitshi (Savchenko, 1967)
Figs. 35-43, map 1

Savchenko & Violovich, 1967: 320, 322, 326, 327, biol, 330, 332, 333, distr, 355-57, descr, figs. wing & hypop, key, 364-65, descr, key (as *Pales*); Savchenko, Violovich & Narchuk, 1972: 74, note, 82 distr; Savchenko, 1973: 109-10, descr, figs.hypop, distr (as *Pales*); Oosterbroek, 1980: 368, distr.

Material examined

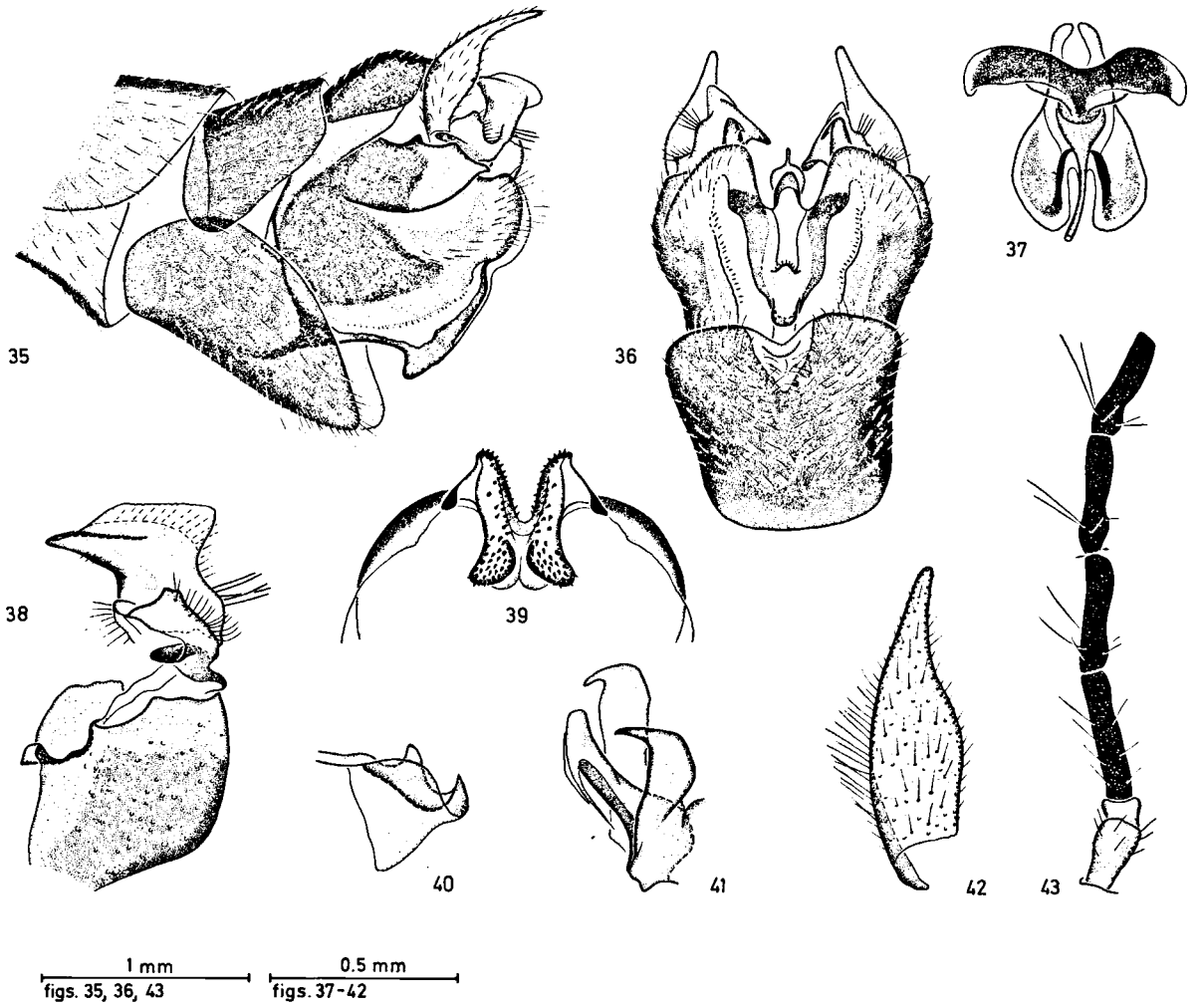
Type material: *Pales violovitshi* Savchenko, 1967 was described from 2♂. The holotype is labelled: "Tuvinskaya ASSR Irbiteĭ r-n 14.VI.1963 g. colleague N. Violovich" (translation, label in Russian) "Holotypus Pales violovitshi sp.n. E. Savshenko d.", condition good, dissected genitalia in a micro-vial on the same pin, preserved in the ASL. The orginal description adds to this: "valley of the Irbitei-river, altitude 1400 m" (situated in the Tannu-Ola mountains). The paratype is topotypic with date: 21-VI-1963, terminal abdominal parts missing, ASL.

Diagnostic notes

Characteristics of *violovitshi* are the black dorsal surface of the rostrum, the triangular and basally broadened occipital marking, the shining dark brown spots at the antero-lateral ends of the lateral stripes on scutum 1 and the shining yellow sides and dorsal surface of the mediotergite. The species is closely related with *perobliqua*, *pamirensis* and *pjotri*. Further differentiating features can be found under the diagnostic notes of *pamirensis*.

Brief description

Male: Body length 15 mm, wing length 14 mm, body colour bright yellow. Antennae 13-segmented, length 4.9-5.1 mm; scape and pedicel yellow, flagellum uniformly black, flagellar segments two and beyond slightly incised beneath (fig. 43) (the first and second flagellar segments are grown together in the holotype). Rostrum shining yellowish with the nasus and dorsal surface largely black; palps black-brown; tubercle and anterior part of vertex opaque yellow with two small orbital spots aside, remainder of vertex and postgenae shining yellow, black occipital marking triangular with broadened base, reaching beyond half length of vertex; postgenae with two black spots on both sides of neck-attachment. Thorax completely shining except the somewhat dull yellow median part of pronotum; stripes black, lateral ones on scutum 1 anteriorly downcurved into a shining dark brown spot; transverse suture yellow, antero-lateral corners of scutum 2 weakly brown tinted; scutellum yellow-brown, mediotergite yellow with a broad dark brown marking posteriorly; pleura bright yellow with blackish spots, posterior part of paratergite with an opaque black dash, anatergite weakly brown tinted. Tarsal claws toothed. Wings with a hyaline-brown tinge, pterostigma dark brown with up to 30 macrotrichia, wings not shaded. Abdomen with a black, interrupted dorsal stripe on tergites 2-7, about as broad as lateral stripes on scutum 1, tergite 1 with a transverse spot anteriorly; lateral dashes on tergites nearly



Figs. 35-43. *N. violovitshi*; ♂. 35. hypopygium, lateral view; 36. hypopygium, caudo-ventral view; 37. semen pump, dorsal view; 38. id, outside; 39. tergite nine, ventral view; 40. sp2, from inside; 41. adminiculum, lateral view; 42. od, outside; 43. basal segments of antenna, paratype ♂.

forming a continuous stripe; ventral markings elongate and narrow; segment 8 and tergite 9 completely and sternite 9 largely black-brown. Hypopygium and internal structures figs. 35-42; posterior extension of tergite 9 with distinctly extended lateral corners; ventral surface of sternite 9 with distinct lateral plates and a sclerotized medisternal appendage.
Female: unknown.

Biology and distribution (map 1)

According to Savchenko & Violovich (1967) *violovitshi* is a geobiont mesophytic species, a characteristic occupant of the central mountain-circle at altitudes from 1400 to 1600 m. The species is known only from the type-material, with dates June 14 and 21; endemic to the Tuva region in central Asia.

Section 2

Nephrotoma electripennis Alexander, 1953
Figs. 44-56, map 2

Alexander, 1953: 146-47, descr, pl. 1, fig. wing; Ishida, 1955: 121, loc, distr; Savchenko, 1973: sh descr, distr (as *Pales*); Oosterbroek, 1980: 386, distr.

Material examined

Type material: *Nephrotoma electripennis* Alexander, 1953 is described from the ♀ holotype only, originating from Japan, Shikoku, Nagoro (Mount Tsurugi), 900 m, 2-VI-1950 (Issiki-Ito). Pinned specimen and slide no. 9417 (wing, leg) preserved in the C. P. Alexander-collection, USNM.

Other material: 15 ♂, 5 ♀ (KU, USNMA, ZMA), from Japan, Kyushu: Shiratori yama in Kumamoto pref. (7♂, 2♀), Seburisan in Fukuoka pref. (1♂), Kujû san in Oita pref. (1♂), Naidaizin, presumably Kumamoto pref. (4♂, 2♀), Kunimi-dake in Kumamoto pref. (2♂, 1♀).

Diagnostic notes

N. electripennis is characterized by the velvety black spots on the antero-lateral parts of scutum 1 and 2, and by the opaque yellow anterior part of the mediotergite. In this it resembles *flammeola*, *fuscescens*, *repanda* and *subpallida*, none of which belong to the *dorsalis* species-group and differing from *electripennis* in the opaque surface between the stripes on prescutum (shining in *electripennis*). The opaque median surface on scutum 2 in *electripennis* is a striking difference from the closely related *nigricauda*, in which this surface is shining. There are also some differences in colouration: antennal flagellum brown-black to yellow-brown, occipital marking usually black, thoracic stripes evenly black and pterostigma brownish in *nigricauda*, compared to the brown-yellow antennal flagellum, the faint occipital marking, the caudally paler thoracic stripes and the yellowish pterostigma in *electripennis*.

Brief description

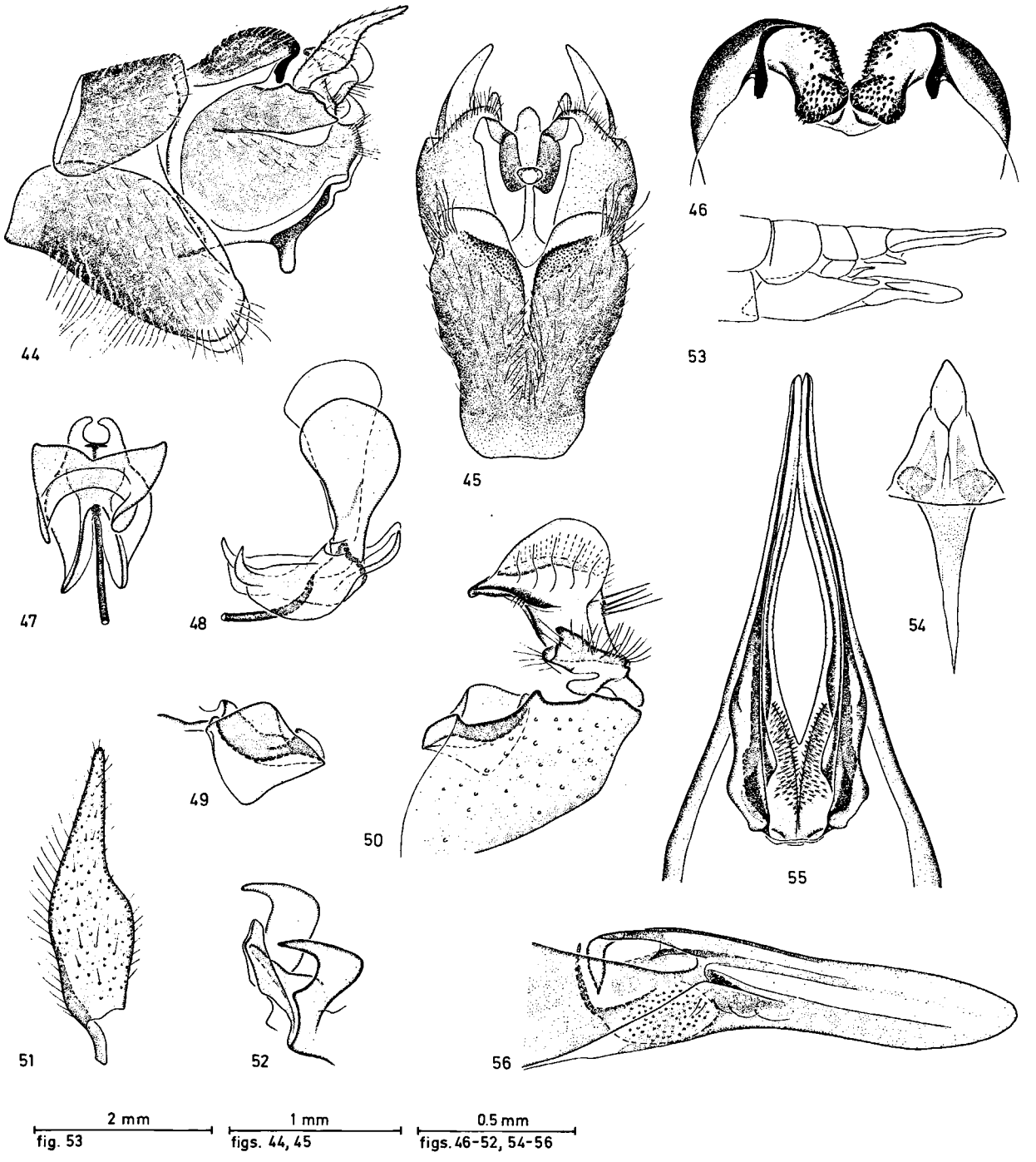
Body length 12.5-14 mm (♂), 14.5-16.5 mm (♀), wing length 12.5-14 mm (♂), 14-15 mm (♀), body colour (light) yellow, abdomen dark yellow. Antennae of both sexes 13-segmented, length 4.5-5.0 mm (♂), 2.8-3.3 mm (♀); first three segments yellow, other segments brown-yellow; flagellar segments of ♂ only weakly incised. Rostrum with yellow sides and a yellow-brown dorsum, nasus brown; palps (dark)brownish, basal segments somewhat paler; vertex opaque with a small, shining, light brown to hardly tinted occipital marking basally and sometimes a brown line in front of it. Thoracic stripes black to brown, usually more pale caudally, with extensively velvety black spots at the antero-lateral ends of the stripes on scutum 1 and the corners of scutum 2; prescutum, except the opaque anterior margin, and scutum 1 shining, scutum 2 shining with an opaque median part and opaque spots at the caudal ends of the stripes; scutellum shining brownish, mediotergite opaque yellow with a shining yellow-brown marking posteriorly; pleura with dark yellow to light brown markings, katatergite and part of meron opaque. Tarsal claws of male toothed. Wings with a yellow tinge, pterostigma yellow to yellow-brown, wings weakly shaded. Abdomen with a dark brown, discontinuous dorsal stripe, separate spots slightly broadened caudad; tergites laterally marked with oblong black dashes; ventral markings narrow, sometimes vague or vanished; (sub)terminal segments 8 and 9 largely dark brown to black in both sexes. Hypopygium and internal structures figs. 44-52; postero-median corners of sternite 8 abundantly set with small black spines. Ovipositor and internal structures figs. 53-56.

Biology and distribution (map 2)

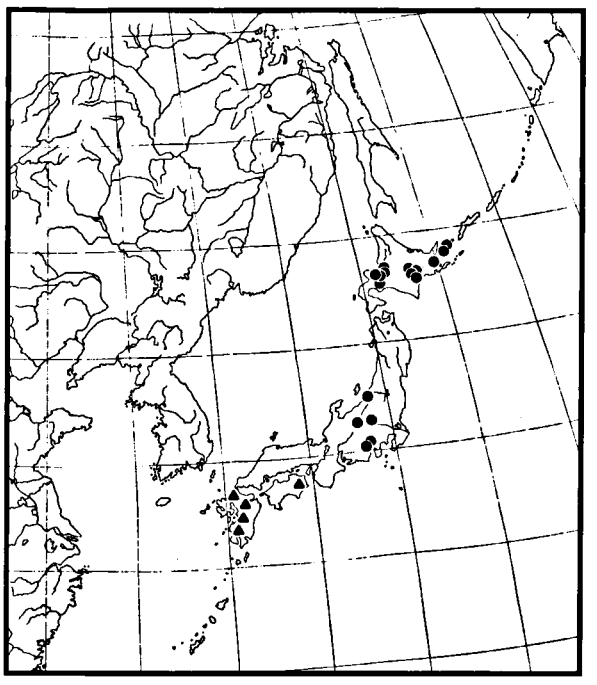
No information about the habitat of *electripennis* could be found in the literature. The flight-period ranges from mid-May till mid-June; specimens were found at altitudes up to 1000 m. The species is endemic to Japan, known only from the southern islands Shikoku and Kyushu.

Nephrotoma nigricauda Alexander, 1925
Figs. 57, 58-68, map 2

Alexander, 1925: 397-98, descr; Masaki, 1933: 92, distr; Ishida, 1955: 122, locs, distr; Takahashi, 1959: 169, sh descr, pl. 85, fig. habitus; Savchenko & Krivolutzkaya, 1966: 46, note, 56, locs (as *Pales*); Savchenko, 1970: 121, distr; Savchenko, 1973: 104-05, descr, figs. hypop, distr, locs (as *Pales*); Oosterbroek, 1980: 368, distr.



Figs. 44-56. *N. electripennis*; 44-52, ♂; 53-56, ♀. 44. hypopygium, lateral view; 45. hypopygium, caudo-ventral view; 46. tergite nine, ventral view; 47. semen pump, dorsal view; 48. semen pump, lateral view; 49. sp2, from inside; 50. id, outside; 51. od, outside; 52. adminiculum, lateral view; 53. ovipositor, lateral view; 54. fused valvulae and furca, dorsal view; 55. hypovalvae, dorsal view; 56. left hypovalva, lateral view.



Map 2. Distribution of *N. electripennis* (triangles) and *N. nigricauda* (dots), based on material examined.

Material examined

Type material: The description of *Nephrotoma nigricauda* Alexander, 1925 was based on at least three specimens, only males. The holotype is labelled: "Sapporo, Japan End July '21 S. Kuwayama" "HOLOTYPE Nephrotoma nigricauda C. P. Alexander", to which the original description adds "Ishikari-no-kuni". Condition rather poor, hypopygium and one wing on slide no. 2471; preserved in the C. P. Alexander-collection, USNM. No paratypes could be found there, although 1♂ and 1♀ in this collection and also 1♂ in the BMNH are labelled: "Maruyama, Sapporo Japan, June 10 '23, S. Kuwayama" "Nephrotoma nigricauda Al. Det. C. P. Alexander 1924". These are topotypic and have same date as the ♂♂ paratypes, as mentioned in the original description.

Other material: 51 ♂, 46 ♀ (ASL, KU, MAK, USNMA, ZMA), from Kunashir (Kuril Islands): Lagunnogo (25♂, 23♀) and Tretjakowo (3♂, 1♀) and from Japan, Hokkado: Ashoro (1♂, 1♀), Taisho (6♂, 2♀), Lake Shikaribetsu (1♂, 4♀), Otofuke (1♂, 1♀), all in Tokachi pref., Sapporo (1♂, 3♀), Kotoni (1♀), Maruyama (2♂, 4♀), Nopporo (1♀), all in Ishikari pref., Kimobetsu in Iburi pref. (1♀), Naka Shibetsu in Nemuro pref. (1♂), and Honshu: Kanayama (1♂, 2♀), Kamikochi (6♂), both in Yamanashi pref., Azusagawa in Nagano pref. (1♂), Karuizawa in Gumma pref. (1♀), Kurokawa, Echigo in Niigata pref. (2♂, 1♀).

Diagnostic notes

The most striking characteristics of *nigricauda* are the velvety black spots on the antero-lateral parts of scutum 1 and 2, and the opaque yellow anterior part of the mediotergite, in which it resembles *electripennis*, a close relative, and also *flammeola*, *fuscescens*, *repanda* and *subpallida*, species not belonging to the *dorsalis* species-group. Differences are mentioned under the diagnostic notes of *electripennis*.

Brief description (fig. 57)

Body length 11-15 mm (♂), 14.5-18 mm (♀), wing length 11.5-14 mm (♂), 12.5-16 mm (♀), body colour (bright)yellow. Antennae of both sexes 13-segmented, length 4.5-5.8 mm (♂), 2.7-3.6 mm (♀); scape and pedicel yellowish, flagellum varying from brown-black to yellow-brown, flagellar segments of ♂ slightly incised beneath. Rostrum shining yellow with a dark brown spot dorsally; palps dark brown; vertex opaque yellow with a shining, shortly triangular occipital marking, usually black, sometimes much paler, sometimes narrowly prolonged anteriorly. Thoracic stripes black to dark brown with exensively velvety black spots at the antero-lateral ends of the stripes on scutum 1 and corners of scutum 2; prescutal and scutal surfaces shining, except the opaque anterior margin of the prescutum and the opaque caudal ends of the stripes on scutum 2; scutellum shining brownish, mediotergite opaque yellow with a shining yellow-brown marking posteriorly; pleura yellow with dark yellow to red-brown markings, katatergite and part of meron opa-

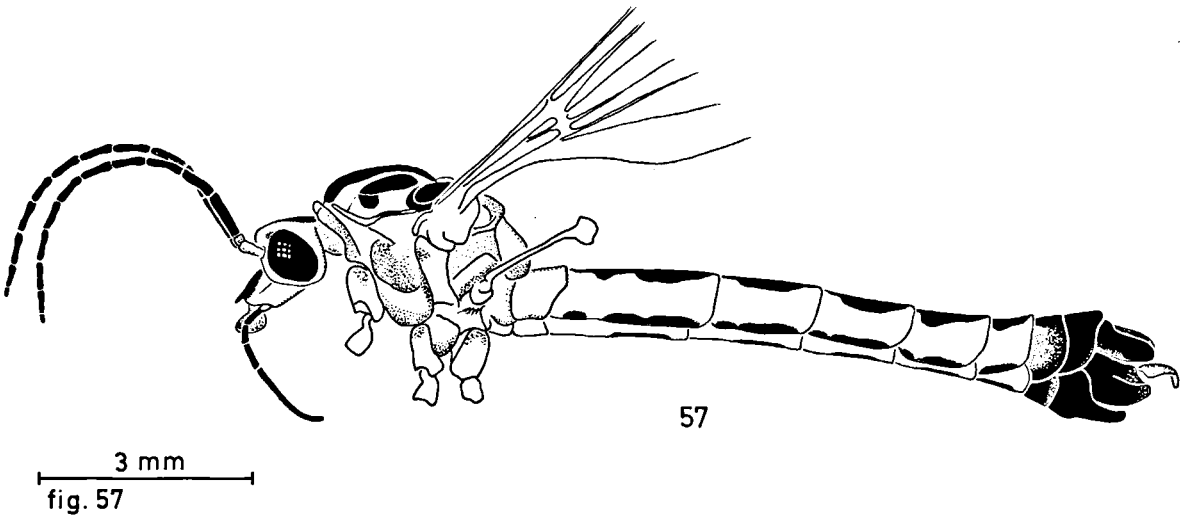


Fig. 57. *N. nigricauda*; ♂ from Honshu, Japan, habitus, lateral view.

que. Tarsal claws of male toothed. Wings with a dark yellow tinge, pterostigma usually brown, sometimes paler, wingtip and bases of cells r3, r4 + 5 brown shaded. Abdomen with a usually continuous, dark brown dorsal stripe, separate spots in ♀ usually strongly, in ♂ more slightly broadened caudad; tergites laterally marked with elongate dashes; elongate ventral markings dark brown; seventh abdominal segment partly, further terminal segments largely dark brown to black in both sexes, ovipositor reddish brown. Hypopygium and internal structures figs. 58-64; posterior corners of sternite 8 extended and on top set with black spines, caudoventral parts of sternite 9 also set with a few black spines. Ovipositor and internal structures figs. 65-68.

Biology and distribution (map 2)

No information about the biology of *nigricauda* is given in the literature. The species is on the wing from mid-May till the end of July and is recorded from altitudes up to 1500 m. The distribution of *nigricauda* comprises Kunashir (the most southern of the Kuril Islands), Hokkaido and the central part of Honshu (Japan).

Nephrotoma kaulbacki Alexander, 1951
Figs. 69-77, map 3

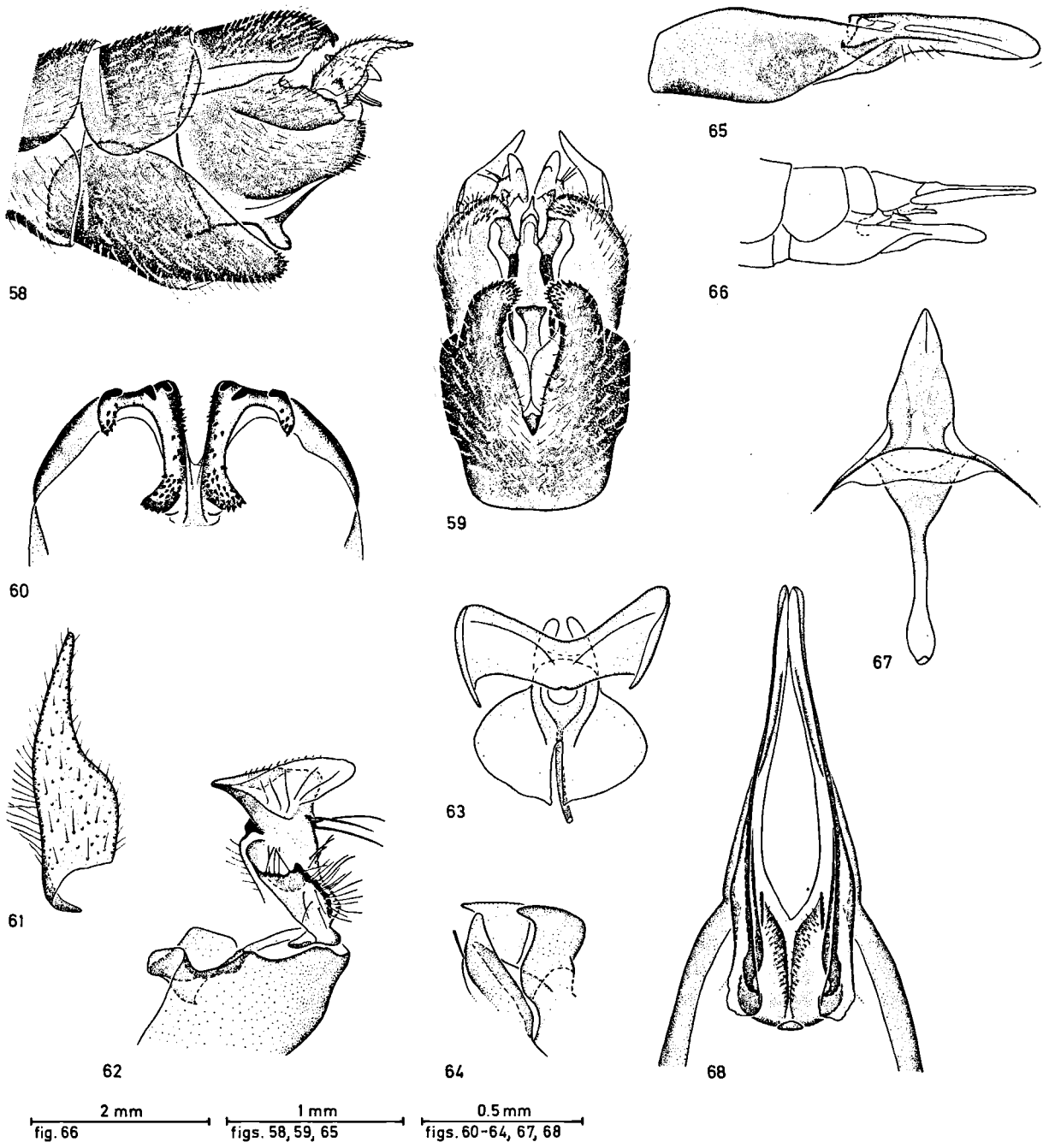
Alexander, 1951: 1094-96, descr, comp; Alexander, 1952: 332, sh descr, figs. hypop; Savchenko, 1973: 105-06, descr, comp, distr (as *Pales*).

Material examined

Type material: The description of *Nephrotoma kaulbacki* Alexander, 1951 was based on one ♂ and one ♀. The ♂ is labelled: "Holotype" "EAST TIBET: Poshö. Kyari Dzong. 12,000 ft. 27.VI.1936." "R. J. H. Kaulback. B.M. 1937-547." "Hypo. on sep. slide C. P. A." "HOLOTYPE ♂ Nephrotoma kaulbacki C. P. Alexander", condition good, right antenna intact, dissected genitalia partly on slide, preserved in the BMNH. One leg, the left antennal flagellum, one id and one od of the holotype on slide no. 9154 in the USNMA. Allotype ♀, topotypic, condition good, one wing, leg and antennal flagellum on slide, preserved in the USNMA. The type-locality is situated in southeastern Tibet, near the Salween River.

Diagnostic notes

N. kaulbacki can be easily recognized by the following features: the opaque vertex with the



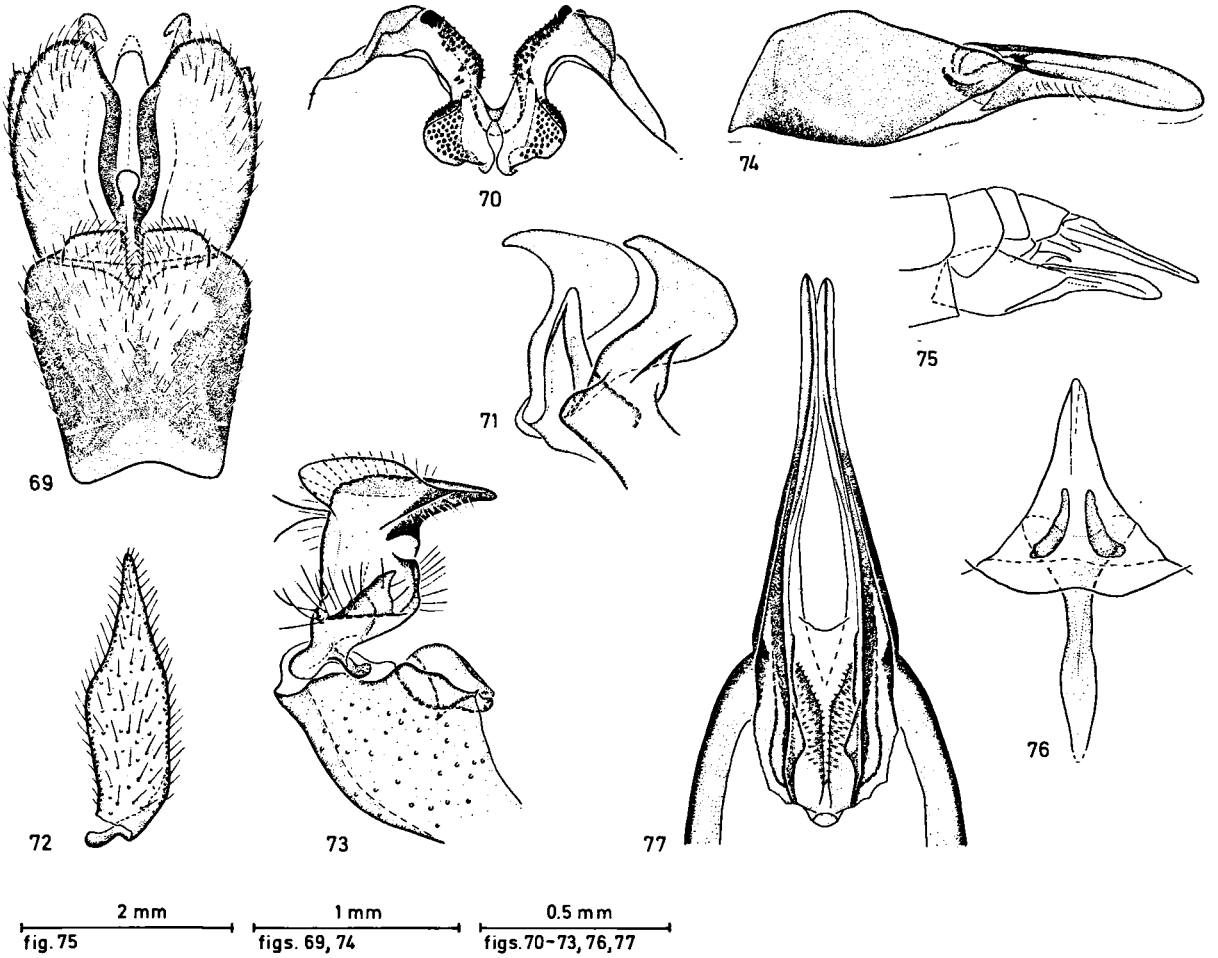
Figs. 58-68. *N. nigricauda*; 58-64, ♂, 65-68, ♀. 58. hypopygium, lateral view; 59. hypopygium, caudo-ventral view; 60. tergite nine, ventral view; 61. od, outside; 62. id, outside; 63. semen pump, dorsal view; 64. adminiculum, lateral view; 65. left hypovalva, lateral view; 66. ovipositor, lateral view; 67. fused valvulae and furca, dorsal view; 68. hypopvalvae, dorsal view.

anteriorly extended occipital marking, the opaque yellow lateral areas of the prescutum, the velvety brown-black spots at the antero-lateral ends of the stripes on scutum 1 and at the corners of scutum 2 and the opaque yellow mediotergite. The species resembles and is related to the two Japanese species *electripennis* and *nigricauda* and also to *perobliqua*, *violovitshi*,

pjotri, *pamirensis* and *libra*, but none of these species shows the above-mentioned set of characters.

Brief description

Body length 11.5 mm (♂), 13.5 mm (♀), wing lenght 12 mm (♂), 13.5 mm (♀), body colour deeply yellow. Antennae of both sexes 13-segmented, length 3.9 mm (♂), 2.3 mm (♀); scape and pedicel yellow, flagellum nearly uniformly dark brown, first few segments slightly paler at base; flagellar segments in both sexes more or less cylindrical with weakly swollen basal nodes. Rostrum shining yellow, dorsal part largely dark brown; palps brown-black; vertex and postgenae opaque orange-yellow except the shining basal part of the longdrawn brown-black occipital marking, which reaches beyond top op tubercle. Pronotum, lateral yellow parts of prescutum and mediotergite opaque, remainder of thoracic dorsum largely shining; stripes brown-black, median one sometimes with a paler spot on prescutal part, lateral ones on scutum 1 anteriorly curved into a velvety brown-black spot, lateral ones on scutum 2 slightly paler caudo-laterally; antero-lateral corners of scutum 2 opaque dark brown; scutellum yellow-brown, mediotergite opaque yellow with dark to orange-yellow lateral parts and a broad shining brown-yellow spot posteriorly; pleura



Figs. 69-77. *N. kaulbacki*; 69-73, ♂; 74-77, ♀. 69. hypopygium, caudo-ventral view, synthesized from fragments; 70. tergite nine, ventral view, flattened; 71. adminiculum, lateral view; 72. od, outside; 73. id, outside; 74. left hypovalva, lateral view; 75. ovipositor, lateral view; 76. fused valvulae and furca, dorsal view; 77. hypopvalvae, dorsal view.

largely shining dark yellow with red-yellow to brown-yellow markings, katatergite opaque. Tarsal claws of male toothed. Wings with a light grey-brown tinge, pterostigma dark brown without macrotrichia, wings not shaded. Dorsal stripe on abdomen dark brown, slightly broader than lateral stripes on scutum 1 and interrupted at posterior margins of segments in ♂, continuous and caudally broader in ♀; lateral stripes interrupted (♂) or continuous (♀); ventral markings on sternites long and narrow, in ♀ somewhat broader and stripe continuous; segment 8 in ♂ and segment 8 and tergite 9 in ♀ largely dark brown, remainder of terminal segments pale. Hypopygium and internal structures figs. 69-73; these structures are only known from one incomplete and flattened slide, the caudal view of the hypopygium is an interpretation on the basis of some fragments. Ovipositor and internal structures figs. 74-77; cerci very slender, hypovalvae with rounded tips.

Biology and distribution (map 3)

N. kaulbacki is known only from the ♂ holotype and the ♀ allotype, both captured on June 27 at 3650 m altitude in the southeastern part of Tibet.

SECTION 3

Nephrotoma libra Alexander, 1951
Figs. 78-84, map 3

Alexander, 1951: 1092-94, descr, comp; Alexander, 1952: 333, sh descr, figs. hypop; Savchenko, 1973: 159-60, descr, comp, distr, biol (as *Pales*).

Material examined

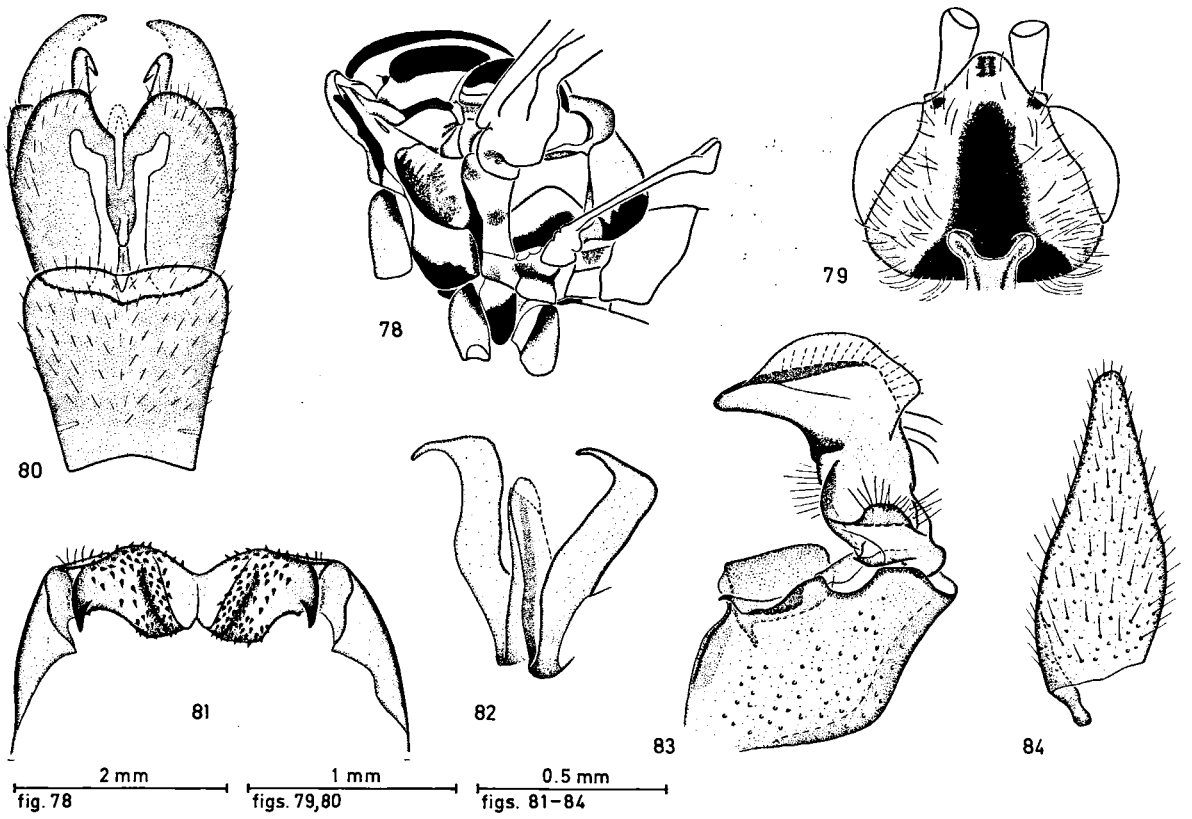
Type material: The description of *Nephrotoma libra* Alexander, 1951 was based on the ♂ holotype only, labelled: "Holotype" "Tibet: Gyantse 13000 ft. 19-VII-1928. Lt.Col. F. M. Bailey. B.M. 1928-409." "Hypopyg. on slide" "HOLOTYPE ♂ Nephrotoma libra C. P. Alexander", condition fair, right antenna intact, wings glued on label, dissected genitalia on slide, preserved in the BMNH. One leg and antennal flagellum of the holotype on slide no. 9156, USNMA. The coordinates of the type-locality, Gyantse = Chiang-tzu, are 28° 53′ N 89° 35′ E.

Diagnostic notes

Characteristics of *libra* are the opaque vertex with shining occipital marking (fig. 79), the straight and subshining black thoracic stripes, the yellow antero-lateral corners of scutum 2, the subshining yellow anterior part of the mediotergite, the opaque black dash on paratergite (fig. 78) and the very narrow abdominal dorsal stripe. There is some resemblance with *laticrista* (which has a shining vertex, an anterior stripe on mediotergite and no opaque black dash on paratergite) and with the species *kaulbacki*, *pamirensis*, *perobliqua*, *pjotri* and *violovitshi* (all with more or less anteriorly downcurved lateral stripes on scutum 1 and toothed tarsal claws in males).

Brief description

Male: Body length about 13 mm, wing length 12 mm, body colour orange-yellow. Antennae 13-segmented, length 4.8 mm; scape basally yellow, apically brownish, pedicel brown, flagellum uniformly blackish, flagellar segments two and beyond with slightly swollen basal nodes. Rostrum shining yellow with two dark brown dashes dorsally; palps dark brown; vertex opaque dark yellow except the large, shining black, elongated triangular occipital marking; frontal tubercle with a brown spot on top and two small black orbital spots aside; postgenae with two black spots on both sides of neck-attachment (fig. 79). Dorsum of thorax subshining; stripes black, lateral ones on scutum 1 straight; antero-lateral corners of scutum 2 largely yellow; scutellum yellow-brown, mediotergite subshining yellow with a large black marking posteriorly; pleura shining with dark brown to black markings, posterior part of paratergite with an opaque black dash (fig. 78). Tarsal claws untoothed. Wings with a grey-brown tinge, pterostigma brown without macrotrichia, wings only weakly shaded at



Figs. 78-84. *N. libra*; ♂. 78. thorax, lateral view; 79. head, dorsal view; 80. hypopygium, caudo-ventral view, synthesized from fragments; 81. tergite nine, ventral view; 82. adminiculum, lateral view, synthesized from fragments; 83. id, outside; 84. od, outside.

bases of cells r3, r4 + 5. Dorsal stripe on abdomen dark brown and narrow, interrupted at posterior margins of tergites, on caudal segments more pale; lateral spots on tergites forming a continuous stripe; ventral markings forming a narrow and continuous line; terminal segments brown-yellow. Hypopygium and internal structures figs. 80-84; these structures are only known from one incomplete and flattened slide, some drawings (caudal view of hypopygium and adminiculum) are a synthesis of separate fragments and consequently an interpretation.
Female: unknown.

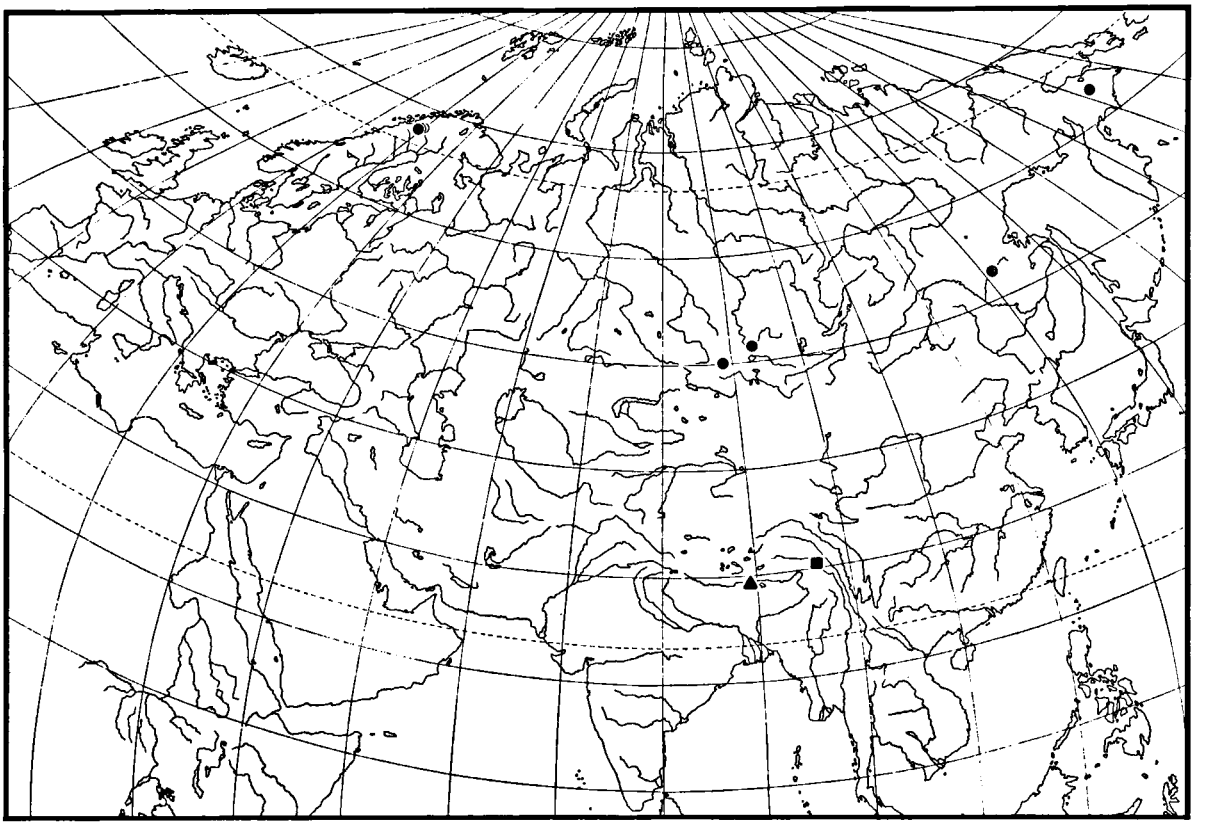
Biology and distribution (map 3)

N. libra is know only from the ♂ holotype, recorded from July 19 on 3950 m altitude in eastern Tibet.

Nephrotoma ramulifera Tjeder, 1955
Figs. 85, 86, map 3

Tjeder, 1955a: 226, descr; Tjeder, 1978: 10, figs. hypop & ovipos; the species is treated in detail by Oosterbroek, 1979c: 180-85, refs, type mat, descr, figs. hypop, biol, distr, 191, key; Oosterbroek, 1980: 337-39, phylogeny, fig. tergite 9, 345, 350, notes, 364, 369, distr; Tangelder, 1983: 118, notes, 119, key ♂, 122, key ♀, 198-201, diag notes, descr, figs. hypop & ovipos, biol, distr.

N. ramulifera is a rare species with a holarctic distribution, known from six localities throughout the Palaearctic region and from three localities in the Nearctic region (Alaska). In the literature this species is treated comprehensively several times (Tjeder, 1955a, 1978; Savchenko, 1973; Oosterbroek, 1979c; Tangelder, 1983), accordingly the discussion of *ramulifera* will be brief.



Map 3. Distribution of *N. kaulbacki* (square), *N. libra* (triangle) and *N. ramulifera* (dots), based on material examined (black marks) and literature (stippled dots).

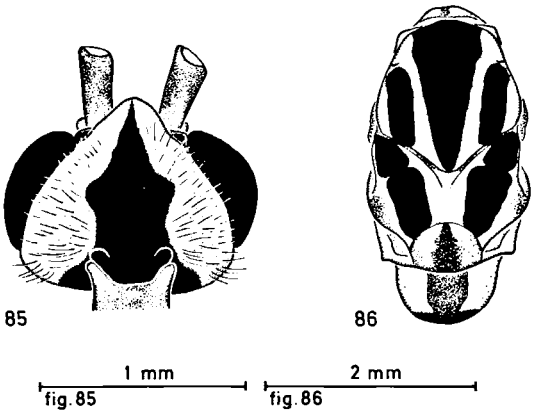
Material examined

Type material: *Nephrotoma ramulifera* Tjeder, 1955 was described from the ♂ holotype and one ♀ paratype, both from Torne Lappmark, northern Sweden (Jebrenjokk, 22-VII-1926 and Abisko, 9-VII-1920 respectively), preserved in the ZIL, not examined by me.

Other material: 10 ♂, 8 ♀, from: the USA (Alaska, 4♂, 6♀ UKaL, USNMA, ZMA); Sweden (Abisko, 1♂, ZMA) and the USSR: Tuvinskaya aut. obl. (Khundurgun Mts. (50° 50′N 91°52′E), 1♂, 1♀, ASL); Gorno-Altayskaya aut. obl. (Tarkhata river, Yuzhno Chuyskiy Mts. (50°00′N 88°40′E), 3♂, 1♀, ASL, MAK); Magadanskaya obl. (Bolshaja river, Chukotski region (63°01′N 171°50′E), 1♂, ASL).

Diagnostic notes

Apart from the distinct hypopygial and ovipository features (see Tangelder, 1983), *ramulifera* can be recognized by the following characters: the 13-segmented antennae with the black flagellum, the yellow sides and black-brown dorsal surface of the rostrum, the (dark)yellow posteriorly shining vertex with the black, broad and elongated occipital marking (fig. 85), the shining black thoracic stripes, the median one on scutum 1 with a somewhat broadened anterior part (fig. 86) and the lateral ones on scutum 1 usually with a shining infuscation below anterior ends, the brown to black-brown antero-lateral corners of scutum 2, the usually broad dark brown antero-dorsal stripe on mediotergite, the abundant black-



Figs. 85-86. *N. ramulifera.* 85. head, dorsal view, ♂ from Gorno-Altayskaya, USSR; 86. thorax, dorsal view, ♂ from Abisko, Sweden.

brown pleural markings, the dark brown pterostigma and brown shades of the wings, the toothed tarsal claws of the ♂, the broad and continuous black-brown abdominal dorsal stripe and the extremely strong (sub)terminal darkening in both sexes (of segments 7 (largely), 8 and 9 in ♂, of segment 8 and tergites 9, 10 in ♀). In general appearance *ramulifera* mostly resembles *lunulicornis*, *quadristriata* (both having a rostrum with brown sides, a largely shining vertex and usually brown spots along dorsal eye-margins) and *sublunulicornis* (with a largely shining vertex and rather narrow stripes on occiput and anterior mediotergite) in the Palaearctic region and *excelsior*, *oosterbroeki* and *vittula* in the Nearctic region (see Tangelder, 1983). There are no clear differences between the palaearctic and nearctic specimens of *ramulifera.*

Biology and distribution (map 3)

N. ramulifera is a boreal species from (alpine) tundra and mountain steppe, once found near a willow-grove in a river-valley. The few altitude records range up to 2100 m (Altai). The species is known from July 6 to 22 in the Palaearctic region and from June 10 till July 15 in Alaska. The distribution of *ramulifera* comprises presumably the whole northern part of the Holarctic region, but the localities up to now are scarce and widely scattered. In Oosterbroek (1979c) one locality, additional to those mentioned under material examined can be found: USSR, Amurskaya obl., Selemdzha region, river Deribi (collection Savchenko, Kiyev).

SECTION 4

Nephrotoma dorsalis (Fabricius, 1781)
Figs. 87, 90-99, 100, map 4

Fabricius, 1781: 403, descr (as *Tipula*); the species is treated in detail by Oosterbroek, 1979b: 159-65, refs, type mat, figs. ant, hypop & ovipos, descr, biol, distr, 173, fig. hypop, 191, fig. cercus (as *dorsalis dorsalis*); Oosterbroek 1979c: 191, key; Noll & Caspers, 1979: 48, loc; Oosterbroek, 1980: 337-39, phylogeny, fig. tergite 9, 340, fig. adm, 345, 350, notes, 364, 369, distr; Simova & Vuković, 1981: 115, locs; Theowald & Oosterbroek, 1983: 376, distr, 387, note.

The discussion of the species will be brief and supplementary to the information in Oosterbroek (1979b).

Material examined

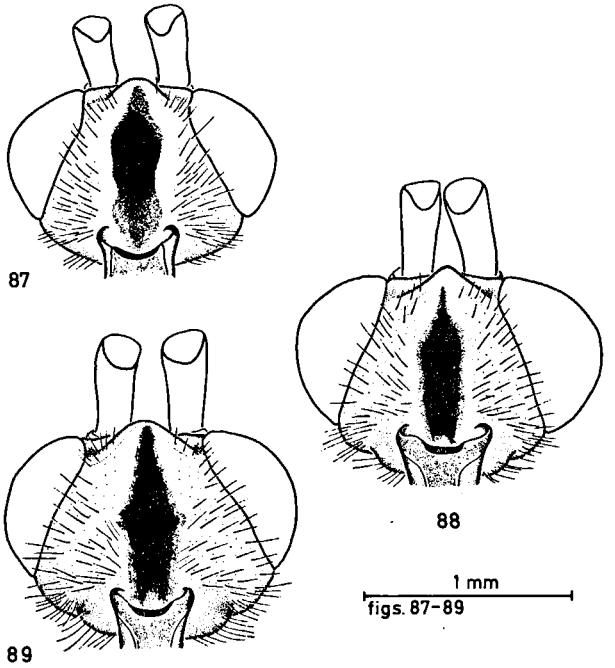
Type material: The types of *Tipula dorsalis* Fabricius, 1781, the type-species of *Nephrotoma*, are not preserved (Zimsen, 1964; Oosterbroek, 1979b), but it is almost completely certain that the interpretation of the species is correct (see Oosterbroek, 1979b).

Other material: Supplementary to the material examined by Oosterbroek (1979b) from many western palaearctic countries and to the localities mentioned in the literature as indicated by Oosterbroek (1979b), the following 61 ♂, 68 ♀ are examined: from Norway (1♂), Sweden (1♂, 1♀), the Netherlands (49♂, 38♀), West Germany (3♀), Czechoslovakia (2♂, 1♀), Switzerland (7♂, 3♀), Italy (1♀), Austria (1♀), all ZMA, and the USSR: Ukraina SSR, Khemelnitskaya obl. (Slavuta, 2♀); Arkhangelskaya obl. (Shapkina River, Bol'shezemelskaya Tundra, 1♀); Komi ASSR (Popova na Tsilme, 1♀); Leninggradskaya obl. (Yukki, 1♂, 2♀; Leningrad, 2♀; Log, 2♀; Ostrovki na Newe, 1♀); Pskovskaya obl. (Charlamova Mt., 1♀); Latviyskaya SSR (near Ventspilsa, 2♀); Ulyanovskaya obl.

(Ulyanovsk, 1 ♀); Krasnoyarskiy Kray (Krasnoyarsk, Bazaikha Valley, 1 ♀; Minusinsk, 1 ♀); Irkutskaya obl. (near Irkutsk, 1 ♀); Yakutskaya ASSR (Vilyuy River-mouth, 1 ♀); Amurskaya obl. (Budunda River, 1 ♀); all ASL.

Diagnostic notes

N. dorsalis is closely related with and strongly resembles *spicula* and *sachalina*; these three species are characterized by the polymerous antennae (17-20 segments in ♂, 15-16 segments in ♀, figs. 100-102), the elongated occipital marking (figs. 87-89), the straight dark brown to black thoracic stripes, the strong darkening of the subterminal segments and the conspicuous hypopygial features as the strongly extended, lobe-shaped caudal corners of sternite 8 and, in *dorsalis* and *sachalina*, the antero-basal extensions of the gonapophyses. The ♂♂ of these three species can easily be distinguished by some hypopygial characters (caudo-dorsal corners of sternite 9 with a tooth-like projection in *dorsalis* (fig. 91), a pointed-tapering one in *spicula* (fig. 114) and without such a projection in *sachalina*, and differences in the antero-basal extensions of the gonapophyses, see figs. 93, 108, 117). There is some difficulty in separating the ♀♀ by means of external features; some differences are: the length of the longest verticillar hairs (not more than twice as long as segments in *dorsalis* and *spicula*, more than twice as long as segments in *sachalina*), the shape of the occipital marking (figs. 87-89), the breadth of the dorsal abdominal stripe (not broader or about as broad as median scutal stripe in *sachalina* and *spicula*, distinctly broader than median scutal stripe in *dorsalis*) and the subterminal darkening (mainly limited to segment 8 in *dorsalis* and *spicula*, usually extended to tergite 9 and part of tergite 10 in *sachalina*). Hypopygium, ovipositor and internal structures of *dorsalis* figs. 90-99.

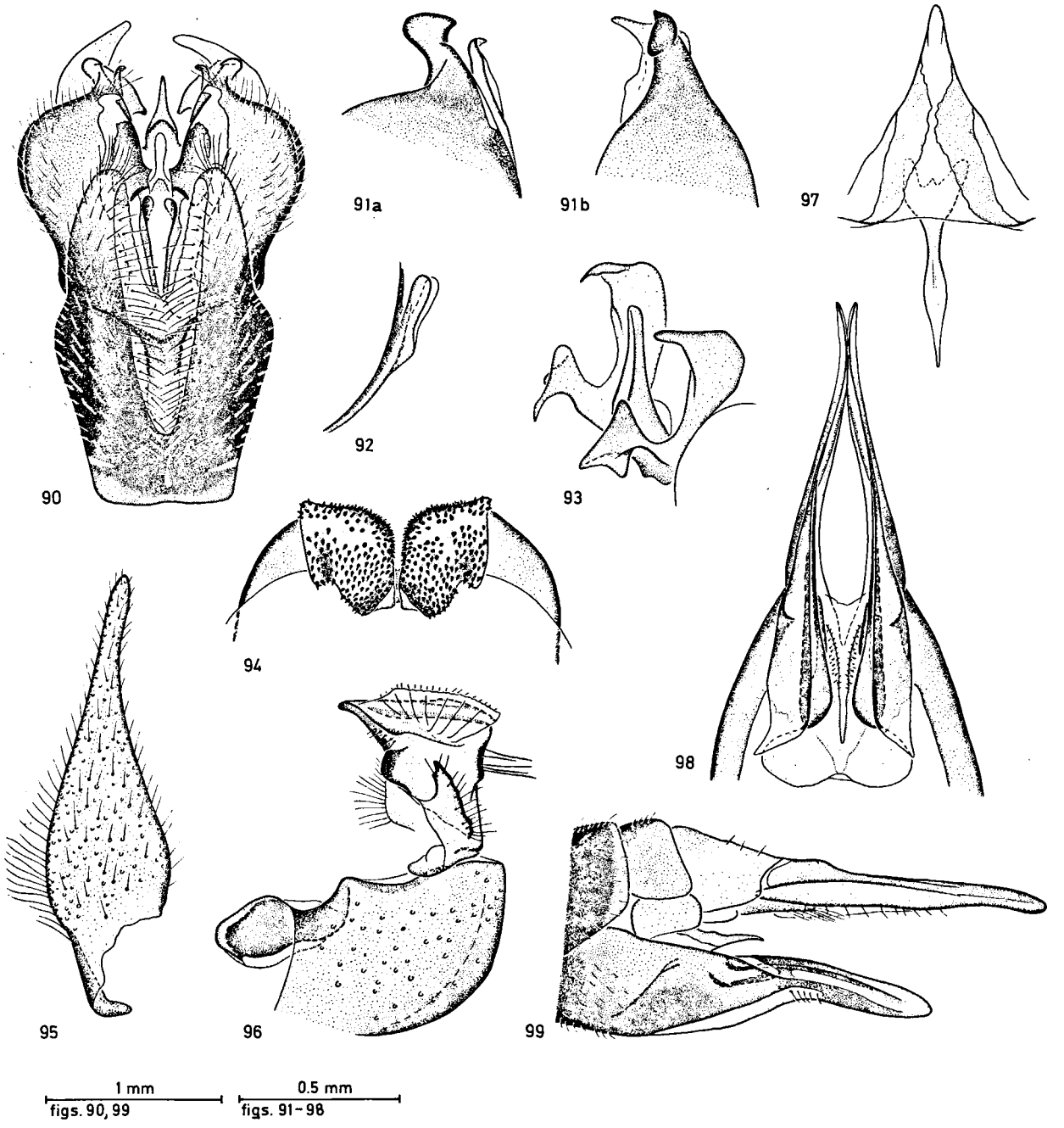


Figs. 87-89. 87. *N. dorsalis*, head, dorsal view, ♂ from Switzerland; 88. *N. sachalina*, head, dorsal view, ♂ from Hokkaido, Japan; 89. *N. spicula*, head, dorsal view, ♂ from North Korea.

Biology and distribution (map 4)

N. dorsalis "... is found in a variety of habitats, with a preference for clearings in damp woods and brushwood vegetations along rivers and ponds" (Oosterbroek, 1979b) and according to Savchenko (1973) the species is locally not rare. In the western Palaearctic region *dorsalis* is on the wing from mid-May till the end of August, most abundantly in July and to a lesser extent in June. In the eastern Palaearctic part of the range the flight-period of *dorsalis* runs from mid-June till the first week of August, as can be concluded from the rather scanty records available (Savchenko, 1966c, 1973, and material examined). The eggs of *dorsalis* hatch after 9-15 days (Cramer, 1968) and Beling (1878, as *lunulicornis*) mentions a pupal stage of about 7 days. No altitudes are given for this species.

The geographical distribution as inidicated on the map is based on material examined and on data from the literature: Fischer, 1952 (West Germany); Lundström, 1912, 1916 (Finland); Mannheims & Theowald, 1959 (Italy); Nielsen, 1919, 1925 (Denmark); Noll & Caspers, 1979 (West Germany); Oosterbroek, 1979b (Switzerland, Rumania, Bulgaria); Pierre,



Figs. 90-99. *N. dorsalis*; 90-96, ♂; 97-99, ♀. 90. hypopygium, caudo-ventral view; 91. left caudo-dorsal corner of sternite nine: a, caudal view, b, lateral view; 92. medisternal appendage of sternite nine, lateral view; 93. adminiculum, lateral view; 94. tergite nine, ventral view; 95. od, outside; 96. id, outside; 97. fused valvulae and furca, dorsal view; 98. hypovalvae, dorsal view; 99. ovipositor, lateral view.

1924 (France); Savchenko, 1966a, d (Ukraina), 1966c (eastern Palaearctic), 1973 (european USSR, eastern Palaearctic); Simova & Vuković, 1981 (Yugoslavia); Tjeder, 1955b (Sweden) and Oosterbroek, in literis 1984 (Norway, Ireland, Great Britain, Belgium, West Germany, Poland, Czechoslovakia, Austria). Compared to the strongly fragmented distribu-

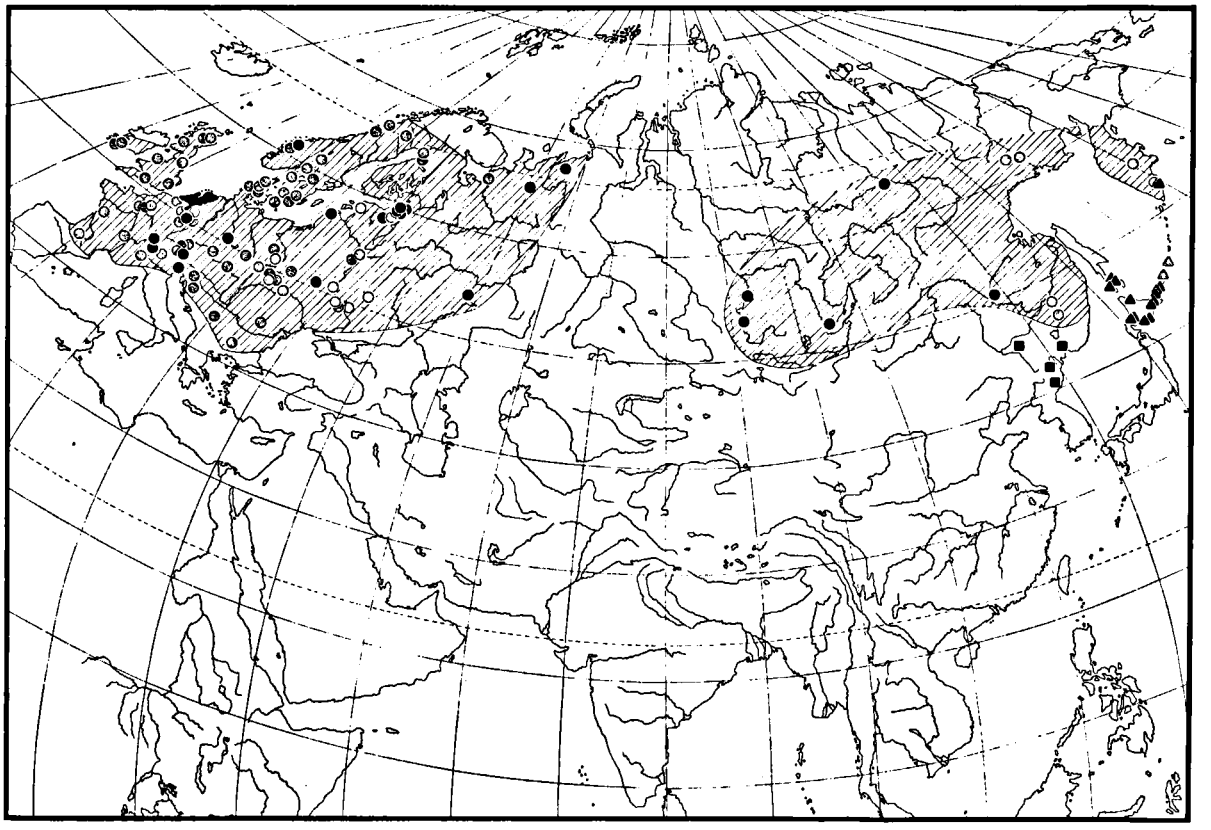
tion of *dorsalis* mentioned by Oosterbroek (1979b), the present-known range is considerably extended, from both western and eastern palaearctic sides, into the direction of central Asia, with the consequence that the 'gap' between the two disjunct distribution-areas of *dorsalis* is strongly reduced and comparable now with the disjunct distributions of for example *lunulicornis* and *quadristriata.* The data underlying this correction of the range originate mainly from female specimens of *dorsalis*, preserved in the ASL, identified as *lunulicornis* or *l. angustistria* and also mentioned as such in Savchenko (1973). The western part of the distribution-range of *dorsalis* comprises the largest part of Europe, except the northern part of Scandinavia and Iceland and in the south the Mediteranean countries; eastward the species ranges to nearly the foot of the Ural Mountains. The eastern part of the range of *dorsalis* stretches from the Krasnoyarskiy Region in central Asia eastward to the Kamchatka peninsula and the Primorskiy Region.

Nephrotoma sachalina Alexander, 1924
Figs. 88, 101, 103-112, map 4

Alexander, 1924: 597, comp, descr (as *dorsalis sachalina*); Masaki, 1933: 91, distr; Alexander, 1966: 120, locs; Savchenko, 1966a: 480, note (as *Pales*); Savchenko, 1966c: 95, note (as *Pales*); Savchenko & Krivolutzkaya, 1966: 56, locs, note, biol (as *Pales*); Savchenko, 1970: 120, locs, biol, note, 121, distr; Savchenko, 1973: 103-04, figs. hypop, descr, distr, locs, biol (as *Pales*); Oosterbroek, 1979b: 164, comp, distr, refs, 165, distr; Oosterbroek, 1979c: 191, distr; Oosterbroek, 1980: 364, 368, distr; all except Alexander, 1966, as *dorsalis sachalina.*

Material examined

Type material: *Nephrotoma dorsalis sachalina* Alexander, 1924 was described from 2 ♂. The



Map 4. Distribution of *N. dorsalis* (black spot, dots and oblique hatching), *N. sachalina* (triangles) and *N. spicula* (squares), based on material examined (black marks) and literature (stippled marks).

holotype is labelled: "Toyohara, Saghalien, VII-16-1922 Teiso Esaki" "HOLOTYPE Nephrotoma dorsalis sachalina Al.", condition fair (left antenna intact, hypopygium strongly creased), preserved in the C. P. Alexander-collection, USNM. The topotypic paratype lacks the hypopygium; one antenna, a leg and one wing are on two slides no. 2606, USNMA. The type-locality 'Toyohara' (from 1948 named Yuzhno-Sakhalinsk, see Westermann's Lexikon der Geografie) is situated on the southern part of Sakhalin (46°58'N 142°45'E).

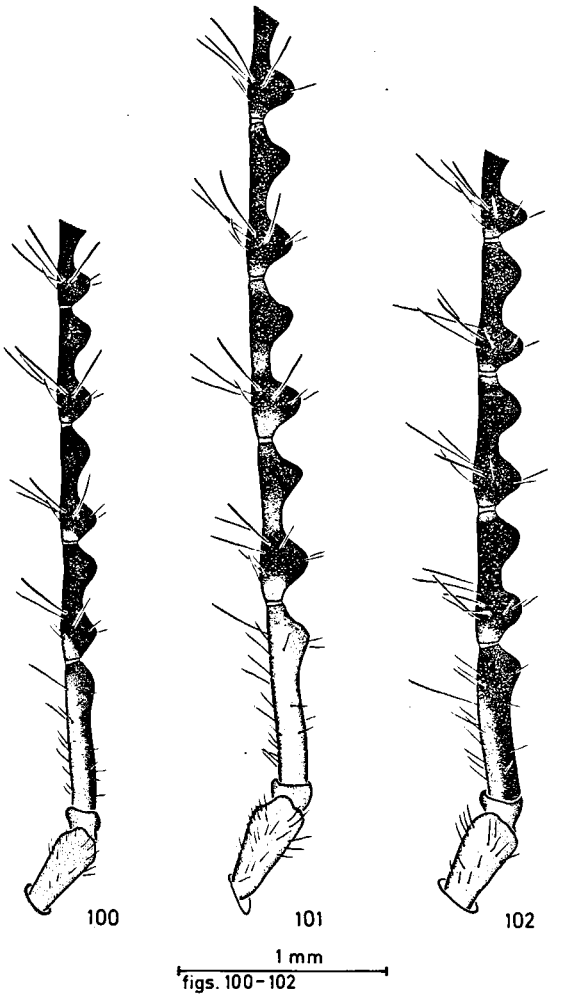
Other material: 14 ♂, 12 ♀ (ASL, MAK, USNMA, ZMA), from the following peninsula and islands: Kamchatka: Petropavlovsk (1♂, 2♀); Sakhalin: Yuzhno-Sakhalinsk (1♂, 2♀), Konuma (5 mi N of Yuzhno-Sakhalinsk, 1♀), Nevelsk (1♂), unlocated (1♂); Kunashir: Yuzhno-Kurilsk (3♂, 1♀), Lagunnogo (1♂, 1♀), Pondomari (1♂), near Alechino (1♂), unlocated (1♂); Hokkaido: Sarufuto (1♂) and Samiokeba (1♂), both in Hidaka pref., Esashi in Kitami pref. (1♀), Naka-shibetsu (2♀) and Kenebetsu(1♀), both in Nemuro pref., Sapporo (1♀) and Kotoni (1♂), both in Ishikari pref.

Diagnostic notes

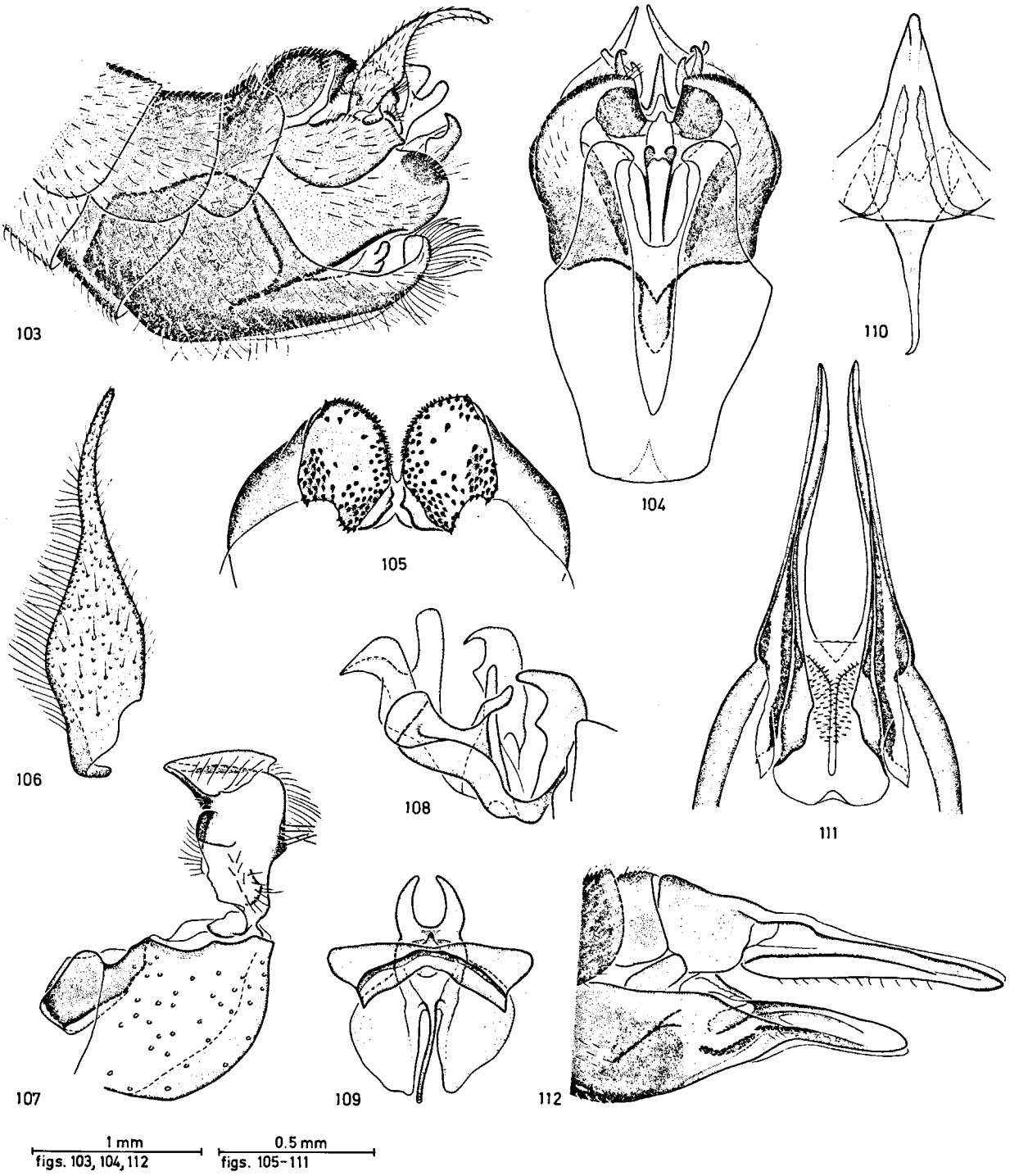
N. sachalina shows a strong resemblance with the two closely related species *dorsalis* and *spicula*; the species is characterized by the polymerous antennae (18-19 segments in ♂, 15-16 segments in ♀), the length of the longest verticillar hairs of the antennae in ♀ (more than twice as long as segments), the completely yellow sides of the rostrum, the straight black-brown thoracic stripes, the extremely strong (sub)terminal darkening in both sexes and the special features of the hypopygium. For other differentiating characters see under the diagnostic notes of *dorsalis*.

Brief description

Body length 11.5-14 mm (♂), 14-16.5 mm (♀), wing length 12-14.5 mm (♂), 12.5-14.5 mm (♀), body colour light to saturated yellow. Antennae 18- to 19-segmented in ♂, 15- to 16-segmented in ♀, length (8.2)8.6-10.1 mm (♂), 2.6-3.1 mm (♀); scape yellowish, pedicel yellow to brown, first flagellar segment largely yellow to yellow-brown with usually a brownish apex and sometimes a darkened frontal surface, other flagellar segments nearly completely brown to dark brown, sometimes the basal parts slightly darker; first flagellar segment in ♂ bulbously thickened distally, following segments strongly incised (fig. 101), longest verticillar hairs of the flagellum in ♀ more than twice as long as segments. Rostrum shining yellow with sometimes weakly brown dashes



Figs. 100-102. 100. *N. dorsalis*, basal segments of antenna, ♂ from Switzerland; 101. *N. sachalina*, basal segments of antenna, ♂ from Hokkaido, Japan; 102. *N. spicula*, basal segments of antenna, ♂ from North Korea.



Figs. 103-112. *N. sachalina*; 103-109, ♂; 110-112, ♀. 103. hypopygium, lateral view; 104. hypopygium, caudo-ventral view; 105. tergite nine, ventral view; 106. od, outside; 107. id, outside; 108. adminiculum, lateral view; 109. semen pump, dorsal view; 110. fused valvulae and furca, dorsal view; 111. hypovalvae, dorsal view; 112. ovipositor, lateral view.

dorsally; palps yellow-brown; vertex and postgenae shining (dark)yellow, occipital marking dark brown and elongated, usually reaching to base of tubercle (fig. 88). Thorax completely shining except the brownish, dull median part of pronotum; stripes brown-black to black, lateral ones on scutum 1 straight; transverse suture brownish, antero-lateral corners of scutum 2 dull dark brown to yellow-brown; scutellum yellow-brown with a narrow dark brown median line, mediotergite with a brown anterior stripe and caudal spot and a dark brown band along posterior margin; pleura with mainly (dark)brown markings and some lighter ones, anatergite usually distinctly (light)brown tinted. Tarsal claws untoothed. Wings with a yellow-brown tinge, pterostigma dark brown, bases of cells r3, r4 + 5 and wingtip with a brown shade. Dark brown dorsal stripe on abdominal tergites 1-6 or 7 in ♂ slightly interrupted and not broader than median stripe on scutum 1, in ♀ continuous and slightly broader; dark brown dashes on sides of tergites fused into a continuous stripe; ventral markings on sternites varying from oval-shaped dots to elongate dashes; ♂ with segment 7 frequently (dark)brown, sometimes partly and with segments 8 and 9 completely dark brown to black, ♀ with tergites 7, 9 and 10 sometimes (partly) darkened and segment 8 largely dark brown to black. Hypopygium and internal structures figs. 103-109; caudo-dorsal corners of sternite 9 without projections; antero-basal extensions of the gonapophyses very large and strongly modified (fig. 108). Ovipositor and internal structures figs. 110-112.

Biology and distribution (map 4)

Savchenko & Krivolutzkaya (1966) mention birch- and alder- groves along streams and also taiga with dark pine-forests as habitat of *sachalina* on the Kuril Islands. The flight-period ranges from mid-June till the end of August, but the species is most frequent in July.

The distribution of *sachalina* comprises the southern point of Kamchatka, southern Sakhalin, the Kuril Islands and Hokkaido (Japan). Some supplementary localities from the literature are: Chinomiji, Kunashir (Alexander, 1966), Kompaneiski, Urup and Gorjatsjije Klutchi, Iturup (Savchenko & Krivolutzkaya, 1966) and Malokurilskoye (= Shikotan, Savchenko, 1970).

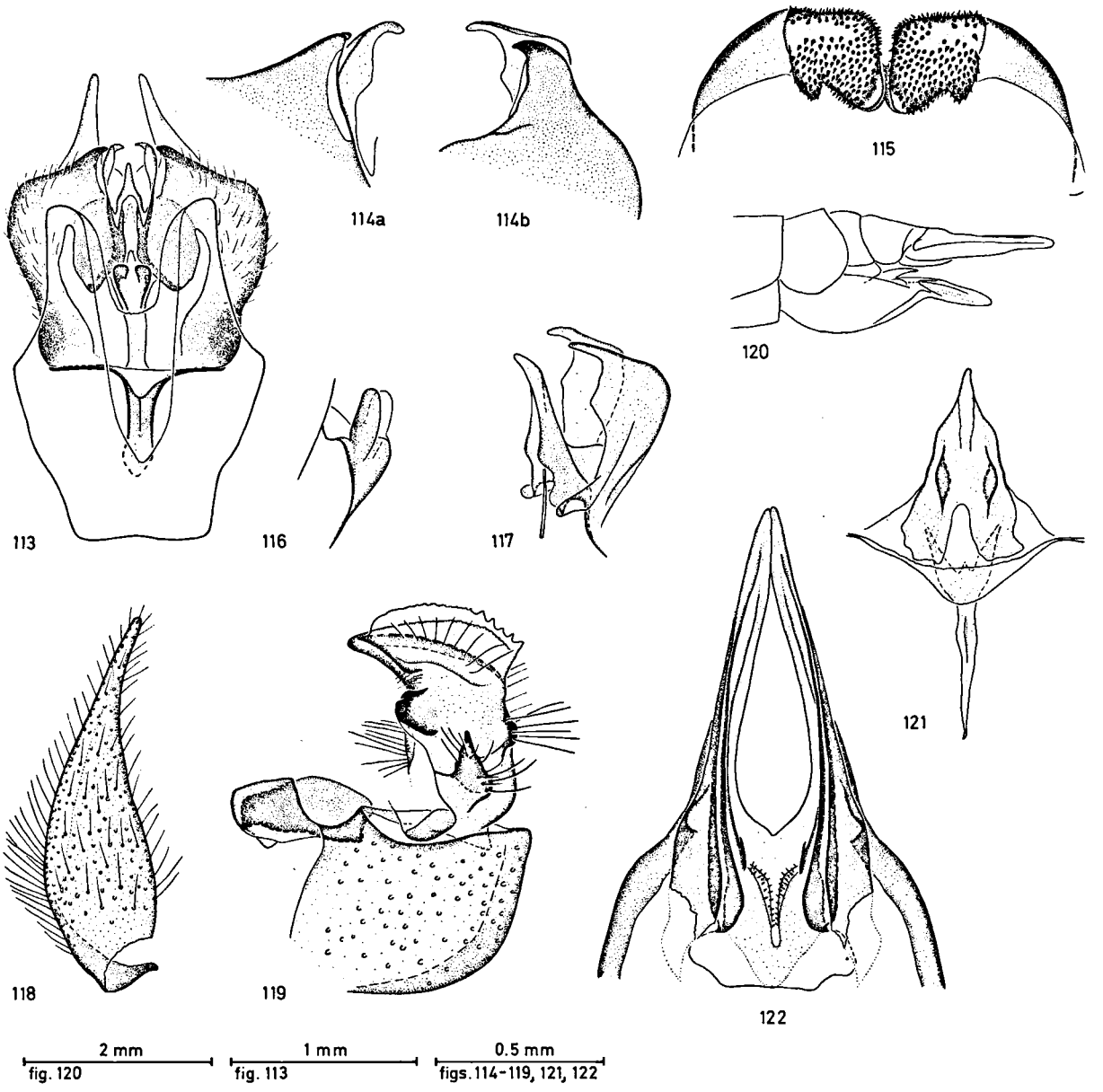
Discussion

N. sachalina was originally described by Alexander (1924) and treated subsequently by other authors as a subspecies of *dorsalis* except for Alexander (1966, as species). Recently it appears that there is some overlap in the distribution-ranges of *dorsalis* and *sachalina* (the southern point of Kamchatka). Moreover, study of the internal genital structures revealed differences between *dorsalis* and *sachalina* large enough to consider them as different species. Additionally a new species has been discovered, *spicula*, closely related to *dorsalis* and *sachalina* and allopatric with both.

Nephrotoma spicula spec. nov.
Figs. 89, 102, 113-122, map 4

Type material

Holotype ♂, labelled: "North Korea Kankyo Nando" "Kankyo Nando Puksu Pyaksan" "Alt. 4000 ft. VII-19 1939 A. Yankovsky" "Holotype Nephrotoma spicula I. Tangelder", condition good, preserved in the C. P. Alexander-collection, USNM. The coordinates of the type-locality: Puksu Pyaksan in Kankyo Nando province (the second highest peak in Korea) are about 40°40′N 127°45′E. Paratypes as follows: 1♂ topotypic, altitude 1525 m (5000 ft), VII-16-1939, USNMA; 1♂, 1♀ (copula) topotypic, altitude 1830 m (6000 ft), VI-25-1939, ZMA; 2♂ from North Korea, Chonsani, near Paiktusan, altitude 910 m (3000 ft), VII-12-1937 (Paiktusan = Chang Pai, the highest mountain in Korea, close to the border of Manchuria, coordinates about 42°N 128°E), USNMA; all collected by A. Yankovsky; 1♂ from Manchuria, Mao-erh-shan, 7-VII-1939, W. Alin (coordinates 45°18′N 127°34′E), coming from the Mannheims-collection, now in the



Figs. 113-122. *N. spicula*; 113-119, ♂; 120-122, ♀. 113. hypopygium, caudo-ventral view; 114. left caudo-dorsal corner of sternite nine: a, caudal view, b, lateral view; 115. tergite nine, ventral view; 116. medisternal appendage of sternite nine, lateral view; 117. adminiculum, lateral view; 118. od, outside; 119. id, outside; 120. ovipositor, lateral view; 121. fused valvulae and furca, dorsal view; 122. hypovalvae, dorsal view.

USNMA; 1♀ from South Primorye, near Ussuriysk, 23-VI-1927, Martynov (label in Cyrillic handwriting, partly illegible), USNMA.

Diagnostic notes

N. spicula is closely related to and strongly resembles *dorsalis* and *sachalina*; it is characterized by the polymerous antennae (17-18 segments in ♂, 15-16 segments in ♀), the long and narrowly triangular occipital marking, the straight black-brown thoracic stripes, the rather broad dark brown marking on scutellum, the black-brown antero-lateral corners of scutum 2

and the special features of the hypopygium. For other differentiating characters see under the diagnostic notes of *dorsalis*.

Description

Body length 12.5-14.5 mm (♂), 17-18 mm (♀), wing length 13-14 mm (♂), 14-14.5 mm (♀). Body colour yellow to bright yellow.

Head: Antennae 17- to 18-segmented in ♂, 15 to 16-segmented in ♀, length (8.3)9.0-9.5 mm (♂), 3.0-3.1 mm (♀); scape (dark)yellow, pedicel dark yellow to yellow-brown, first flagellar segment largely (dark)yellow, frontal surface and apical part usually (dark)brown, other segments nearly completely dark brown, first flagellar segment with a bulbous distal end and following segments strongly incised in ♂ (fig. 102); flagellar segments two and beyond with slightly thickened basal nodes in ♀, longest verticillar hairs exceeding 1.5 to 2 times length of segments. Rostrum shining yellow with brown to yellow-brown lower sides. Palps yellowish with yellow-brown proximal segments. Frons and tubercle somewhat opaque yellow, vertex and postgenae shining yellow, occipital marking dark brown, narrowly triangular and reaching to nearly top of tubercle (fig. 89); postgenae with small brown spots.

Thorax: Median part of pronotum dull yellow-brown, remainder of thorax shining, dorsal surface highly polished. Scutal stripes dark brown to black, lateral ones on scutum 1 straight. Transverse suture strongly brown tinted, antero-lateral corners of scutum 2 dull brown to black. Scutellum largely light brownish with a rather broad dark brown median stripe; mediotergite yellow with a (dark)brown, caudally somewhat tapering anterior stripe and a broad (dark)brown posterior marking. Pleura light yellow with markings ranging from yellow-brown to dark brown, anatergite distinctly (light)brown tinted. Legs dark yellow, femora and tibiae with dark brown tips, tarsi brownish, claws untoothed. Wings with a strong yellow-brown tinge, veins brown; pterostigma dark brown with 5-15 macrotrichia; bases of cells r3, r4 + 5 with a distinct (dark)brown shade, wingtip weakly shaded; cell m1 subsessile to long-petiolate. Halteres yellow with a yellow-brown club.

Abdomen: Dorsal stripe dark brown, more or less continuous on segments 1-6 (♂) and 1-7 (♀), about as broad as median stripe on scutum 1; spots on separate segments slightly broadened caudally, in ♀ more distinct, and somewhat obliterated on posterior tergites. Lateral dark brown dashes on tergites 2-6 or 7 usually forming a continuous stripe. Sternites ventrally marked with small oval spots to elongated dashes. Dorsal surface of tergite 7 in ♂ largely (dark)brown, sternite 7 in ♂ frequently with a broad brown posterior band; segment 8 in both sexes largely dark brown to black; remainder of terminal segments in ♂ brown to brown-yellow, in ♀ brown-yellow.

Hypopygium: External and internal structures figs. 113-119; the species strongly resembles *dorsalis* and *sachalina* in many characters. Lateral view of hypopygium as in *sachalina*, ventral view as in *dorsalis*, except the pointed-tapering projections at the caudo-dorsal corners of sternite 9 (fig. 114). Sternite 8 with strongly extended, lobe-shaped caudal corners, the deep median incision partly closed by a membrane, set with medially directed hairs. Gonapophyses of adminiculum without the peculiarly formed antero-basal extensions (fig. 117). Semen pump as in *sachalina*.

Ovipositor: Cerci slightly narrowed in apical one-third; hypovalvae parallel-sided, weakly curved and with rounded tips (fig. 120). Internal structures figs. 121-122.

Biology and distribution (map 4)

The species is recorded from June 23 till July 19 at altitudes up to 1830 m. The distribution of *spicula* is confined to North Korea, the extreme south of South Primorye and eastern Manchuria.

Etymology

This new species is named '*spicula*' after the pointed-tapering projections at the caudo-dorsal corners of the male sternite 9.

SECTION 5

Nephrotoma lunulicornis (Schummel, 1833)
Figs. 123, 127-132, 133, map 5

Schummel, 1833: 107-09, descr, comp (as *Tipula*); Meigen, 1838: 35-36, descr (as *Tipula picta*); the species is treated in detail by Oosterbroek, 1979b: 172-79, refs, type mat, syn, descr, biol, distr, figs. hypop & ovipos; Oosterbroek, 1979c: 192, key; Noll & Caspers, 1979: 48, loc; Oosterbroek, 1980: 337-39, phylogeny, fig. tergite 9, 340, fig. adm, 345, 350, notes, 365, 369, distr; Simova & Vuković, 1981: 115, locs; Theowald & Oosterbroek, 1983: 376, distr, 387, note.

The discussion of the species will be brief and supplementary to the information in Oosterbroek (1979b).

Type material and synonymy

The types of *Tipula lunulicornis* Schummel, 1833 are apparently lost (Oosterbroek, 1979b), but the original description is clear enough to establish a correct diagnosis. Type-locality: vicinity of Breslau, Schlesien, at present Wroclaw in Poland.

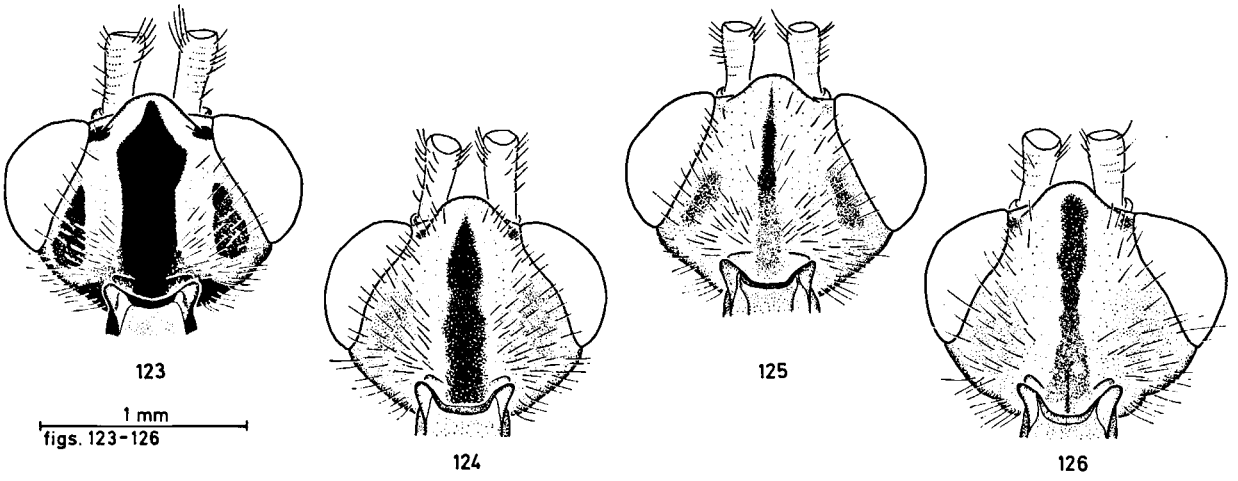
The ♀ holotype of *Tipula picta* Meigen, 1838 lacks the abdomen and is preserved in the Meigen collection (MNHNP). Not examined by me. The synonymy of *picta* with *lunulicornis* was established by Mannheims (1964) and Oosterbroek (1979b).

Other material

Supplementary to the material examined by Oosterbroek (1979b) from many western palaearctic countries and to the localities mentioned in the literature as indicated by Oosterbroek (1979b), the following 88♂, 101♀, 1 intersex (ASL, USNMA, ZMA) have been examined: from Sweden (5♀), Finland (3♂, 3♀, 1 intersex), the Netherlands (7♂, 20♀), West Germany (6♂, 3♀), Switzerland (13♂, 7♀), Austria (1♂), Poland (1♀), Czechoslovakia (2♂, 1♀), Yugoslavia (1♀) and the USSR: Belorussiya SSR: Minskaya obl. (1♂, 1♀), Vitebskaya obl. (1♂, 2♀); Ukraina SSR: Kiyevskaya obl. (2♂), Poltavskaya obl. (1♀); Rossiya SFSR: Arkhangelskaya obl. (1♂), Estonskaya obl. (2♂), Leningradskaya obl. (31♂, 20♀), Novgorodskaya obl. (4♂, 2♀), Kalininskaya obl. (1♂, 4♀), Smolenskaya obl. (1♀), Yaroslawskaya obl. (1♂), Vladimirskaya obl. (1♀), Krasnodarskiy Kray (1♂), Tomskaya obl. (Firsowy bolota, unlocated, 1♀), Gorno-Altayskaya Aut. obl. (Teletskoye Oz., 1♂, Altayskoye, 1♂), Krasnoyarskiy Kray (near Krasnoyarsk, Pritoka, 9♂, 28♀).

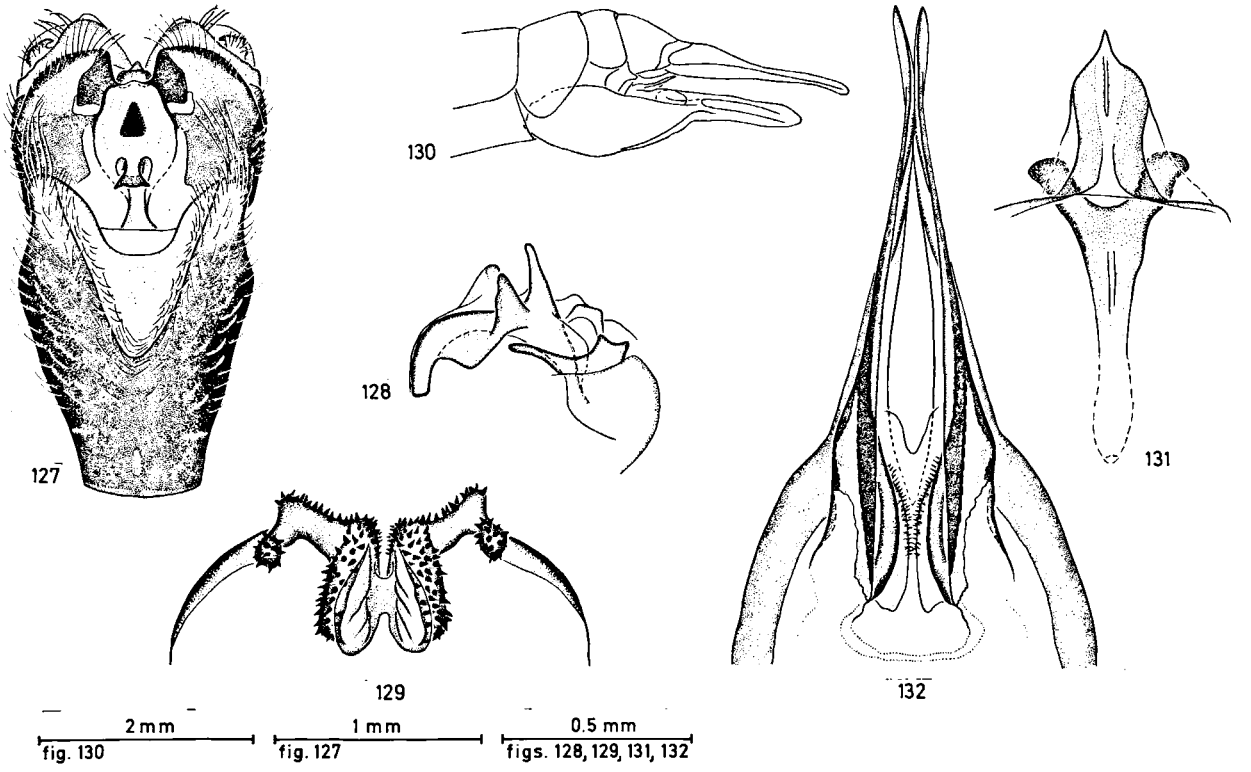
Diagnostic notes

N. lunulicornis is closely related to and strongly resembles *difficilis*, *angustistria* and *koreana*.



Figs. 123-126. 123. *N. lunulicornis*, head, dorsal view, ♂ from Switzerland; 124. *N. difficilis*, head, dorsal view, ♂ holotype from North Korea; 125. *N. koreana*, head, dorsal view, ♂ from North Korea; 126. *N. angustistria*, head, dorsal view, ♀ allotype from Honshu, Japan.

Apart from the hypopygial characters these species can be recognized by the straight brown to black thoracic stripes, the dark to black-brown antero-lateral corners of scutum 2, the usually (dark)brown spots along the dorsal eye-margins (figs. 123-126) and the dark brown shades on the wings. *N. lunulicornis* can be separated from these three species by the nearly completely black-brown antennal flagellum (fig. 133), which is bicoloured in the other taxa, and the distinct brown to black-brown pleural markings. *N. difficilis* differs from *koreana* and *angustistria* in the elongated triangular occipital marking (compared to a narrow stripe or spot in the other taxa, figs. 124-126), the ventrally directed medisternal appendage of sternite 9 in ♂ (fig. 139) and the rather short and broad cerci in ♀ (fig. 145). The two species *angustistria* and *koreana* can be distinguished by the length of the antennae in ♂ (*angustistria* has slender and elongated flagellar segments, *koreana* has short ones, figs. 135, 136), the breadth of the abdominal dorsal stripe (as broad as scutellum in *angustistria*, narrow in *koreana*), the (sub)terminal darkening of the abdomen (strong in *angustistria*, weak or not in *koreana*) and the tips of the hypovalvae (somewhat pointed in *angustistria*, rounded off in *koreana*). Confusion of *lunulicornis*, *difficilis* and *koreana* is possible with: *austriaca* and *dorsalis* (both do have antennae with 14 or more segments in both sexes), *helvetica* (with an occipital marking as broad as vertex), *scurra* (with a rather pale pterostigma and no shades on the wings), *sublunulicornis* (with yellow sides on rostrum) and especially *quadristriata* (with a (pale)brown pterostigma and less distinct shades on the wings and with the (sub)terminal darkening narrow). Hypopygium, ovipositor and internal structures of *lunulicornis* figs. 127-132.



Figs. 127-132. *N. lunulicornis*; 127-129, ♂; 130-132, ♀. 127. hypopygium, caudo-ventral view; 128. adminiculum lateral view; 129. tergite nine, ventral view; 130. ovipositor, lateral view; 131. fused valvulae and furca, dorsal view; 132 hypovalvae, dorsal view.

Biology and distribution (map 5)

Oosterbroek (1979b) mentioned that *lunulicornis* "... is a woodland species, especially frequent at moist, shaded places near streams and rivers, or clearings and edges of deciduous forests" and that the larvae are known from humic woodland soils. The flight-period ranges from mid-May till the beginning of August, with extreme dates of 9-10-V (Kiyev) and 12-VIII (near Krasnoyarsk).

N. lunulicornis has a disjunct distribution, the westernmost range stretches from Great Britain in the west to the western european part of the USSR in the east and from Scandinavia in the north to southern France, northern Italy, Yugoslavia and Bulgaria in the south, while *lunulicornis* is also known from a few localities in central Asia. Some localities mentioned by Savchenko (1973) proved to be from other species, such as Bolshezemelskaya Tundra, Arkhangelskaya obl. (= *dorsalis*), Komi ASSR (= *scurra*, *dorsalis*), Ulyanowskaya obl. (= *dorsalis*), Minysinsk, Krasnoyarskiy Kray (= *difficilis*, *dorsalis*), Irkutskaya obl. (= *dorsalis*), Buryatskaya ASSR (= *difficilis*) and Yakutskaya ASSR (= *dorsalis*). Supplementary western palaearctic localities in the literature are from: Brolemann, 1923 (France); Coe, 1960 (Yugoslavia); Erhan & Theowald, 1961 (Rumania); Fisher, 1952 (West Germany); Lackschewitz, 1933, 1935 (Norway); Lundström, 1907, 1912 (Finland); Mannheims, 1954 (Finland); Nielsen, 1919 (Denmark); Oosterbroek, 1979b (Norway, England, Andorra, Italy, Bulgaria); Pierre, 1924 (France); Savchenko, 1966d (Ukraina); Savchenko, 1973 (european USSR); Simova, 1959, 1976 (Yugoslavia); Stewart, 1975 (Scotland); Tjeder, 1955b (Sweden) and from Oosterbroek, in literis, 1984 (Belgium, West Germany, East Germany, Czechoslovakia, France, Austria, Yugoslavia).

Discussion

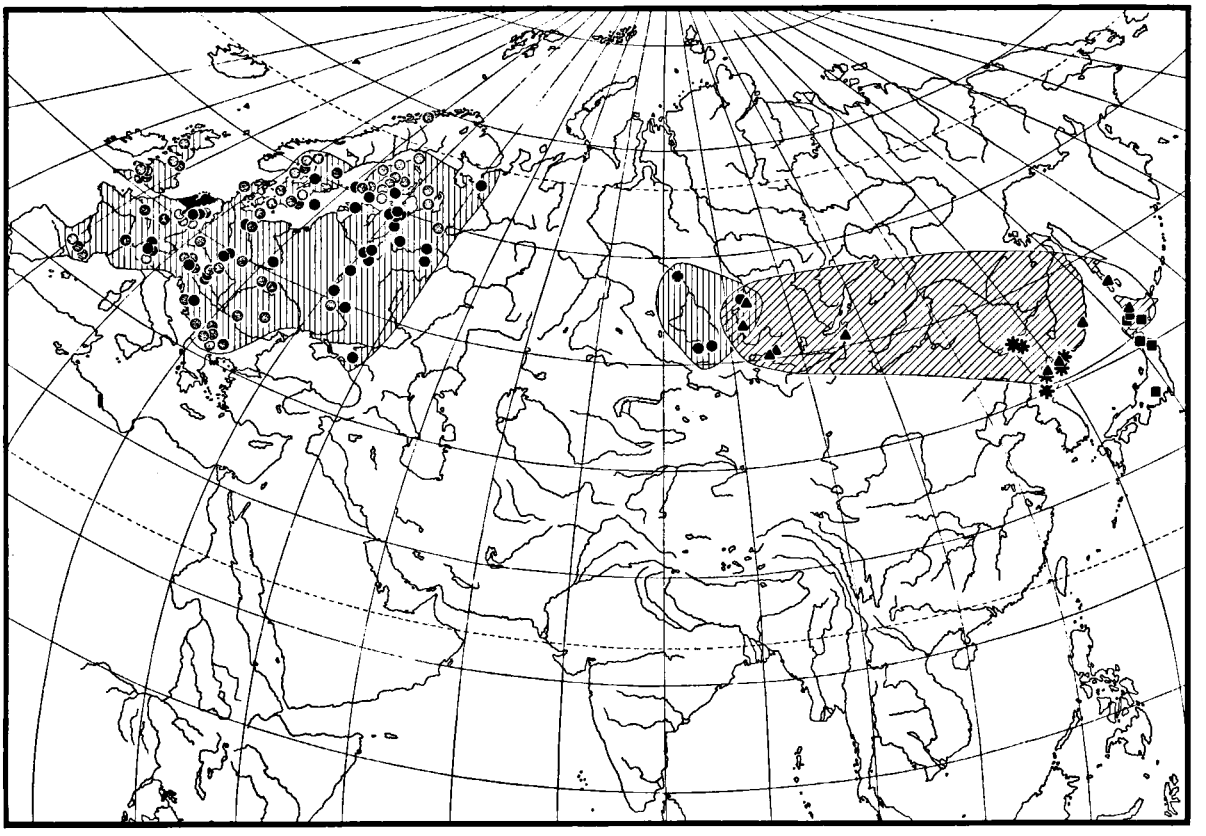
Until the present, *N. lunulicornis* was considered to comprise two subspecies: the nominate one, occurring in the western Palaearctic and central Asia, and *l. angustistria*, representing the species in the Tuva region and eastern Asia, interpreted as such by Savchenko & Violovich (1967) and Savchenko (1973) because of the supposed allopatry. Study of the type-material of *angustistria* in the C. P. Alexander-collection and of many specimens in the Academy of Sciences, Leningrad, on which Savchenko based his interpretation, revealed that two different species were mixed up here. It appears that *angustistria* is restricted to Japan, while the specimens of the USSR, interpreted as *angustistria* by Savchenko, proved to be a new species, *difficilis*, closely related indeed, with a distribution from central Asia to Japan. Besides this another new species was discovered, *koreana*, also closely related to the three preceding taxa and occurring in and around North Korea. Although closely related, mainly characterized by the intricate anterior extension of the central part of the adminiculum in ♂, all these four taxa are now considered to have species-rank. Three species, *lunulicornis*, *koreana* and *angustistria* are allopatric, while *difficilis* is partly sympatric with all three taxa. However, because of the scanty material, this figure is probably incomplete.

Nephrotoma difficilis spec. nov.
Figs. 124, 134, 137-148, map 5

Savchenko & Violovich, 1967: 320, 322, biol, 326, dates, 328, distr, 354, locs (as *Pales lunulicornis angustistria*); Savchenko, 1973: 91-92, sh descr, figs. hypop, distr, locs, biol (as *P. l. angustistria*); Oosterbroek, 1979b: 177, map, 178-79, note, distr, comp (partly, as *lunulicornis angustistria*); Oosterbroek, 1980: 365, 368, distr (partly, as *l. angustistria*).

Material examined

Type material: Holotype ♂, labelled: "Chonsani, Paiktusan. N. Corea 3700′ VII-13,′37 Yankovsky" "HOLOTYPE Nephrotoma difficilis I. Tangelder", condition good, dissected genitalia in a micro-vial on the same pin, preserved in the C. P. Alexander-collection, USNM. The type-locality is situated near Paiktusan (= Chang Pai), the highest mountain in Korea, close to the border of Man-



Map. 5. Distribution of *N. lunulicornis* (black spot, dots and vertical hatching), *N. difficilis* (triangles and oblique hatching), *N. koreana* (asterisks) and *N. angustistria* (squares), based on material examined (black marks) and literature (stippled dots); fragmented dot: locality not exactly specified.

churia, coordinates about 42°N 128°E. Paratypes as follows: 1♀ topotypic with the holotype, USNMA; 1♂ from "S. Primorye Khasan distr. 9.VII-976 E. Savchenko" (Nat. Park "Redzooaja Padj", near border with N. Korea), ZMA; 1♀ from "Horokanai Hokkaido, Japan 30-VII-1958 T. Nakashima" (in Rumoi pref.), USNMA.

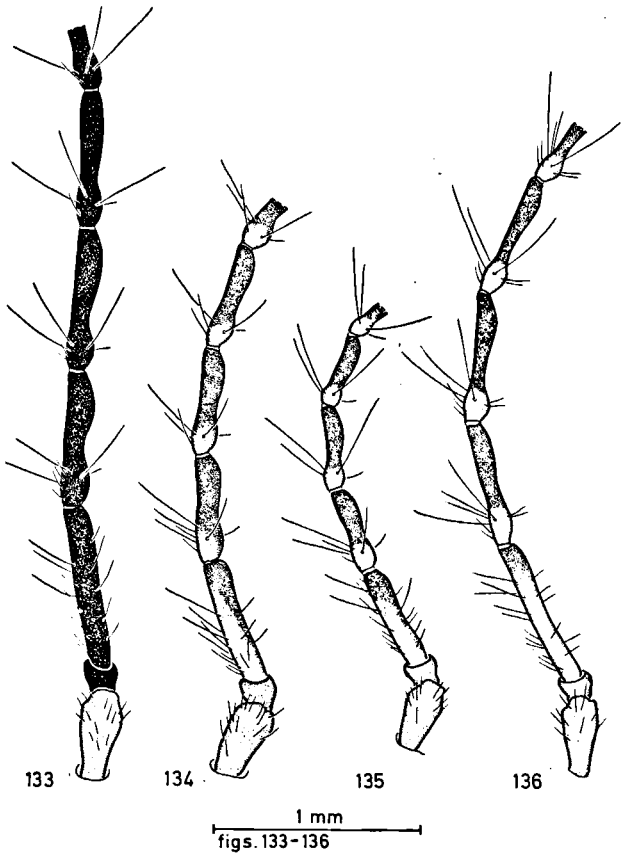
Other material: 11♂, 1♀ (ASL), from the USSR: Krasnoyarskiy Kray (2♂, Bazaikha river, near Krasnoyarsk, 15-VI-1952, 19-VI-1953; 1♂, Minusinsk, 17-VI); Tuvinskaya ASSR (1♂, Erzin, Tesiyn river, 17-VI-1963; 1♂, Chita river, 11/18-VI-1912); Buryatskaya ASSR (1♂, Ust'-Kiran, Chikoy river, 26-VI-1903); Primorskiy Kray (3♂, Sanchode river-mouth, not located, 18/20-VI-1937; 2♂, Ta-Kema river-mouth, 45°26'N 137°14'E, 28/29-VI-1938); Sakhalin (1♀, Yuzhno-Sakhalinsk, 11-VIII-1956).

Diagnostic notes

N. difficilis is characterized by the bicoloured antennal flagellum (fig. 134), the elongate triangular occipital marking (fig. 124), the black-brown and straight thoracic stripes, the dark brown antero-lateral corners of scutum 2 and the brown shades of the wings. It is closely related to *lunulicornis*, *koreana* and *angustistria*. Differences between these species are mentioned under the diagnostic notes of *lunulicornis*.

Description

Body length 13-14.5 mm (♂), 16-17 mm (♀), wing length 13-14 mm (♂), 14-15 mm (♀). Body colour light yellow.



Figs. 133-136. 133. *N. lunulicornis*, basal segments of antenna, ♂ from Switzerland; 134. *N. difficilis*, basal segments of antenna, ♂ holotype from North Korea; 135. *N. koreana*, basal segments of antenna, ♂ from North Korea; 136. *N. angustistria*, basal segments of antenna, ♂ holotype from Hokkaido, Japan.

Head: Antennae of both sexes 13-segmented, length 5.1-5.3 mm (♂), 3.5 mm (♀), scape yellow, pedicel brown-yellow, first flagellar segment dirty yellow with usually darkened apical part; following flagellar segments in ♂ (dark) brown with pale basal nodes, weakly incised, longest verticillar hairs not as long as length of segments (fig. 134); second and following flagellar segments in ♀ (light)brown with yellowish bases, very weakly incised, longest verticillar hairs about as long as segments. Rostrum shining yellow with (dark)brown spots on sides. Palps with dark brown basal segments and yellowish apical ones. Frons and tubercle opaque yellow, vertex and postgenae shining yellow, occipital marking dark brown and elongated triangular, sometimes weakly brown spots along dorsal eye-margins (fig. 124).

Thorax: Median part of pronotum dull yellow, remainder of thorax highly polished. Scutal stripes dark brown to black, lateral ones on scutum 1 straight. Transverse suture weakly tinted, antero-lateral corners of scutum 2 dull dark brown. Scutellum yellow-brown, usually with a narrow dark brown line in the middle; mediotergite yellow with a (dark) brown, caudally tapering stripe anteriorly and a broad dark brown marking posteriorly. Pleura light yellow with yellow-brown to red-brown markings. Legs dark yellow, tips of femora broadly to narrowly dark brown, tips of tibiae narrowly darkened, metatarsus dark yellow, other tarsal segments brown to dark brown, claws untoothed. Wings with a brown-yellow tinge; pterostigma dark brown with 5 to 20 macrotrichia; bases of cells r3, r4 + 5 and tip of wing with a distinct brown shade; cell m1 long- to short-petiolate. Halteres yellowish.

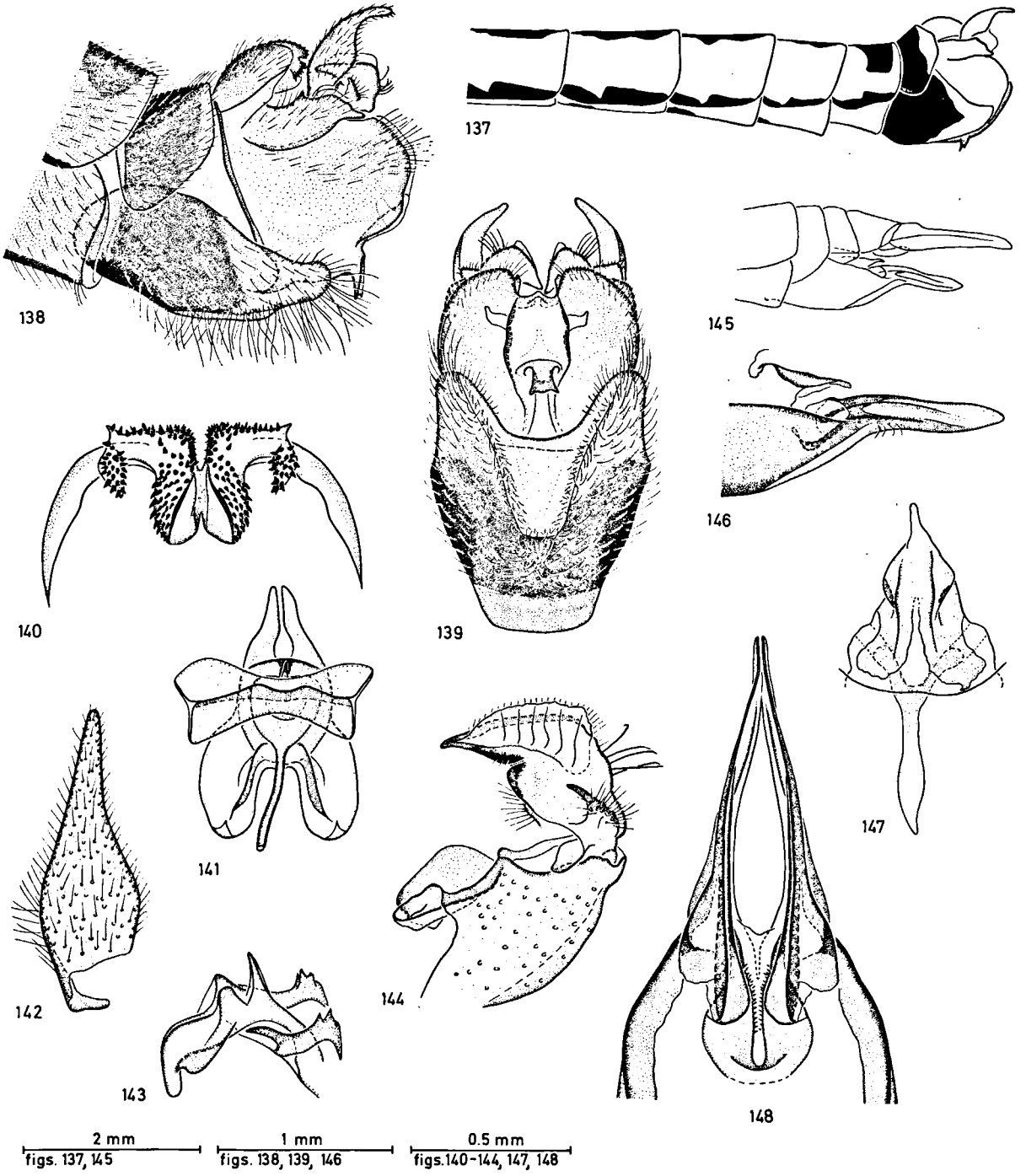
Abdomen: Dark brown dorsal stripe nearly as broad as scutellum, slightly interrupted at posterior margins of tergites, distinct on tergites 1-7, separate spots narrowed anteriorly. Dark brown lateral stripes on tergites 2-7 more or less continuous. Ventral markings on sternites 2-7 narrow and elongated. Both sexes with the eighth segment largely brown-black and the ninth segment not or partly darkened (fig. 137).

Hypopygium: External and internal structures figs. 138-144. Hind margin of sternite 8 deeply incised. Medisternal appendage of sternite 9 flattened, bifid and ventrally directed. Median part of adminiculum with an intricate extension anteriorly, as in fig. 143; gonapophyses with an acute extension at base, without upcurved tips.

Ovipositor: Cerci rather broad and short; hypovalvae parallel-sided with slightly pointed tips (figs. 145, 146). Internal structures figs. 147, 148.

Biology and distribution (map 5)

According to Savchenko & Violovich (1967, as *lunulicornis angustistria*) *difficilis* is a geobiont,



Figs. 137-148. *N. difficilis*; 137-144, ♂; 145-148, ♀. 137. distal segments of the abdomen, lateral view; 138. hypopygium, lateral view; 139. hypopygium, caudo-ventral view; 140. tergite nine, ventral view; 141. semen pump, dorsal view; 142. od, outside; 143. adminiculum, lateral view; 144. id, outside; 145. ovipositor, lateral view; 146. left hypovalva, lateral view; 147. fused valvulae and furca, dorsal view; 148. hypovalvae, dorsal view.

mesophytic species and an occupant of deciduous and mixed forests along outer marches of rivers. The flight-period of *difficilis* ranges from mid-June till the end of July with one record of August 11 (♀, Sakhalin). The species occurs in the eastern Palaearctic and is distributed from central Asia (Krasnoyarsk and Tuva regions) eastward to South Primorye and North Korea, South Sakhalin and Hokkaido.

Etymology

Because this new species was involved in lots of confusion, it is named '*difficilis*'.

Nephrotoma koreana spec. nov.
Figs. 125, 135, 149-160, map 5

Type material

Holotype ♂, labelled: "Ompo N. Corea 170′ V-17, 37 Yankovsky" "HOLOTYPE Nephrotoma koreana I. Tangelder", condition good, preserved in the C. P. Alexandercollection, USNM. The type-locality, Ompo, is situated a few miles inland from the coast of North Korea, just south of 42°N. Paratypes, 12 ♂, 8♀, as follows: 2♂, 1♀ topotypic, 45 m (170 ft), VI-10-1937, USNMA; 2♂ idem, ZMA; 1♂ idem, VI-15-1937, USNMA; 2♂ idem, VI-20-1937, USNMA; 1♂ idem, 230 m (750 ft), VII-4-1937, USNMA; 1♂, 2♀ from North Korea, Chonsani, near Paiktusan (= Chang Pai, the highest mountain in Korea, close to the border of Manchuria, coordinates about 42°N 128°E), 910 m (3000 ft), VII-12-1937, ZMA; 1♀ idem, 1125 m (3700 ft), VII-15-1937, USNMA; 1♂, 1♀ idem, 975 m (3200 ft), VII-24-1937, USNMA; 1♀ from Norht Korea, Puksu Pyaksan in Kankyo Nando province (the second highest peak in Korea, coordinates about 40°40′N 127°45′E), 1370 m (4500 ft), VI-6-1939, USNMA; 1♂ idem, 1070 m (3500 ft), VI-11-1939, USNMA; all collected by A. Yankovsky; 1♂ from South Primorye, Khasan distrinct (near border with North Korea), National Park Redzooaja Padj, VI-28-1976 (E. Savchenko), ZMA; 1♀ from Manchuria, Mao-erh-shan (coordinates 45°18′N 127°34′E), VII-14-1939 (W. Alin), MAK; 1♀ from Manchuria, Kaolingtze (presumably nearby Mao-erhshan), VII-28-1939 (second labes says VII-14) (W. Alin, USNMA.

Diagnostic notes

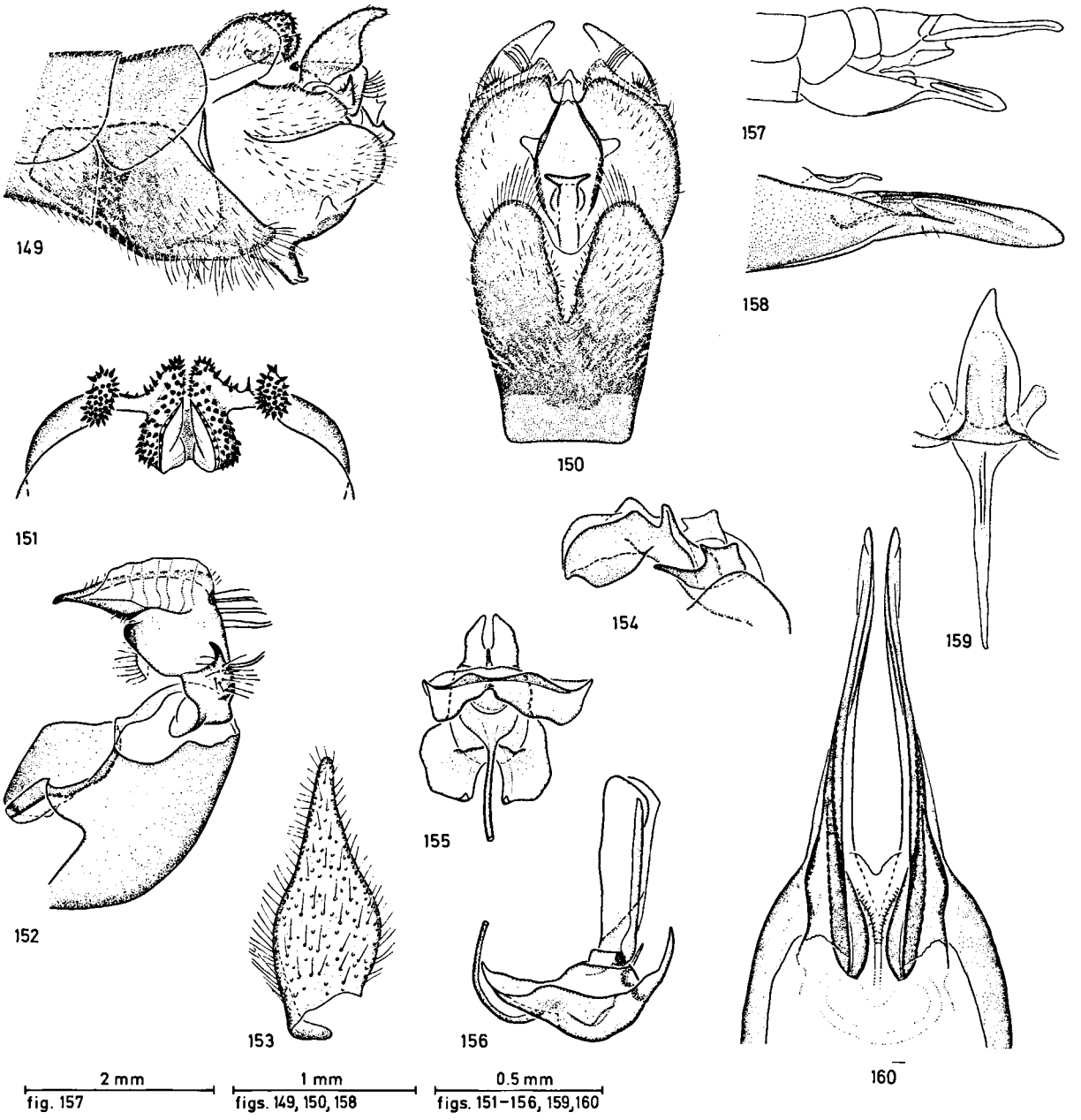
N. koreana can be recognized by the more or less bicoloured antennal flagellum (fig. 135), the narrow occipital marking (fig. 125), the (dark)brown and straight thoracic stripes, the dull dark brown antero-lateral corners of scutum 2 and the distinct brown shades of the wings. Differences between *koreana* and the closely related *augustistria*, *difficilis* and *lunulicornis* are mentioned under the diagnostic notes of *lunulicornis*.

Description

Body length 12.5-15 mm (♂), 16.5-18 mm (♀), wing length 12.5-14 mm (♂), 13-16 mm (♀). Body colour bright yellow.

Head: Antennae of both sexes 13-segmented, length 3.8-4.4 mm (♂), 2.6-3.0 mm (♀); scape and pedicel yellowish, first flagellar segment ranging from completely yellow to largely brownish, following flagellar segments light brown to dark brown with pale basal nodes; flagellar segments two and beyond in ♂ weakly incised and with verticillar hairs not exceeding length of segments (fig. 135); ♀ with more or less cylindrical flagellar segments and with verticillar hairs distinctly exceeding length of segments. Shining yellow rostrum usually with brown stripes dorsally and with brown to dark brown sides. Palps brown with pale apical segments. Frons and tubercle opaque yellow, vertex and postgenae shining yellow, brown occipital marking an elongated spot or a narrow stripe, usually brown spots along dorsal eye-margin (fig. 125).

Thorax: Median part of pronotum dull yellow, remainder of thorax shining. Scutal stripes brown to dark brown, lateral ones on scutum 1 straight. Transverse suture weakly tinted, antero-lateral corners of scutum 2 dull dark brown. Scutellum yellowish-brown; mediotergite yellow with a brown, caudally



Figs. 149-160. *N. koreana*; 149-156, ♂; 157-160, ♀, 149. hypopygium, lateral view; 150. hypopygium, caudo-ventral view; 151. tergite nine, ventral view; 152. id, outside; 153. od, outside; 154. adminiculum, lateral view; 155. semen pump, dorsal view; 156. semen pump, lateral view; 157. ovipositor, lateral view; 158. left hypovalva, lateral view; 159. fused valvulae and furca, dorsal view; 160. hypovalvae, dorsal view.

tapering median stripe and a broad, light brown posterior marking. Pleura yellow with dark yellow to light brown markings. Legs yellow, tips of femora narrowly brown, tips of tibiae hardly darkened, tarsi dark yellow to light brown, claws untoothed. Wings with a strong yellow tinge; pterostigma light brown to brown, number of macrotrichia ranging from 0 to 23; bases of cells r3, r4 + 5 and wingtip with a distinct brown shade; cell m1 sessile to long-petiolate. Halteres yellowish.

Abdomen: Dark brown dorsal stripe narrow,

usually not as broad as lateral stripes on scutum 1, discontinuous and obliterated caudad, usually distinct on tergites 1 to 6. Sides of tergites 2 to 6 (7) marked with dark brown dashes, forming a slightly interrupted stripe, obliterated caudad. Sternites ventrally marked with narrow dark brown lines. Basal part of sternite 8 in ♂ usually dark brown, in ♀ without darkening, remainder of (sub)terminal segments yellowish.
Hypopygium: External and internal structures figs. 149-156. Hind margin of sternite 8 rather deep incised, lined with yellow hairs. Medisternal appendage of sternite 9 bifid and caudally directed. Median part of adminiculum with a large, intricate extension anteriorly (fig. 154); gonapophyses with an acute extension at base, without upcurved tips.
Ovipositor: Cerci slightly narrowed in apical one-third; hypopvalvae parallel-sided with rounded tips (figs. 157, 158. Internal structures figs. 159, 160.

Biology and distribution (map 5)

The habitat of *koreana* is not known; it is recorded from altitudes up to 1370 m and is on the wing from the last week of May till the end of July. The distribution of *koreana* is confined to North Korea, the extreme south of South Primorye and two localities in eastern Manchuria.

Etymology

This new species is named '*koreana*' because of its occurrence in North Korea and nearby localities.

Nephrotoma angustistria Alexander, 1925
Figs. 126, 136, 161-169, map 5

Alexander, 1925: 389-99, descr; Masaki, 1933: 92, distr; Ishida, 1955: 120, locs, distr; Savchenko & Violovich, 1967: 320, 322, biol, 326, dates, 328, distr, 354, locs (as *Pales lunulicornis angustistria*; = *difficilis*); Savchenko, 1973: 91-92, descr, figs. hypop, distr, locs, biol (as *Pales l. angustistria*; = *difficilis*); Oosterbroek, 1979b: 177, map, 178-79, note, distr, comp (as *lunulicornis angustistria*; = partly *difficilis*); Oosterbroek, 1980: 365, 368, distr (as *l. angustistria*; = partly *difficilis*).

Material examined

Type material: The type-series of *Nephrotoma angustistria* Alexander, 1925 consists of 3♂ and 3♀. Examined are the ♂ holotype, labelled: "Jozankei, Japan VIII-16, '23 T. Esaki" "HOLOTYPE Nephrotoma angustistria C. P. Alexander", in the original description supplied with "Ishikari-no-kuni, Hokkaido, altitude 1000 ft.", condition fair, dissected genitalia, one antenna and one wing on slide no. 2808, and the ♀ allotype, labelled: "Yumoto, Japan 5820 ft. VII-23 '23 T. Esaki" "ALLOTYPE Nephrotoma angustistria C. P. Alexander", supplied with "Shimotsuke-no-kuni, Honshiu" in the original description; both preserved in the C. P. Alexander-collection, USNM. The following paratypes were not found: 1♀, topotypic with the allotype, 1♂ from Shimokebo, Hitaki-no-kuni, Hokkaido, 9/10-VIII-1923 and 1♂, 1♀ from Sapporo, Ishikari-no-kuni, Hokkaido, 17-V-and 20-VI-1923.

Other material: 2 specimens from Japan, Honshu: Yashiki yama Mt. in Aomori pref. (1♂, 28-VII-1951, USNMA) and Kamikochi Mt. in Yamanashi pref. (1♀, 7-IX-1935, USNMA).

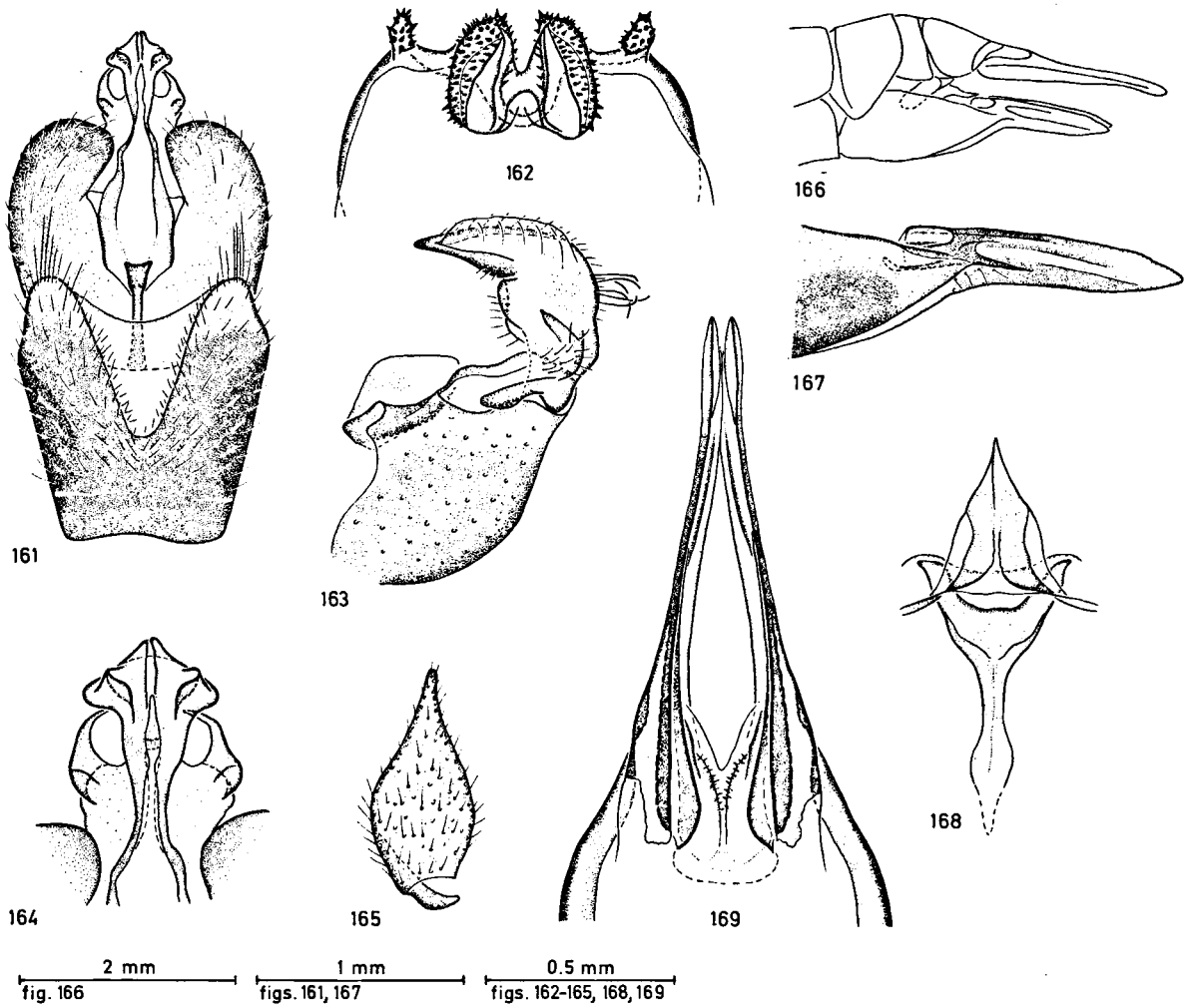
Diagnostic notes

N. angustistria can be identified by the narrow and elongated occipital marking (fig. 126), the straight black-brown thoracic stripes, the brown median stripe on scutellum, the black-brown antero-lateral corners of scutum 2 and the dark brown shades of the wings. It is closely related to and resembles *koreana*, *lunulicornis* and *difficilis*; differences are mentioned under the diagnostic notes of *lunulicornis*.

Brief description

Body length 12 mm (♂), 17-19 mm (♀), wing length 12 mm (♂), 15-16 mm (♀), body colour (dark)yellow. Antennae of all examined specimens partly broken off, presumably 13-segmented, extrapolated length 5.6-6.3 mm (♂), 3.9 mm (♀); scape yellow, pedicel dirty yellow, first flagellar segment yellowish, sometimes brown apically, other flagellar

segments light brown to brown with pale basal nodes, in ♂ slender, elongated and slightly incised (fig. 136). Rostrum shining yellow with dark brown sides; palps (dark) brown or apically more pale; vertex largely shining, occipital marking a narrow dark brown line, nearly reaching to top of tubercle (fig. 126); sometimes light brown spots along dorsal eye-margins. Thorax completely shining, stripes dark brown to black, lateral ones on scutum 1 straight; transverse suture slightly brown tinted, anterolateral corners of scutum 2 dull dark brown to black; scutellum yellow-brown with a narrow to broad dark brown median stripe, mediotergite with a brown, caudally tapering anterior stripe and a broad, more pale posterior marking; pleural markings dark yellow-brown. Tarsal claws untoothed. Wings with a dark yellow tinge; pterostigma dark brown, bases of cells r3, r4 + 5 and wingtip with a dark brown shade. Abdominal dorsal stripe dark brown, nearly as broad as scutellum, in ♂ usually slightly interrupted at posterior margins of tergites; lateral stripes more or less continuous; ventral markings elongated and narrow; segment 8 largely, tergite 9 and part of sternite 9 dark brown. Hypopygium and internal structures figs. 161-165; hind margin of sternite 8 deeply incis-



Figs. 161-169. *N. angustistria*; 161-165, ♂; 166-169, ♀. 161. hypopygium, caudo-ventral view, synthesized from fragments; 162. tergite nine, ventral view; 163. id, outside; 164. adminiculum, caudal view; 165. od, outside; 166. ovipositor, lateral view; 167. left hypovalva, lateral view; 168. fused valvulae and furca, dorsal view; 169. hypovalvae, dorsal view.

ed, medisternal appendage of sternite 9 bifid; median part of adminiculum with a large, intricate anterior extension (fig. 164), gonapophyses basally extended, without dorsally curved tips. Ovipositor and internal structures figs. 166-169.

Biology and distribution (map 5)

The few records of the specimens examined range from July 23 till September 7; this can be supplemented with May 17 and June 20 mentioned for some paratypes by Alexander (1925). The altitudes recorded for *angustistria* are 305 m (holotype) and 1775 m (allotype). The species is endemic to Japan, where it is known from Hokkaido and Honshu.

SECTION 6

Nephrotoma cirrata spec. nov.
Figs. 170, 172-181, map 6

Type material

Holotype ♂, labelled: "Japan, Hokkaido, Ebeotsu 12-VII-1937 K. Sakurai" "HOLOTYPE Nephrotoma cirrata I. Tangelder", condition good, coordinates of type-locality: 43°38′N 141°56′E. Paratypes as follows: 2♂ from Hokkaido, Maruyama, Sapporo with dates 25-VI-1932 and 26-VI-1932 (Okada); 1♀ from Hokkaido, Shintoku, Kamikawa, Tokachi pref., 6-VII-1935 (Kuwayama). Holotype and two paratypes in the C. P. Alexander-collection, USNM, one paratype in the ZMA.

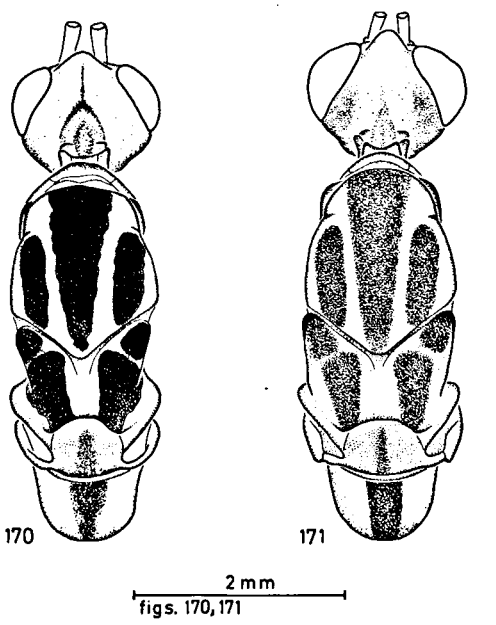
Diagnostic notes

N. cirrata can be recognized by: the shortly triangular, brownish occipital marking, the straight dark brown to black scutal stripes, the dark brown pterostigma and shades on bases of cells r3, r4 + 5 and wingtip, the strong (sub)terminal darkening in both sexes and the conspicuous features of sternites 8 and 9 in males. In general appearance *cirrata* somewhat resembles *minuticornis*, differing from it in the dark brown pterostigma and wingtip, the brownish antero-lateral corners of scutum 2 and the (dark)brown posteriorly tapering median stripe on the mediotergite, which are all pale in *minuticornis*.

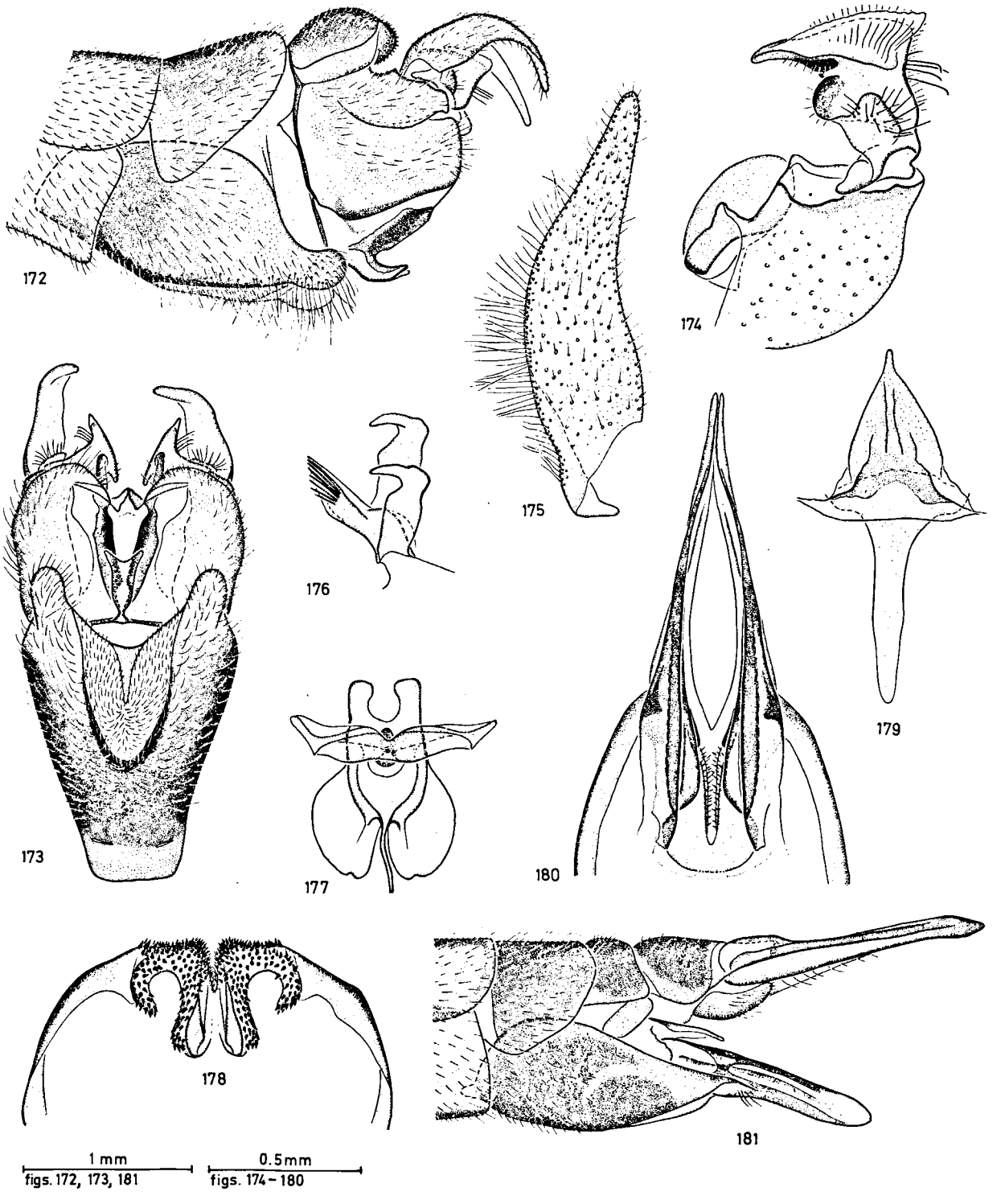
Description (fig. 170)

Body length 15-16 mm (♂), 18 mm (♀), wing length 14-15.5 mm (♂), 14.5 mm (♀). Body colour saturated yellow.

Head: Antennae 13-segmented, length 3.3-3.5 mm (♂); scape and pedicel yellow, flagellum brown to yellow-brown, basal segment somewhat paler, other segments in ♂ weakly incised and with slightly paler basal nodes; longest verticillar hairs in ♂ more or less equalling length of segments; antennae of ♀ missing. Rostrum shining yellow, sides brown to dark brown. Palps yellow-brown. Frons and tubercle opaque yellow, remainder of head shining yellow with a shortly triangular, anteriorly slightly prolonged brown occipital marking.



Figs. 170-171. 170. *N. cirrata*, head and thorax, dorsal view, ♂ from Hokkaido, Japan; 171. *N. microcera*, head and thorax, dorsal view, ♂ from Hokkaido, Japan.



Figs. 172-181. *N. cirrata*; 172-178, ♂; 179-181, ♀. 172. hypopygium, lateral view; 173. hypopygium, caudo-ventral view; 174. id, outside; 175. od, outside; 176. adminiculum, lateral view; 177. semen pump, dorsal view; 178. tergite nine, ventral view; 179. fused valvulae and furca, dorsal view; 180. hypovalvae, dorsal view; 181. ovipositor, lateral view.

Thorax: Median part of pronotum dull, remainder of thorax highly polished. Scutal stripes dark brown to black, lateral ones on scutum 1 straight. Transverse suture and antero-lateral corners of scutum 2 brownish. Scutellum yellow-brown with a brown line in the middle; mediotergite yellow with a broad (dark)brown, posteriorly tapering median stripe and a broad yellow-brown marking on caudal part. Pleura yellow with red-yellow to red-brown markings. Legs yellow, femora and tibiae with narrowly dark brown tips, tarsi brown to dark brown, claws untoothed. Wings with a yellow-brown tinge, veins dark brown; pterostigma dark brown with sometimes a few macrotrichia; bases of cells r3, r4 + 5 and tip of wing conspicuously dark brown shaded; cell m1 petiolate. Halteres dark yellow.

Abdomen: Dark brown dorsal stripe narrow in ♂, about as broad as lateral stripes on scutum 1, interrupted at posterior margins of the tergites and obliterated on tergites 6 and 7; in ♀ dorsal stripe slightly broader, more or less continuous, separate spots posteriorly fusing with the transverse brown bands along hind margins of tergites. Sides of tergites 2-5(6) marked with dark brown dashes. Sternites ventrally marked with narrow spots or dashes on anterior parts, in ♀ more elongated. In ♂ tergites 8, 9 and largest part of sternite 8 black-brown, remainder of hypopygium yellow-brown; in ♀ segment 8 largely and tergites 9, 10 black-brown.

Hypopygium: External and internal structures figs. 172-178. Sternite 8 with bulbously extended caudal corners and a deep median incision of hind margin, closed by a short-haired membrane. Membranous area on caudo-ventral surface of sternite 9 with strongly sclerotized lateral plates and a solid, bifid medisternal appendage. Median part of adminiculum fringed at apex.

Ovipositor: Lateral view and internal structures figs. 179-181. Dorsal base of hypovalvae strongly extending the dorso-lateral margins of sternite 8.

Biology and distribution (map 6)

The species is recorded from June 25/26 and July 6 and 12. It is known only from the northern Japanese island Hokkaido.

Etymology

The species is named '*cirrata*', which means 'provided with fringe', referring to the apically fringed median part of the adminiculum (fig.176).

Nephrotoma gaganboi spec. nov.
Figs. 182-189, map 6

Type material

Holotype ♂, labelled: "[HONSHU] Kanayama YAMANASHI 30.VI.1975 J. Emoto" "HOLOTYPE Nephrotoma gaganboi I. Tangelder", condition good, dissected genitalia in a micro-vial on the same pin, preserved in the KU.

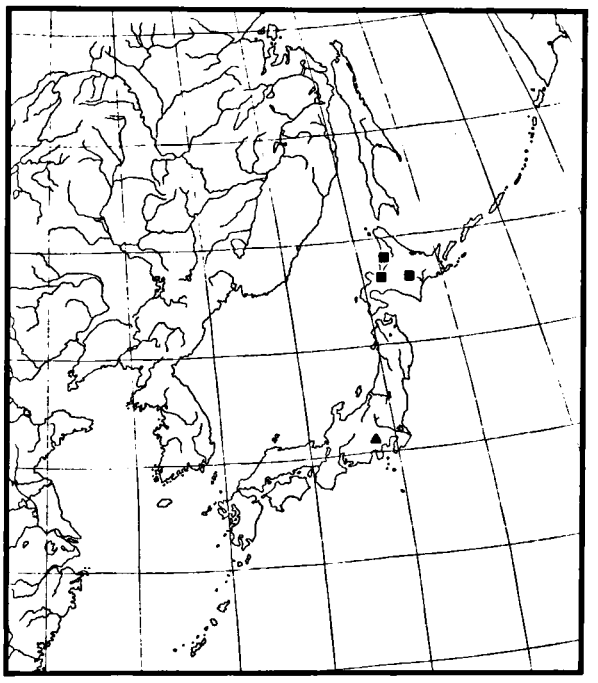
Diagnostic notes

Some distinct characteristics of *gaganboi* are the broad, dark brown occipital marking, the highly polished thorax with the shining brown spots below anterior ends of the lateral stripes on scutum 1, the rather pale pleura and the conspicuously brown-shaded parts of the wings (fig. 182). There is a slight resemblance to *saghaliensis*, not belonging to the *dorsalis* species-group, which differs from *gaganboi* in the opaque vertex with small occipital marking, the scarcely shaded wings and the lack of ventral abdominal markings.

Description

Body length 13 mm (♂), wing length 14 mm (♂), Body colour bright yellow.

Head(♂): Antennae 13-segmented, length 5.5 mm; scape, pedicel and basal part of first flagellar segment yellow, following flagellar segments dark brown and slightly incised, verticillar hairs shorter than length of segments. Rostrum shining yellowish. Palps yellow



Map 6. Distribution of *N. cirrata* (squares) and *N. gaganboi* (triangle), based on material examined.

brown. Frons and tubercle opaque yellow, remainder of head shining yellow with a broad, dark brown occipital marking, half oval-shaped and reaching to base of tubercle.

Thorax(♂): Median part of pronotum dull, remainder of thorax highly polished. Scutal stripes brown-black, lateral ones on scutum 1 antero-laterally curved and passing into a large, shining brown spot. Transverse suture yellowish, antero-lateral corners of scutum 2 narrowly opaque dark brown. Scutellum evenly dark brown, mediotergite yellow with a dark brown, caudally tapering median stripe and a broad, light brown posterior marking. Pleura yellow with light brown and dark yellow markings. Legs yellow, femora and tibiae with broadly dark brown tips, tarsi dark brown, claws untoothed. Wings with a yellow-brown tinge, veins mainly brown; pterostigma dark brown with 12-15 macrotrichia; distinct brown shades at bases of cells r3, r4 + 5, along wingtip and along veins CuA1 and CuA2 (fig. 182); cell m1 long-petiolate. Halteres yellow.

Abdomen(♂): Dark brown dorsal stripe nearly continuous, about as broad as stripes on scutum 2, on tergite 7 passing into the black-brown darkening of the (sub)terminal segments. Sides of tergites 2-6 marked with elongated dark brown spots. Sternites ventrally marked with small oval spots on anterior parts. Segment 7 largely and segments 8 and 9 nearly completely black-brown.

Hypopygium: External and internal structures figs. 183-189. Median incision of hind margin of sternite 8 closed by a short-hairy membrane. Medisternal appendage on ventral surface of sternite 9 bifid. Median part of adminiculum with two sheet-like extensions basally and two rows of short stiff setae on anterior side.

Female: not known.

Biology and distribution (map 6)

N. gaganboi is known only from the ♂ holotype, captured on June 30 in the central part of Honshu, Japan.

Etymology

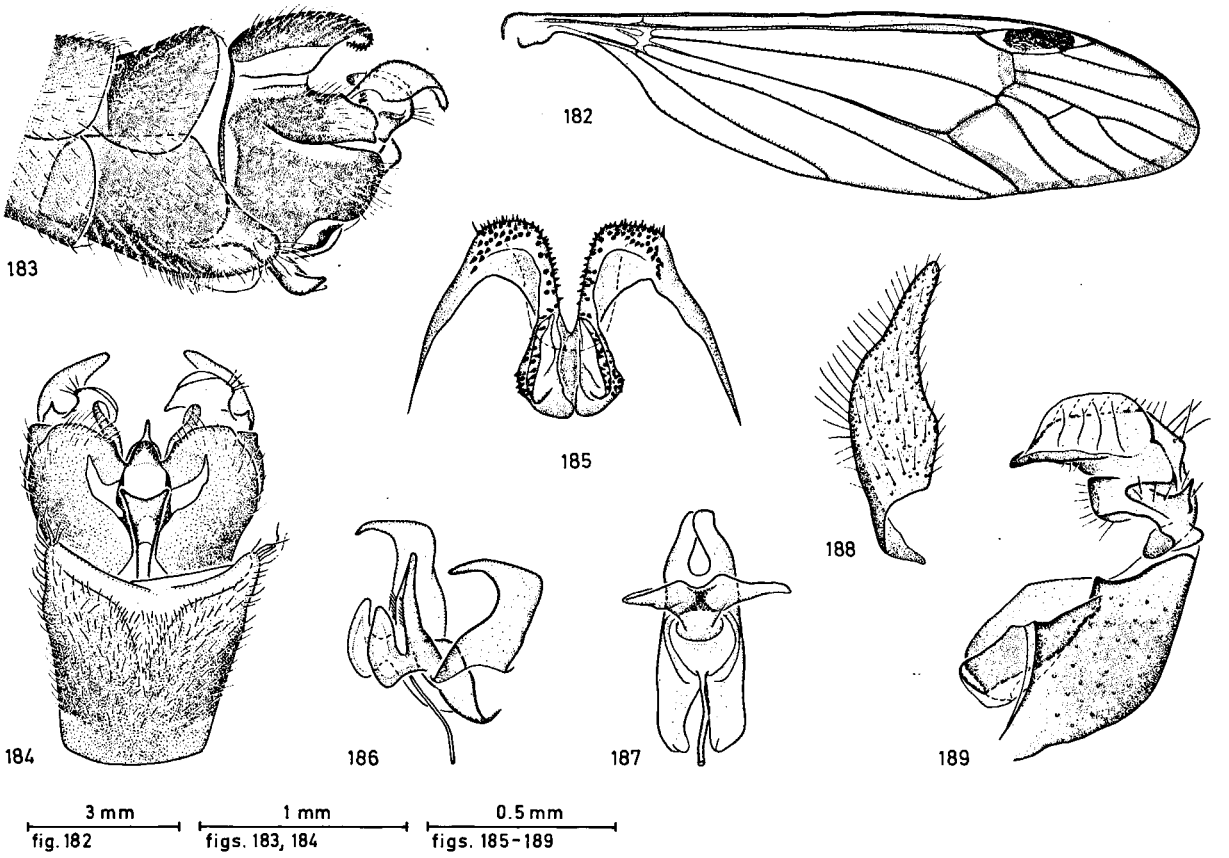
This new endemic species for Japan is named after the Japanese word for crane fly, 'gaganbo'.

Nephrotoma microcera Alexander, 1921
Figs. 171, 190-200, map 7

Alexander, 1921: 133-34, descr, comp; Masaki, 1933: 91, distr; Ishida, 1955: 122, locs, distr; Savchenko, 1973: 84, 85, syn (as *Pales*); Oosterbroek, 1979b: 181, 184, 186, notes.

Material examined

Type material: The original description of *Nephrotoma microcera* Alexander, 1921 is based on the ♂ holotype and 5♂, 3♀ paratypes. Examined are the holotype, labelled: "Komaba, Japan June 6, '20 H. Machida" "HOLOTYPE Nephrotoma microcera C. P. Alexander", to which the original description adds "Tokio", condition rather good; the topotypic allotype and one ♀ paratype with



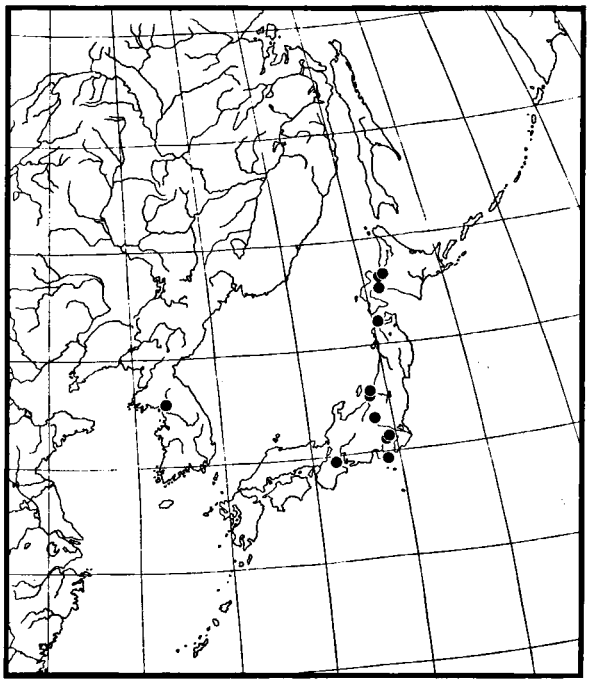
Figs. 182-189. *N. gaganboi*; ♂. 182. wing; 183. hypopygium, lateral view; 184. hypopygium, caudo-ventral view; 185. tergite nine, ventral view; 186. adminiculum, lateral view; 187. semen pump, dorsal view; 188. od, outside; 189. id, outside.

date "V-29-'20", both lacking the terminal parts, and a ♂ paratype from "Maruyama, Sapporo, Japan VII-18-'16 S. Kuwayama", also without terminalia; all preserved in the C. P. Alexander-collection, USNM. One topotypic ♀ paratype with date "VI-6-'20" was seen in the ASL. The paratypes not found are 3♂, topotypic with the holotype and 1♂ from Sapporo, VIII-25-1916.

Other material: 15♂, 9♀ (USNMA, ZMA), from Japan, Hokkaido: Maruyama, Sapporo (1♂) and Kotoni, Sapporo (2♂, 1♀), both in Ishikari pref.; near Lake Toya in Iburi pref. (2♀); and Honshu: Tappi zaki on Tsugaru Hanto (1♂); Kurokawa, Echigo (5♂, 6♀) and Niigata, Echigo (1♂), both in Niigata pref.; Numata in Gumma pref. (1♂); Tokyo (2♂); Oshima, Izu Shoto (1♂); Funakoshi, probably Mie pref. (1♂). Also 1♀ from South Korea, Central Nat. Forest, 27 km (18 mi) NE of Seoul (UKaL).

Diagnostic notes

Apart from the 11-segmented antennae in both sexes *microcera* is characterized by the absence of an occipital marking, the straight red- to dark brown thoracic stripes, the velvety black antero-lateral corners of scutum 2 and the conspicuous dark brown marking on the anterior part of the mediotergite (fig. 171). In this it resembles no other *Nephrotoma* species in Japan, being closer in general appearance to some eastern palaearctic species such as *scurra* and *profunda*, which can be distinguished by their 13-segmented antennae.



Map 7. Distribution of *N. microcera*, based on material examined.

Brief description (fig. 171)

Body length 11-15.5 mm (♂), 16-20 mm (♀), wing length 10-15.5 mm (♂), 12.5-16 mm (♀), body colour saturated yellow. Antennae of both sexes 11-segmented and very short, length 2.0-2.6 mm (♂), 2.0-2.7 mm (♀); first two or three segments yellow, following segments brownish, sometimes with slightly paler basal nodes; flagellar segments in both sexes more or less cylindrical. Rostrum with (dark)brown sides; palps dark brown, apically more pale; vertex largely shining, lateral parts usually light brown tinted, without distinct occipital marking. Thorax shining, stripes light red- to dark brown, lateral ones on scutum 1 straight; antero-lateral corners of scutum 2 velvety black; scutellum light brown with a dark brown median line; mediotergite yellow with a dark brown stripe anteriorly and a broad yellow-brown spot posteriorly; pleura with dark yellow to red-yellow markings. Tarsal claws untoothed. Wings with a light yellow-brown tinge, wingtips narrowly dark brown shaded, pterostigma pale yellow. Dark brown dorsal stripe on abdomen narrowly interrupted at posterior margins of tergites; lateral stripe on tergites more or less continuous; dark brown ventral stripe nearly continuous; sternite 8 with a dark brown basal part, terminal segments predominantly yellowish. Hypopygium and internal structures figs. 190-197; sternite 8 shallowly incised caudally, sternite 9 with a plain membraneous area caudo-ventrally. Ovipositor and internal structures figs. 198-200.

Biology and distribution (map 7)

Nothing is known about the habitat of *microcera*; the ♀ from Korea is recorded from 120-150 m altitude. The flight-period ranges from mid-May till the end of September. The species is known from the Japanese Islands Hokkaido and Honshu and from central Korea.

Discussion

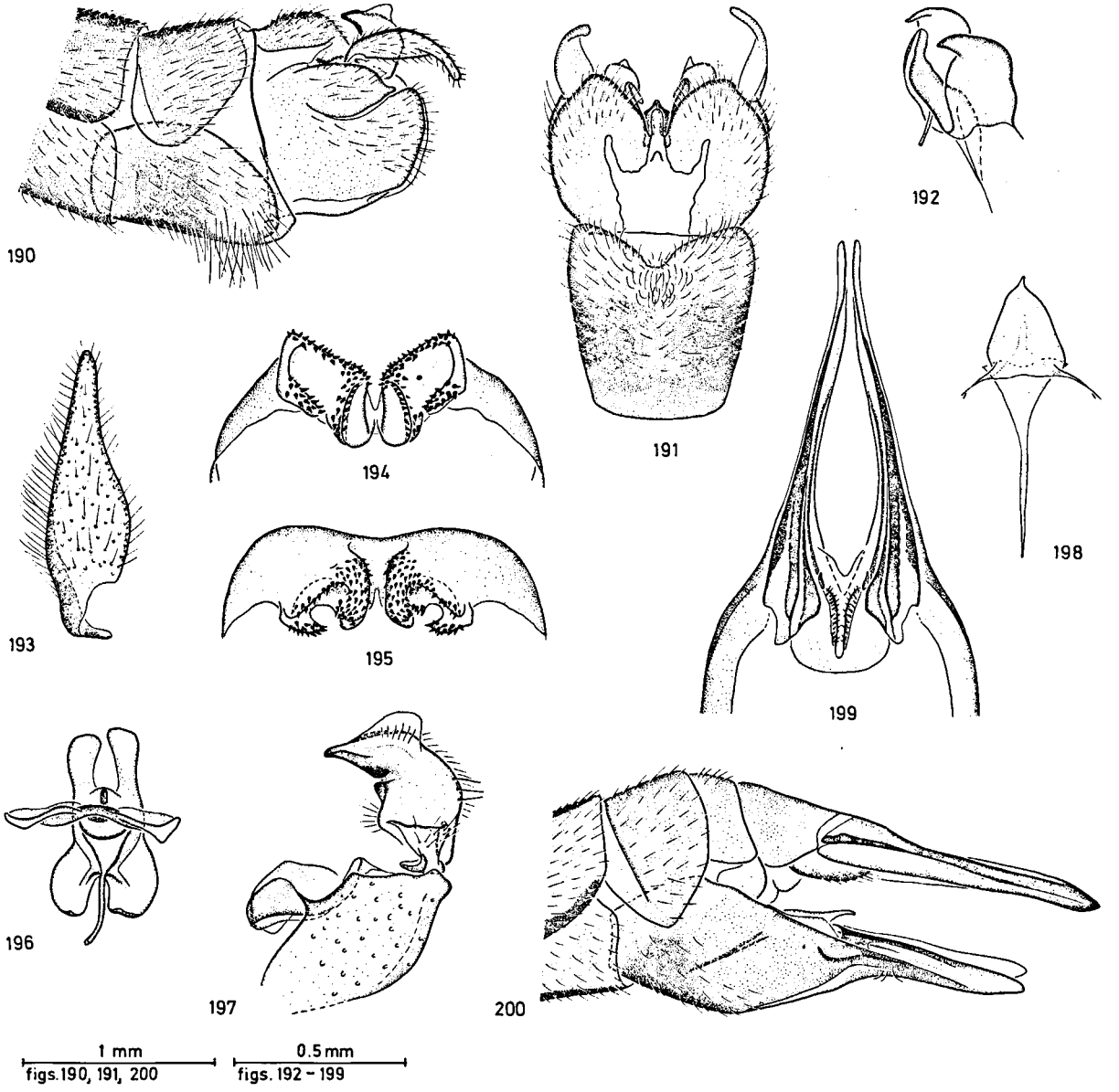
Oosterbroek (1979b) briefly discussed the synonymy of *microcera* with *scurra* suggested by Savchenko (1973) and expressed his doubt about the correctness of the synoymy. In the Academy of Sciences, Leningrad, there is one ♀ paratype of *microcera*, presumably seen by Savchenko and the basis for his confusion, because *scurra* and *microcera* do have many resemblances in general appearance. However, the ovipository and hypopygial differences are evident.

Nephrotoma minuticornis Alexander, 1921
Figs. 201-210, map 8

Alexander, 1921: 134, comp, descr; Alexander, 1924: 599, locs; Kuwayama, 1926: 73, biol; Esaki, 1932: 180, fig. habitus; Masaki, 1933: 91, distr; Alexander, 1935: 229, comp; Shiraki, 1952: 109, biol; Alexaner, 1953: 268, descr, biol, figs.hypop; Ishida, 1955: 122, distr; Alexander, 1966: 120, distr, loc; Savchenko & Krivolutzkaya, 1966: 46, note, 56, locs, biol (as *Pales*); Savchenko, 1970: 121, distr (as *Pales*); Savchenko, 1973: 87-88, descr, figs.hypop, distr, locs, biol (as *Pales*); Oosterbroek, 1980: 368, distr.

Material examined

Type material: The description of *Nephrotoma minuticornis* Alexander, 1921 was based on the

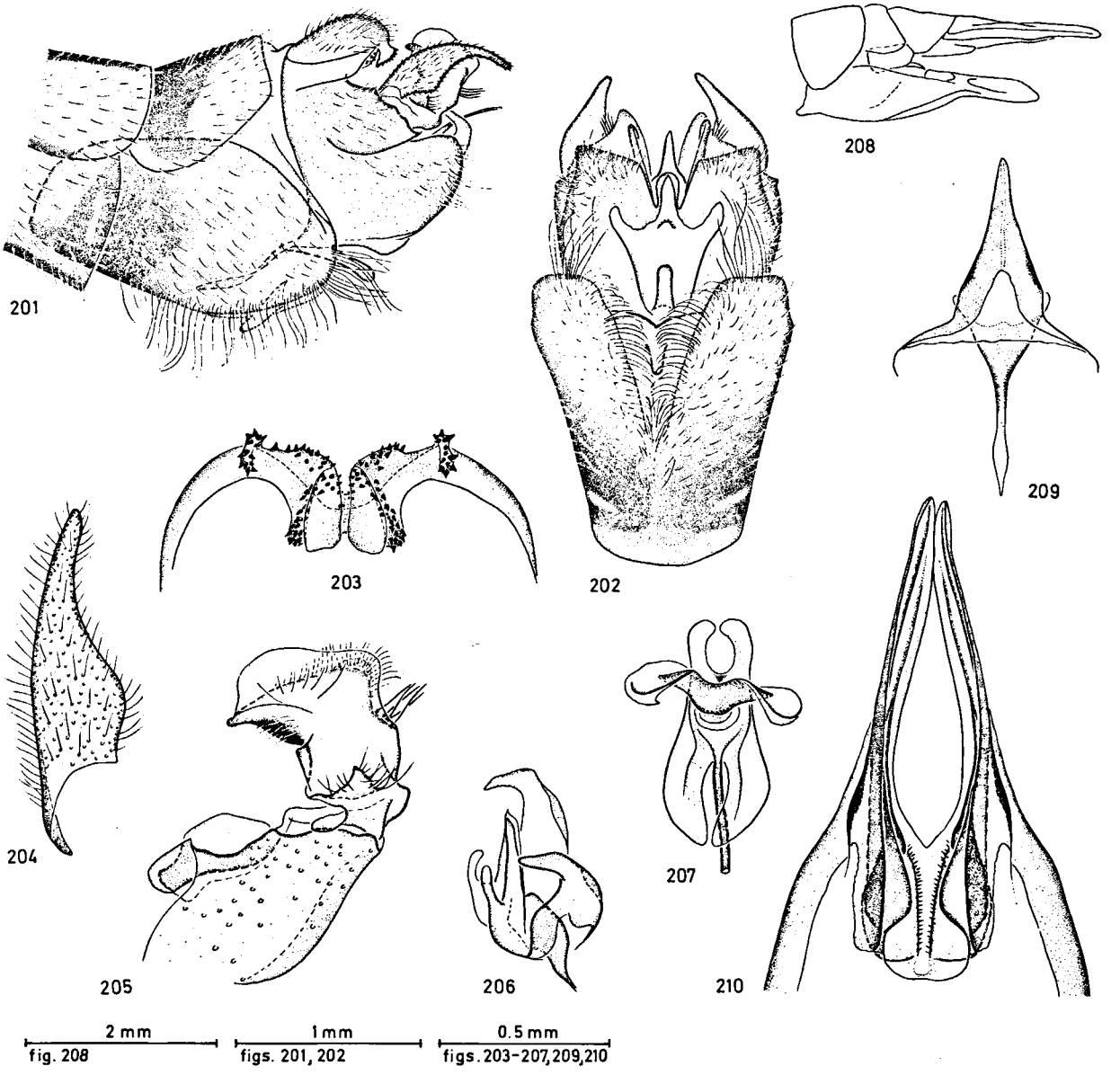


Figs. 190-200. *N. microcera*; 190-197, ♂; 198-200, ♀. 190. hypopygium, lateral view; 191. hypopygium, caudo-ventral view; 192. adminiculum, lateral view; 193. od, outside; 194. tergite nine, ventral view; 195. tergite nine, caudal view; 196. semen pump, dorsal view; 197. id, outside; 198. fused valvulae and furca, dorsal view; 199. hypovalvae, dorsal view; 200. ovipositor, lateral view.

♂ holotype only, labelled: "Sapporo, Japan 1919 S. Kuwayama" "HOLOTYPE Nephrotoma minuticornis C. P. Alexander", condition good but terminal segments are lacking beyond fifth abdominal segment, one wing on slide no. 1828, preserved in the C. P. Alexander-collection, USNM.

Other material: 64♂, 48♀, 1 intersex (ASL, BMNH, KU, MCZ, USNMA, ZMA), from the following islands: Sakhalin: Toyohara (= Yuzhno-Sakhalinsk, 1♀); Kunashir: Golovnino (1♂, 5♀), Sernovodsk (1♀), Pagunnoje (1♀), Yuzhno-Kuril'sk (1♂); Hokkaido: Sapporo (9♂, 11♀), Kamuikotan (2♂, 1♀),

Kotoni (13♂, 15♀), Jozankei (3♂, 1♀), Maruyama (1♀), all in Ishikari pref., Horonai (1♂) and Otoineppu (3♂) in Soya pref., Horokanai in Rumoi pref. (6♂, 1♀), Lake Toya in Iburi pref. (4♂, 4♀, 1 intersex), Abashiri in Abashiri pref. (3♂, 1♀); Honshu: Haghimantai in Iwake pref. (1♀), Kurokawa, Echigo in Niigata pref. (1♀), Nikko in Tochigi pref. (1♀), Shirakawa ko (1♂), Nagano (1♂, 1♀), Mt. Norikura (1♀), all in Nagano pref., Gifu in Gifu pref. (7♂), Kanayama in Yamanashi pref. (3♂), Tokyo (1♂), Koiwai I. in Suo nada (2♂); Shikoku: Matsuyama in Ehime pref. (2♂); Kyushu: Aso Nat. Pk. in Kumamoto pref. (1♂).



Figs. 201-210. *N. minuticornis*; 201-207, ♂; 208-210, ♀. 201 hypopygium, lateral view; 202. hypopygium, caudo-ventral view; 203. tergite nine, ventral view; 204. od, outside; 205. id, outside; 206. adminiculum, lateral view; 207. semen pump, dorsal view; 208. ovipositor, lateral view; 209. fused valvulae and furca, dorsal view; 210. hypovalvae, dorsal view.

Diagnostic notes

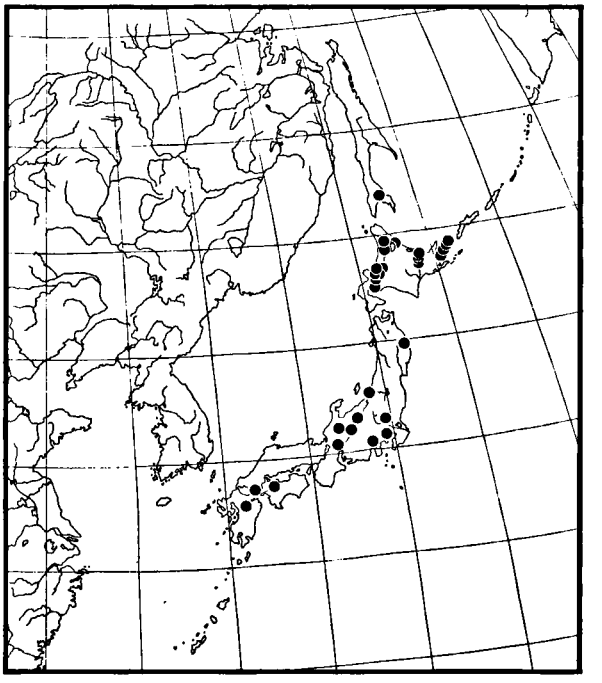
N. minuticornis is characterized by the lack of consipicuous dark markings on the head and thorax except the straight, dark brown to black scutal stripes, by the yellow capillary line on median scutal stripe, the narrow stripes on abdomen and the bundles of curved yellow hairs on sternite 8 of males. In external features *minuticornis* most resembles *cirrata*, a Japanese species which has the pterostigma dark brown and the tip of wing brown shaded (contrary to the pale pterostigma and unshaded wing tip in *minuticornis*) and *barbigera* and *laticrista*, both species from the eastern palaearctic and differing from *minuticornis* in the dark brown pterostigma and the black and distinctly incised antennal flagellar segments of the males.

Brief description

Body length 13.5-16 mm (♂), 17-21.5 mm (♀), wing length 12-14 mm (♂), 13.5-16.5 mm (♀), body colour light yellow, abdomen slighty darker. Antennae of both sexes sometimes 12-, usually 13-segmented and short, length 2.6-3.0 mm (♂), 2.5-2.8 mm (♀); scape and pedicel yellow, flagellum brown to dark brown with sometimes one or two dirty-yellow basal segments; flagellar segments in both sexes more or less cylindrical. Rostrum shining yellow with sometimes light brown spots; palps yellow-brown; vertex largely shining, completely yellow or with a triangular, weakly to light brown tinted occipital marking. Thorax highly polished, stripes dark brown to black, the median one frequently with a yellowish capillary line, the lateral ones on scutum 1 straight; transverse suture and antero-lateral corners of scutum 2 yellowish; scutellum dark yellow, mediotergite with a brown-yellow marking posteriorly and sometimes a dark yellow anterior stripe; pleura with dark yellow to red-yellow markings. Tarsal claws untoothed. Wings with a light yellow-brown tinge, pterostigma pale. Abdominal dorsal stripe brown, narrow and nearly continuous; tergites laterally marked with dark brown dashes; ventral markings elongated and narrow, sometimes partly vanished or indistinct; tergite and sternite 8 usually with dark brown basal parts in both sexes, remainder of (sub)terminal segments predominantly yellowish. Hypopygium and internal structures figs. 201-207; membrane at the incision of the hind margin of sternite 8 and membranous area on ventrocaudal surface of sternite 9 both with a finger-like extension; sternite 8 with conspicuous bundles of curved yellow hairs. Ovipositor and internal structures figs. 208-210.

Biology and distribution (map 8)

Both Kuwayama (1926) and Shiraki (1952) mention the damage to sugarbeets caused by the larvae of *minuticornis* in northern Japan (where it is known as the sugarbeet crane-fly, Ao-hoso-gagan bo), although Alexander (1953) stated that this is of minor economic importance. Savchenko & Krivolutzkaya (1966) mention wet alder-groves and dark pine-forests, mixed with deciduous trees as a habitat of *minuticornis* on the Kuril Islands. The species is



Map 8. Distribution of *N. minuticornis*, based on material examined (black dots) and literature (stippled dots).

on the wing from the end of May till the beginning of October, with a distinct peak from mid-July till the first week of September; it is recorded from altitudes up to 1500 m.

N. minuticornis is a species from the Far East although not known from the continent; it is distributed from southern Sakhalin and Kunashir (Kuril Is.) throughout Japan to Shikoku and Kyushu. Supplementary localities for Hokkaido are from Alexander (1924).

SECTION 7

Nephrotoma austriaca (Mannheims & Theowald, 1959)
Figs. 211-221

Mannheims & Theowald, 1959: 17, loc, 24, key (as *Pales*); the species is treated in detail by Oosterbroek, 1979b: 173, 182, figs. hypop, 186-89, refs, type mat, descr, biol, distr; Oosterbroek, 1979c: 191, key; Oosterbroek, 1980: 337-39, phylogeny, fig. tergite 9, 340, fig. adm, 345, 350, notes, 364, map, 369, distr.

The discussion of the species will be brief and supplementary to the information in Oosterbroek (1979b).

Material examined

Type material: *Pales austriaca* Mannheims & Theowald, 1959 was described from the ♂ holotype and 5♂, 2♀ paratypes (Mannheims & Pechlaner, 1963). The ♂ holotype is from Austria: Schladming, Steiermark prov., 27-VII-1953, preserved in the MAK. The paratypes are from Austria: 1♀ topotypic with the holotype, 10-IX-1955 (MAK), 2♂ from Volderwald near Innsbruck, North Tirol, 28-V-1955 (1♂ MAK, 1♂ ASL), 1♂ from St. Johann in Pongau, Salzburg prov., 31-VII-1955 (Landesmuseum 'Joanneum', Graz); West Germany: 1♀ from Dachau near München, 10-VI-1960 (Zool. Staatsslg. München); Italy: 2♂ from Alagna, southeast of Monte Rosa, 30-VII-1959 (MAK). One ♂ paratype from Austria (Volderwald, ASL) was examined during this study.

Other material; 8 ♂, 5 ♀ (ZMA), from Italy: Udine, Tarvisio, 750 m, 10-VIII (1♀), 12-VIII (1♀), 14-VIII-1958 (1♂); Czechoslovakia: Tatry Mts., Kotlina ú Belè, 27-VII (3♂, 1♀), 29-VII (3♂), 31-VII-1974 (1♂) and Switzerland: Valais, Pfynwald near Siders-Sierre, 550 m, 27-VIII-1953 (1♀).

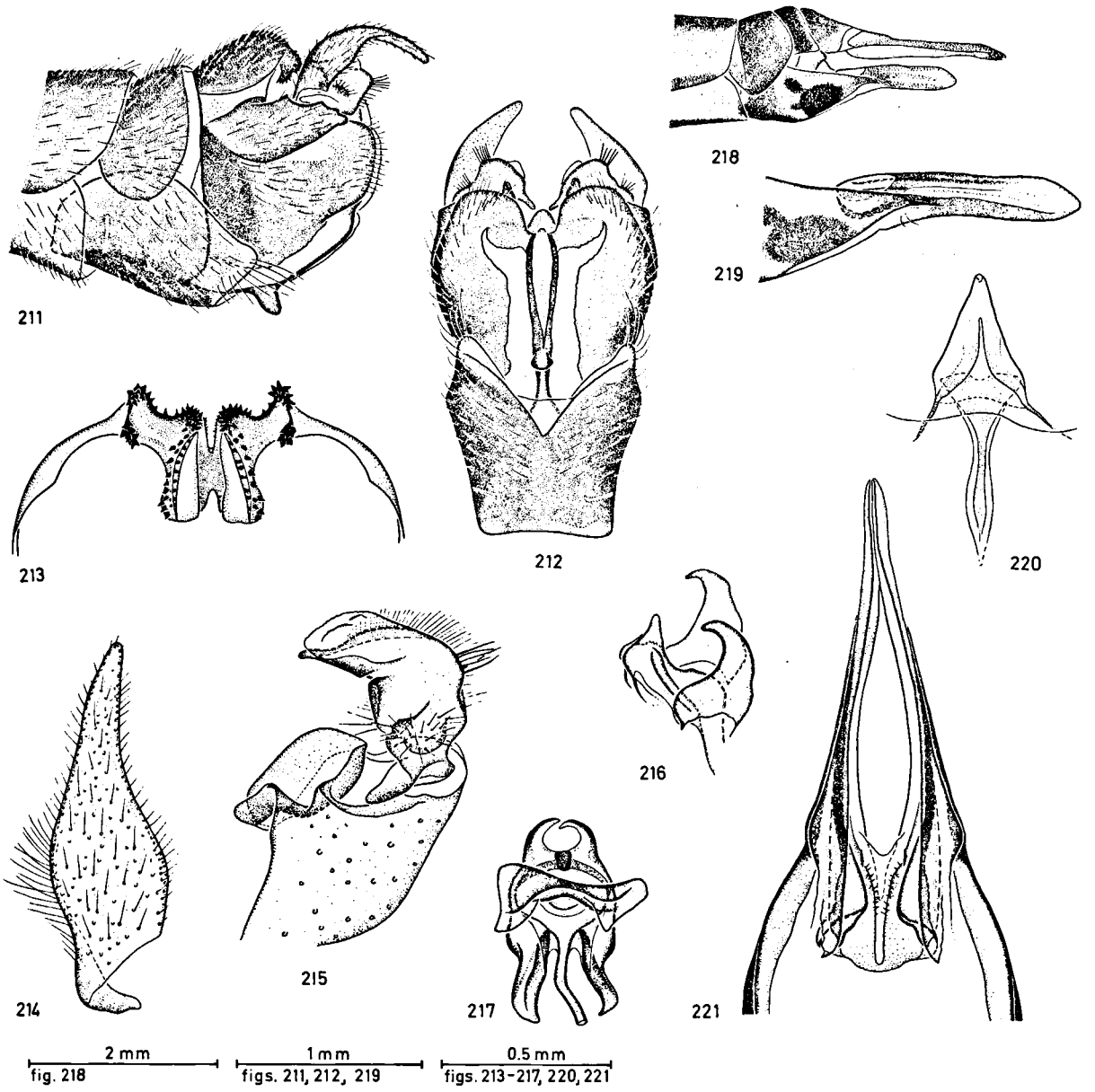
Diagnostic notes

Characteristics of *austriaca* are the 14-segmented antennae in both sexes, the large and broad occipital marking, the straight black thoracic stripes, the black dash on paratergite and the broad dorsal stripe on abdomen with the largely dark brown dorsal surface of tergite 1. It may be confused with *dorsalis* (having 19-segmented antennae in ♂, 15-segmented ones in ♀ and a yellow dorsal side of the rostrum), *helvetica* (having 13-segmented antennae and large dark brown spots laterally of the occipital marking), *lunulicornis* and *quadristriata* (both having 13-segmented antennae, usually (dark) brown spots along dorsal eye-margin and a less broad abdominal dorsal stripe). Hypopygium, ovipositor and internal structures figs. 211-221.

Biology and distribution

N. austriaca was collected in Tirol (Austria) on a boggy slope, overgrown with shrubs, *Phragmites* and much *Equisetum*, in small numbers (Mannheims & Pechlaner, 1963). Savchenko (1966a) mentioned the species from an *Alnus viridis* vegetation in the Ukrainian Carpathians. The species is on the wing from the end of May till the first part of September (28-V to 10-IX), but is most frequent from the last week of July till the end of August (27-VII to 27-VIII). The altitudes on which *austriaca* occurs range from 550 to 1500 m (Oosterbroek, 1979b; Savchenko, 1966a).

The distribution of *austriaca* is limited to the Alps, the Tatry Mountains and the Carpathians. Two additional localities to those mentioned under material examined are: Pozhizhev in the Ukrainian Carpathians, 24-VI-1964 (1♂) and 3-VIII-1961 (1♀) (Savchenko, 1966a,d) and Solalex near Gryon in



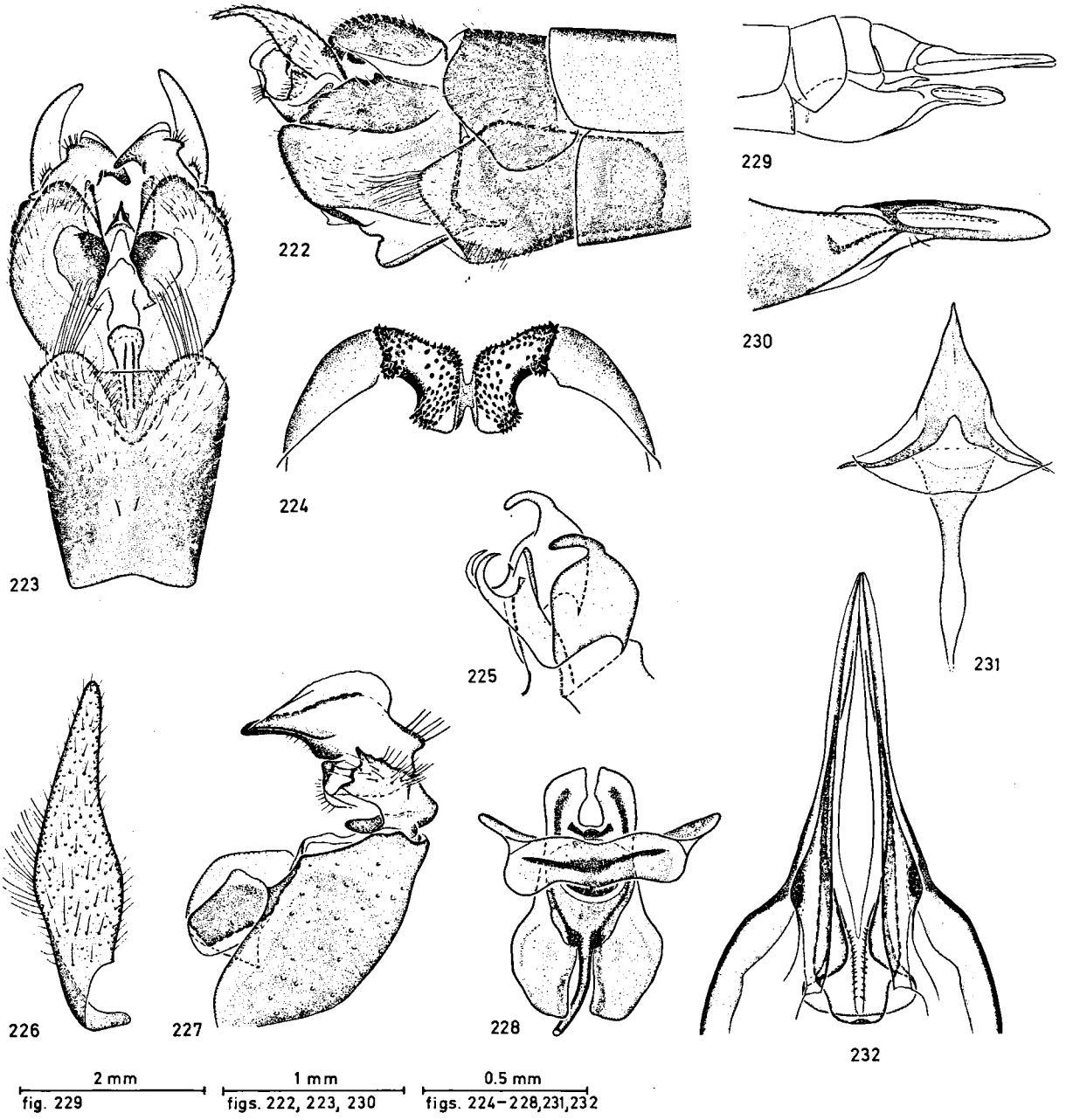
Figs. 211-221. *N. austriaca*; 211-217, ♂; 218-221, ♀. 211. hypopygium, lateral view; 212. hypopygium, caudo-ventral view; 213. tergite nine, ventral view; 214. od, outside; 215. id, outside; 216. adminiculum, lateral view; 217. semen pump, dorsal view; 218. ovipositor, lateral view; 219. left hypovalva, lateral view; 220. fused valvulae and furca, dorsal view; 221. hypovalvae, dorsal view.

Vaud, Switzerland, 18-VIII-1977, 1466 m (1♂) (Oosterbroek, 1979b).

Nephrotoma helvetica (Mannheims & Theowald, 1959)
Figs. 222-232

Mannheims & Theowald, 1959: 24, key (as *Pales*); the species is treated in detail by Oosterbroek, 1979b: 173, fig. hypop, 189-93, refs, type mat, descr, figs. ovipos & hypop, biol, distr; Oosterbroek, 1979c: 190, key; Oosterbroek, 1980: 337-39, phylogeny, fig. tergite 9, 340, fig. adm, 345, 350, notes, 364, 369, distr.

The discussion of the species will be brief and supplementary to the information in Oosterbroek (1979b).



Figs. 222-232. *N. helvetica*; 222-228, ♂; 229-232, ♀. 222. hypopygium, lateral view; 223. hypopygium, caudo-ventral view; 224. tergite nine, ventral view; 225. adminiculum, lateral view; 226. od, outside; 227. id, outside; 228. semen pump, dorsal view; 229. ovipositor, lateral view; 230. left hypovalva, lateral view; 231. fused valvulae and furca, dorsal view; 232. hypovalvae, dorsal view.

Material examined

Type material: The type-series of *Pales helvetica* Mannheims & Theowald, 1959 consists of 5♂ and 1♀ (Mannheims & Pechlaner, 1963), all examined during this study. The ♂ holotype is labelled: "Pfynwald, Wallis, Siders-Sierre 550 m, 27.8.53 W. Grosz leg." "Pales helvetica n.sp. Mannheims det. 1955" "Holotypus", condition good, preserved in the MAK; 3♂

paratypes are labelled as the holotype (2♂ MAK, 1♂ ASL), 1♂ paratype is from Mörel, Wallis (Valais), 750 m, 6-VIII-1953 (MAK) and 1♀ paratype is from the Saltine gully, Brig-Simplon, 1000 m, 13-VII-1953 (MAK). All localities are from Switzerland.

Diagnostic notes

N. helvetica easily can be recognized by the large (dark) brown spots on vertex which occupy the region between the occipital margin and eye-margin, and also by the straight dark brown to black thoracic stripes, the macrotrichia in the apical cells of the wing and the largely dark brown dorsal surface of tergite 1. It may be confused with *austriaca* and *dorsalis* (both having antennae with 14 or more segments and a vertex with yellow lateral parts), *lunulicornis* and *quadristriata* (having the spots on the lateral vertex not connected with the occipital marking and the palps dark brown). Hypopygium, ovipositor and internal structures of *helvetica* figs. 222-232.

Biology and distribution

N. helvetica is recorded from June 28 till August 27 (Oosterbroek, 1979b), at altitudes from 550 to 1000 m. The species is known only from three localities in Valais and from one locality in Ticino (Dufour, *in literis*, 1984), Switzerland.

SECTION 8

Nephrotoma quadristriata (Schummel, 1833)
Figs. 233-242, map 9

Schummel, 1833: 109-111, descr, pl. 3, fig. hypop (as *Tipula*); Riedel, 1910: 424-25, descr, fig. ant (as *Pachyrhina schummelii*); Alexander, 1925: 405-06, descr (as *N. duchazaudi*); the species is treated in detail by Oosterbroek, 1979b: 164, 166-73, refs, type mat, syn, descr, figs. ant & hypop, biol, distr, note, 179, fig. ovipos; Oosterbroek, 1979c: 192, key; Oosterbroek, 1980: 337-39, phylogeny, fig. tergite 9, 340, fig. adm, 345, 350, notes, 364, 369, distr; Theowald & Oosterbroek, 1981: 38, loc, distr, 41, distr; Simova & Vuković, 1981: 115, locs; Theowald & Oosterbroek, 1983: 376, distr, 387, note.

The discussion of the species will be brief and supplementary to the information in Oosterbroek (1979b).

Type material and synonymy

Schummel (1933) based his description of *Tipula quadristriata* on 6 ♂ and 2 ♀, all from the vicinity of Breslau, Schlesien, at present Wroclaw in Poland. The types are apparently lost (Oosterbroek, 1979b), but the original description with figures is clear enough to establish a correct diagnosis.

Pachyrhina schummelii Riedel, 1910 was described from 2♂ from "Süd-Steiermark" (Austria) and 1 ♂ from "Franzenshöhe unterhalb des Ortlermassivs" (Stelvio, Ortles Mountains, North Italy). This last specimen was designated as lectotype by Mannheims (1951b), preserved in the ZMHU. One paralectotype is preserved in the UZMH. No type material was examined during this study. The synonymy of *schummelii* with *quadristriata* was established by Mannheims (1951a) and confirmed by Oosterbroek (1979b).

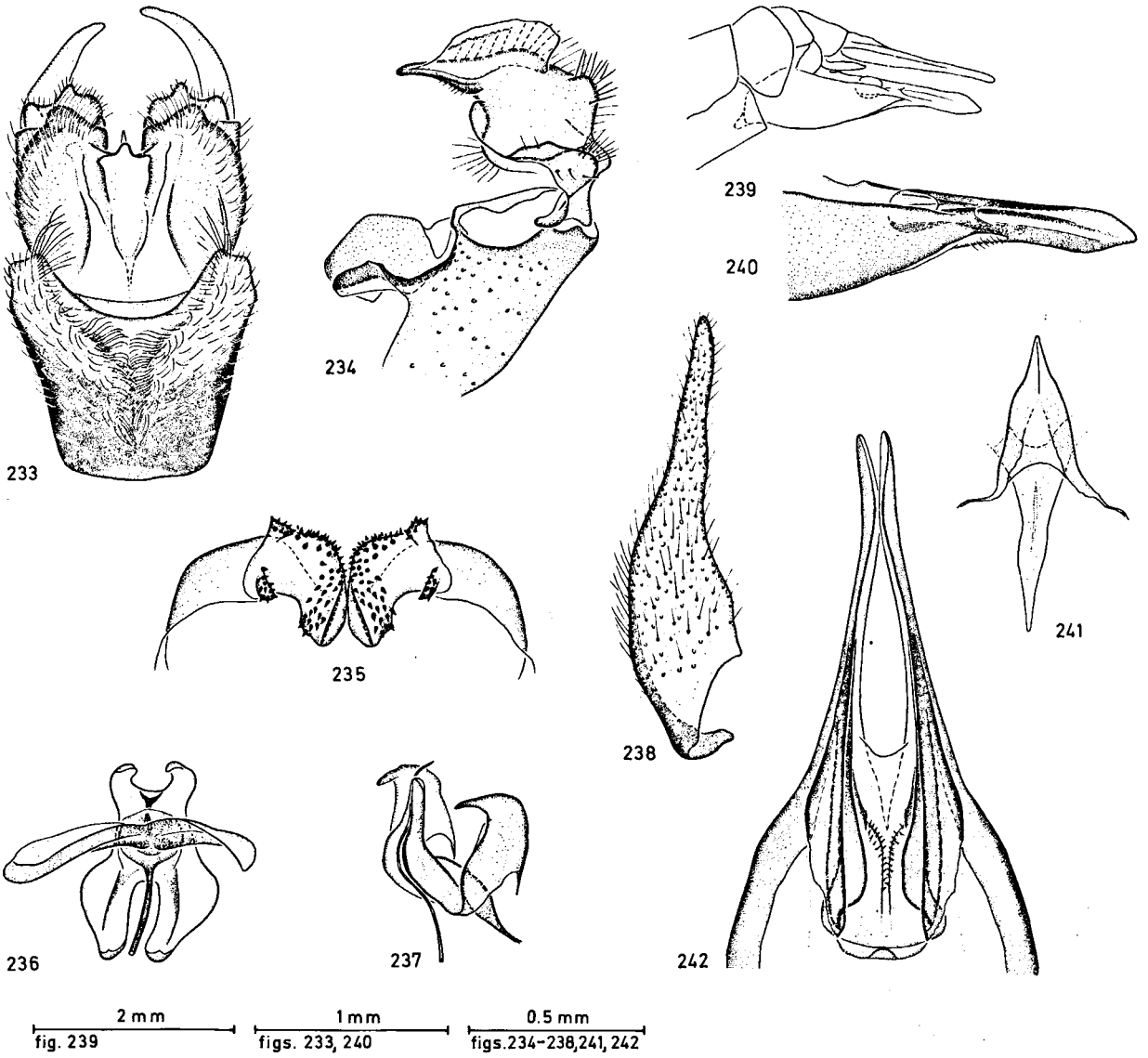
Nephrotoma duchazaudi Alexander, 1925 was described from one ♂ from "Bords du Tarim, July 1909 (Dr. du Chazaud); Mission de Lacoste" (presumably referring to the Tarim or Talimu river in Sinkiang, China). The pinned specimen is preserved in the MNHNP, and one slide with wing and antenna, no. 2503, in the C. P. Alexander-collection, USNM. Only the slide was examined by me. The synonymy of *duchazaudi* with *quadristriata* was supposed by Savchenko (1973) and confirmed by Oosterbroek (1979b).

Other material

Supplementary to the material examined by Oosterbroek (1979b) from many western palaearctic countries and to the localities mentioned in the literature as indicated by Oosterbroek (1979b) the following 14 ♂, 55 ♀ (MNM, ZMA) have been examined: from the Netherlands (5♂, 36♀), Switzerland (1♂, 3♀), Italy (5♂, 13♀), Austria (1♀), Czechoslovakia (Moravia, 1♂, 1♀) and Mongolia: Uvs aimak (1♂, 1♀), Bayan-Ölgiy aimak (1♂).

Diagnostic notes

N. quadristriata is characterized by the dark brown to black antennal flagellum with the relatively long first segment, the usually distinct but sometimes small triangular occipital marking, the two (dark) brown elongate spots along dorsal eye-margins, the straight brown-black thoracic stripes, the extensively brown-black antero-lateral corners of scutum 2 and the rather narrow subterminal darkening. Besides, the ♂♂ are easily recognized by the hypopygial characters (sternite 8 with pointedly extended caudo-lateral corners and a deep and wide incision with a dense tuft of long golden hairs). *N. quadristriata*, especially the females, can be confused with *helvetica* (with an occipital marking as broad as vertex), *austriaca* and *dorsalis* (both having antennae with 14 or more segments in both sexes), *scurra* (without dark



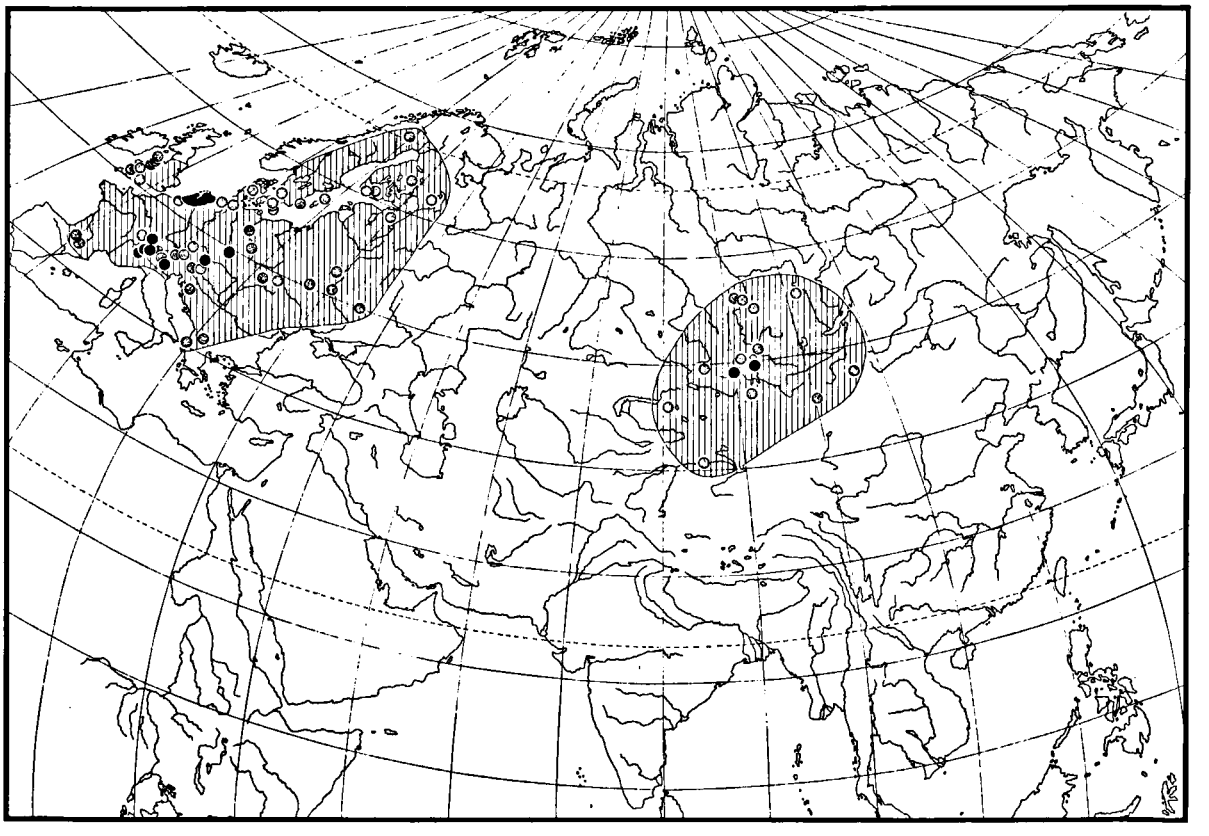
Figs. 233-242. *N. quadristriata*; 233-238, ♂; 239-242, ♀. 233. hypopygium, caudo-ventral view; 234. id, outside; 235. tergite nine, ventral view; 236. semen pump, dorsal view; 237. adminiculum, lateral view; 238. od, outside; 239. ovipositor, lateral view; 240. left hypovalva, lateral view; 241. fused valvulae and furca, dorsal view; 242. hypovalvae, dorsal view.

spots along dorsal eye-margins and with a narrow abdominal dorsal stripe) and *lunulicornis* (with an occipital marking reaching to top of tubercle, a dark brown pterostigma and more distinct shades on the wings and a strong (sub)terminal darkening of the abdomen). Hypopygium, ovipositor and internal structures of *quadristriata* figs. 233-242.

Biology and distribution (map 9)

N. quadristriata can be found in scrub vegetation near marshes or streams at clearings in deciduous forests or in sand dune areas (Oosterbroek, 1979b); in the Tuva region the species was found in deciduous and mixed forests along the outer marches of rivers (Savchenko & Violovich, 1967). The species is known from coastal localities as well as inland and mountainous ones; it is recorded from altitudes up to 1600 m (Austria). The flight-period ranges from the beginning of May till mid-September. In central Asia *quadristriata* has been recorded from June 1 till August 25. The sex-ratio of the museum-specimens under study here is remarkable, with the dominance of females in collections, especially those originating from western Europe (see also Oosterbroek, 1979b).

Apart from the distinct east-west disjunction in the Palaearctic as shown by *quadristriata* and also found in for example *dorsalis* and *lunulicornis*, the distribution of this species especially in the western part of the range seems to be rather fragmented. This western part of the range of *quadristriata* comprises the largest part of Europe, from northern Sweden (Norrboten, Tjeder, 1955b) in the north, Wales and SW England (Oosterbroek, 1979b) in the west, the Pyrenees and S. Albania (both from Oosterbroek, 1979b) in the south and the Ukraine (Savchenko, 1973) in the east. Within this area the species is known from northern Europe: S. Sweden, (Tjeder, 1955b), Finland (Mannheims, 1954, 1965), Denmark (Nielsen, 1919,



Map 9. Distribution of *N. quadristriata*, based on material examined (black marks) and literature (stippled dots).

1933, 1941); western continental Europe: the Netherlands, Belgium (Theowald, 1971), W. Germany (Fischer, 1952; Oosterbroek, 1979b); the alpine region: France, Switzerland, Italy and Austria (Oosterbroek, 1979b, in literis, 1984; material examined) and eastern Europe: E. Germany (Oosterbroek, in literis, 1984), Poland and Czechoslovakia (material examined), Yugoslavia (Simova & Vuković, 1981), european part of the Sovjet Union (Savchenko, 1966d, 1973). In central Asia *quadristriata* is known from western Mongolia, Sinkiang (China), the Altay mountain range, the Tuva region, Krasnoyarsk and Irkutskaya obl. (Savchenko & Violovich, 1967; Savchenko, 1973; Mannheims & Savchenko, 1973; Oosterbroek, 1979b; material examined).

Nephrotoma scurra (Meigen, 1818)
Figs. 243-254, map 10

Meigen, 1818: 198, descr (as *Tipula*); Brullé, 1832: 290-91, descr (as *Tipula nodulosa*); Alexander, 1918: 74-5, descr (as *Nephrotoma stejnegeri*); Savchenko, 1972: 740, distr, loc (as *N.? stejnegeri* = *occipitalis*); Savchenko 1973: 99-100, descr, distr, locs, biol (as *Pales ? stejnegeri* = *occipitalis*); the species is treated in detail by Oosterbroek, 1979b: 173, fig. hypop, 180-86, refs, type mat, syn, descr, figs. hypop, biol, distr, disc; Oosterbroek, 1979c: 191, key; Noll & Caspers, 1979: 48, loc; Oosterbroek, 1980: 337-39, phylogeny, fig. tergite 9, 340, fig. adm, 345, 350, notes, 365, 369, distr; Simova & Vuković, 1981: 116, locs; Wormell, 1982: 383, loc; Theowald & Oosterbroek, 1983: 376, distr, 381, 386, 387, notes.

The discussion of the species will be brief and supplementary to the information in Oosterbroek (1979b).

Type material and synonymy

Tipula scurra Meigen, 1818 was described from one male, locality unknown, preserved in the Meigen-collection, MNHNP. The holotype is not studied by me, but the interpretation of *scurra* is based on the original description and material identified by Oosterbroek.

Tipula nodulosa Brullé, 1832 was described from, presumably, one male from "les environs de Messène" (Greece, Peloponnesos), in April. The type was supposed to be in the MNHNP, but could not be traced there by Oosterbroek (1979b). The synonymy of *nodulosa* with *scurra* was proposed by Mannheims (1951). This synonymy is doubtful because the type-locality of *nodulosa* lies distinctly outside the present-known distribution range of *scurra*.

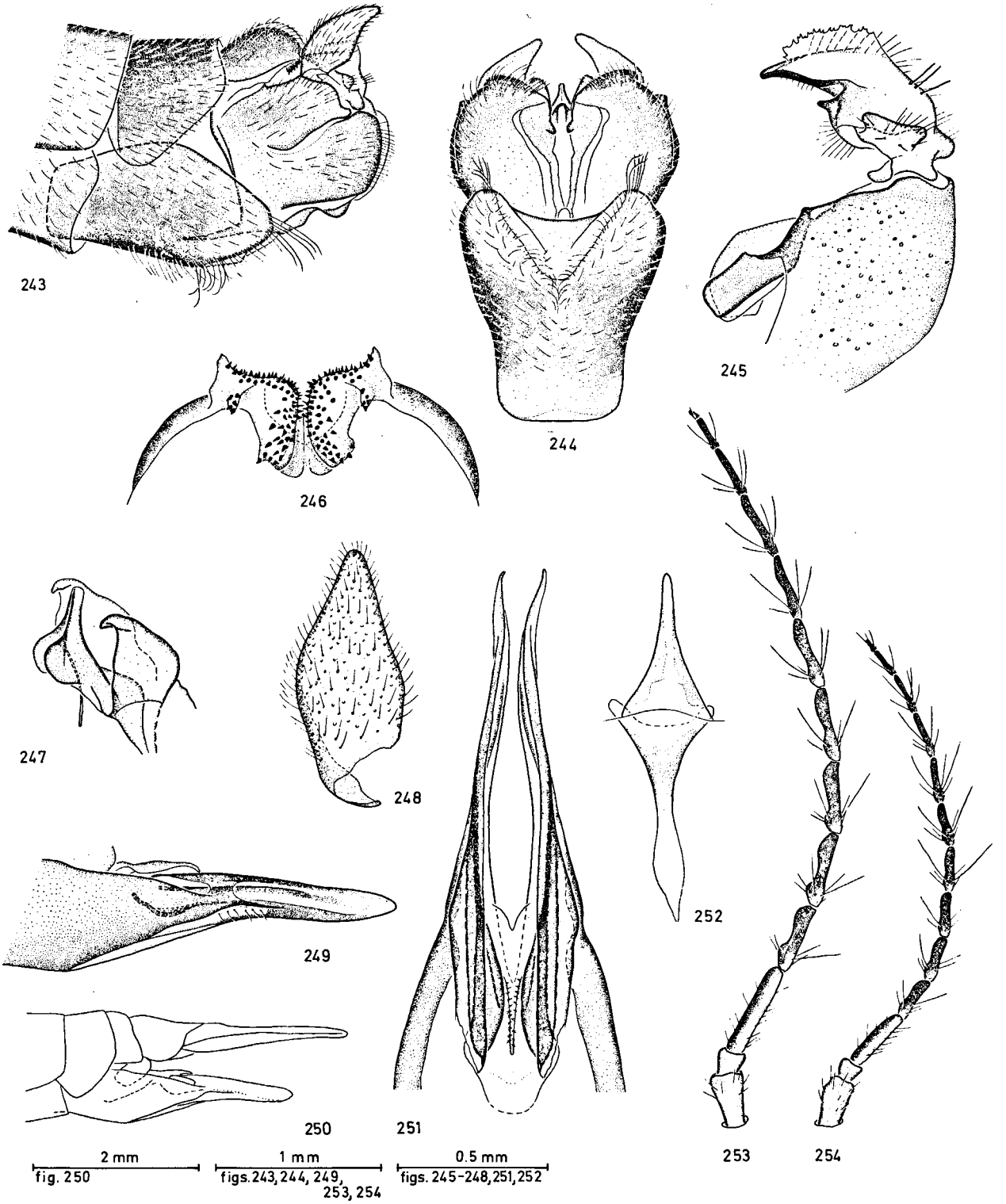
The description of *Nephrotoma stejnegeri* Alexander, 1918 was based on one male only, labelled: "L. Stejneger Kamt. No. 1255" "HOLOTYPE Nephrotoma stejnegeri C. P. Alexander", condition bad, both antennae and all legs broken off and lost, one wing on a slide, dissected genitalia probably lost, preserved in the USNM. The type-locality is Kamchatka, without further specification. Because of the bad condition of the holotype the new synonymy of *stejnegeri* with *scurra* is tentatively, pending the recovering of the dissected genital structures of the type.

Other material

Supplementary to the material examined by Oosterbroek (1979b) from many western palaearctic countries and to the localities mentioned in the literature as indicated by Oosterbroek (1979b) the following material is examined: some hundreds of specimens from the Netherlands and 46 ♂, 42 ♀ (ASL, MNM, USNMA, ZMA) from elsewhere: Sweden (1♂, 2♀), England (2♂, 3♀), Belgium (5♂, 2♀), Luxembourg (1♀), Poland (6♂, 4♀), France (5♂, 4♀), Switzerland (5♂, 4♀), Italy, southern slopes of the Alps (11♂, 14♀), the USSR: Karelskaya ASSR (Olonets, 1♀), Komi ASSR (Ust'-Tsilma, 1♀), Ukraina (Poltavskaya obl., Mirgorod, 1♀), Altayskiy Kray (Teletskoye Lake, 1♀), Amurskaya obl. (Blagoveshchensk, 1♂) and Kamchatka (not further located, 1♀), Mongolia (Hövsgöl aimak, 1♀) and North Korea (10♂, 2♀).

Diagnostic notes

N. scurra can be recognized by the following characters: the usually short and sometimes hardly indicated occipital marking, the straight brownish thoracic stripes with the median one usually more dark coloured, the brown-black



Figs. 243-254. *N. scurra*; 243-248, 253-254, ♂; 249-252, ♀. 243. hypopygium, lateral view; 244. hypopygium, caudo-ventral view; 245. id, outside; 246. tergite nine, ventral view; 247. adminiculum, lateral view; 248. od, outside; 249. left hypovalva, lateral view; 250. ovipositor, lateral view; 251. hypovalvae, dorsal view; 252. fused valvulae and furca, dorsal view; 253. antenna, ♂ from the Netherlands; 254. antenna, ♂ from North Korea.

antero-lateral corners of scutum 2, the usually faint (sometimes brown) pterostigma and the lack of shades of the wings, the narrow abdominal dorsal stripe and the only weak subterminal darkening. Confusion apparently has occurred or is possible with *lunulicornis*, *difficilis* and *koreana* (all having a (dark)brown pterostigma, distinct brown shades on the wings and usually brown spots along dorsal eye-margins), *sublunulicornis* (with the sides of the rostrum yellow and the antero-lateral corners of scutum 2 not or weakly tinted), *quadristriata* (having dark spots along dorsal eye-margins and weak brown shades on the wings), *profunda* (with grey-brown spots along dorsal eye-margins and a broader abdominal dorsal stripe), *occipitalis* (with an elongated occipital marking, hardly tinted to red-brown antero-lateral corners of scutum 2 and a broader abdominal dorsal stripe) and *spicula* (having polymerous antennae). There is also a strong similarity between *scurra* and the Japanese species *microcera* (with 11-segmented antennae in both sexes and a strong shade along tip of wing). Antenna, hypopygium, ovipositor and internal structures of *scurra* figs. 243-254. The specimens of this widely distributed species show a distinct variation in some outward characters such as the length and shape of the antennae, the size and colour of the occipital marking and the tinting of the pterostigma. The specimens from North Korea differ from the others in having very short antennae with hardly incised flagellar segments in the ♂ and by the largely to completely obliterated occipital marking.

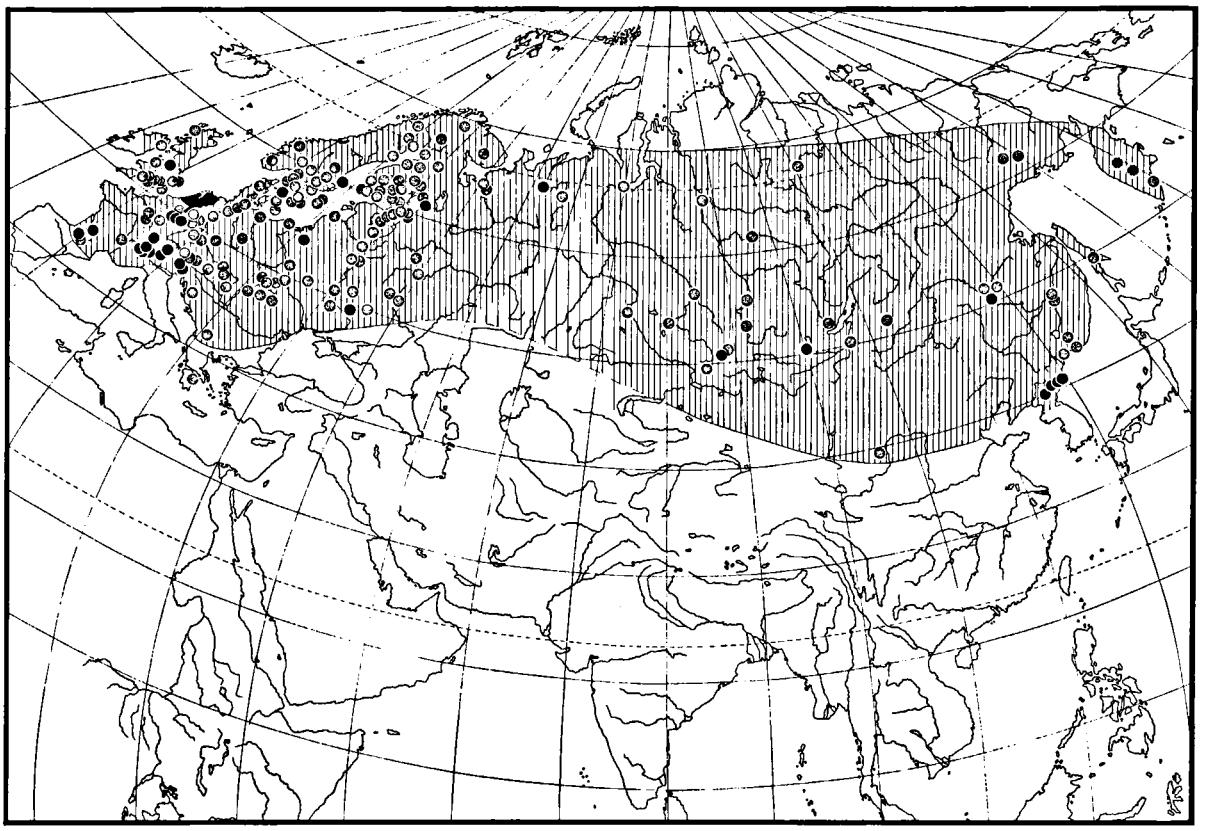
Biology and distribution (map 10)

N. scurra is one of the most abundant species of the genus, occurring in a wide range of habitats such as open sandy heaths, dry woods and hedgerows and humid brush-woods (Oosterbroek, 1979b). The species is recorded from altitudes up to about 1800 m and is on the wing from the end of May till the end of September, but is most abundant in July and August. Because of the long abdomen of the females Savchenko (1973) supposes the eggs to be laid rather deeply into the soil; the development of the eggs takes 7 to 9 days. Savchenko (1973) presumes hibernation of the first and second stage larvae and he reports damage of some crops, such as lupin, by the full-grown larvae. Oosterbroek (1979b) assumes that the males of *scurra* are active in the late afternoon much earlier than the females.

N. scurra is widely distributed throughout the Palaearctic region, extending from Ireland and Great Britain in the west to Kamchatka, Sakhalin and Korea in the east; presumably not crossing the 70° N latitude in the north and the 40° N latitude in the south, except in China and Korea. The records from especially the eastern palaearctic area (literature data based on Zinovjev & Savchenko, 1962; Savchenko, 1966c, 1973) are rather scanty and it is not sure whether the range of *scurra* stretches continuously from east to west, without the disjunction as seen in other species such as *dorsalis*, *lunulicornis* and *quadristriata*. As far as is known the species does not occur in Japan, as suggested by Savchenko (1973) who incorrectly synonymized the Japanese species *microcera* with *scurra*. Western palaearctic localities as indicated on the map are from: Broleman, 1923 (France); Erhan & Theowald, 1961 (Romania); Fischer, 1952 (West Germany); Lackschewitz, 1933, 1935 (Norway); Lundström, 1907, 1912 (Finland); Mannheims, 1954, 1963, 1965 (Finland); Nielsen, 1933 (Denmark); Oosterbroek, 1979b (Ireland); Pierre, 1924 (France); Savchenko, 1966d (Ukraina), Savchenko, 1973 (european part of the USSR); Simova, 1960, Simova & Vuković, 1981 (Yugoslavia); Tjeder, 1955b, 1974 (Sweden); Wormell, 1982 (Scotland) and Oosterbroek, in literis, 1984 (Austria, France, West Germany, East Germany, England, Belgium, Norway, Finland, USSR).

Discussion

N. scurra is a rather variable species and close to some others in general appearance. So it is likely that confusion occurs as well as incorrect



Map 10. Distribution of *N. scurra*, based on material examined (black marks) and literature (stippled dots); fragmented dots: localities not exactly specified.

synonymization when based only on descriptions or insufficient material. The synonymy of *nodulosa* with *scurra*, as proposed by Mannheims (1951) is rather questionable because the type-locality of *nodulosa* is situated far outside the present-known range of *scurra*. The new synonymy of *stejnegeri* with *scurra* has to be tentative because of the extreme poor material available. The incorrect synonymization of *microcera* with *scurra* was presumably based on only one ♀ paratype, the only specimen of *microcera* found in the Academy of Sciences, Leningrad. The interpretation of *profunda* as a subspecies of *scurra* by Savchenko (1973) was based on the original description only. Oosterbroek (1979b) has already reinstated the species-rank of *profunda*.

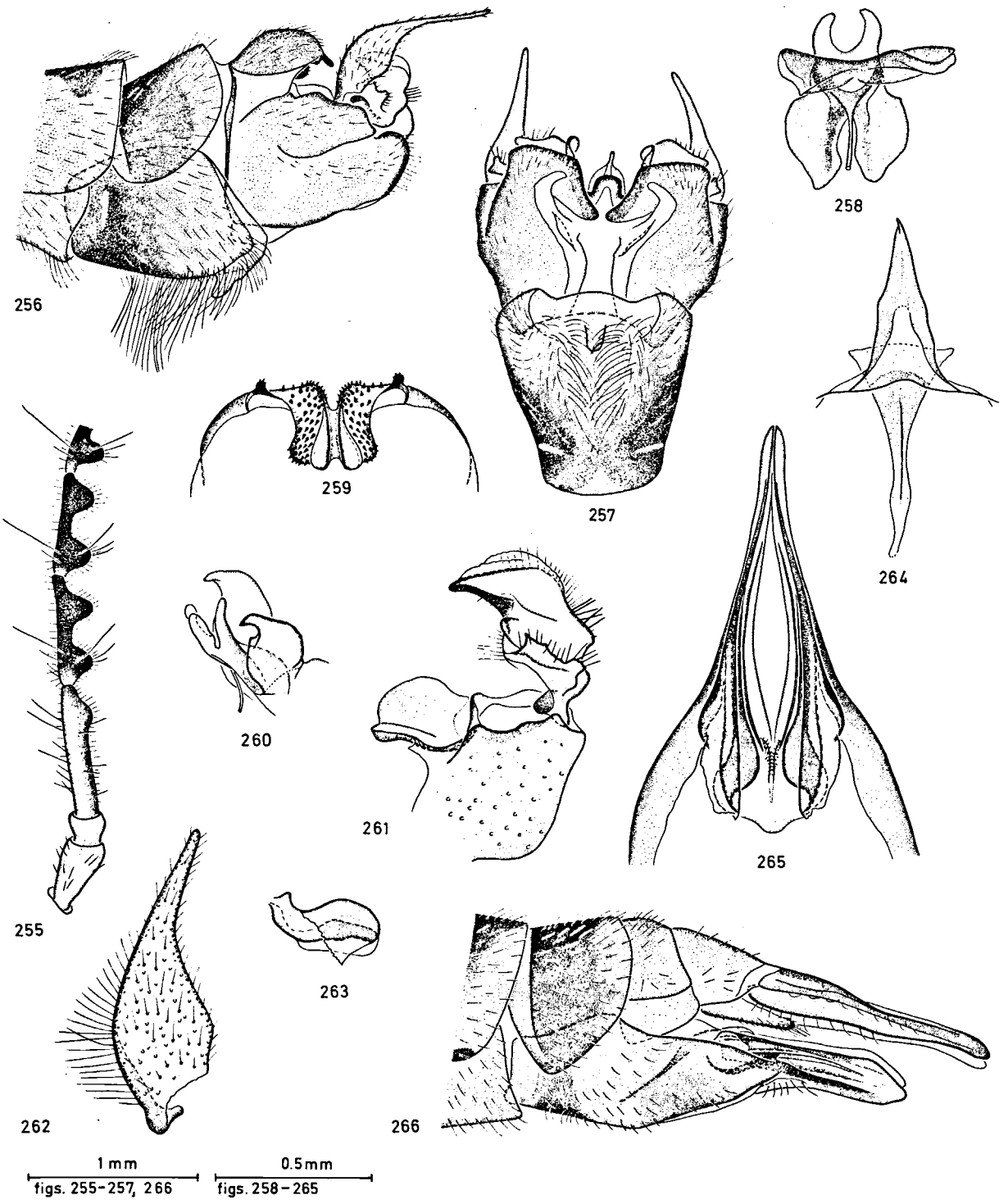
SECTION 9

Nephrotoma barbigera (Savchenko, 1964)
Figs. 255-266, map 11

Savchenko, 1964: 186-88, descr, comp, figs. hypop (as *Pales*); Savchenko, 1966b: 263-64, comp; Savchenko & Violovich, 1967: 329, note (as *Pales*); Savchenko, 1973: 96-97, descr, figs. hypop, distr, loc, biol (as *Pales*); Oosterbroek, 1980: 368, distr.

Material examined

Type material: *Pales barbigera* Savchenko, 1964 was described from the ♂ holotype only, labelled: "Nature reserve Kedrovaya Pad', Primorskiy Kray, Zinowjewa 19-VIII-962" (translation, label in Russian) "Holotypus Pales barbigera sp. n. Savtshenko E."; coordinates of type-locality 43°04′N 131°37′E. Condition



Figs. 255-266. *N. barbigera*; 255-263, ♂; 264-266, ♀. 255. basal segments of antenna, ♂ holotype; 256. hypopygium, lateral view; 257. hypopygium, caudo-ventral view; 258. semen pump, dorsal view; 259. tergite nine, ventral view; 260. adminiculum, lateral view; 261. id, outside; 262. od, outside; 263. sp2, from inside; 264. fused valvulae and furca, dorsal view; 265. hypovalvae, dorsal view; 266. ovipositor, lateral view.

good, dissected genitalia in a micro-vial on the same pin, preserved in the ASL.

Other material: One ♀ from Irkutskaya obl., Tibel'ti (51°46'N 103°13'E), 12-VII-1912 (Janowitskaya), ASL, erroneously mentioned under *sublunulicornis* in Savchenko, 1973.

Diagnostic notes

N. barbigera can be recognized by the strongly incised, largely black antennal flagellum in ♂, the rather small, brown occipital marking, the black and straight thoracic stripes, the pale pleura and the caudally broadened dorsal spot on tergite 7. In external features *barbigera* mostly resembles *laticrista*; some differences are: the colouration of the first flagellar segment (yellow-brown to brown in *barbigera*, black-brown in *laticrista*), the shape of the flagellar segments in ♂ (in *barbigera* more strongly incised as in *laticrista*, figs. 255, 267), the occipital marking (rather small and brown in *barbigera*, a broad black stripe in *laticrista*) and the abdominal dorsal stripe (continuous on tergites 1-7 in *barbigera*, obliterated on tergites 6-7 in *laticrista*). A close relative of *barbigera* is *minuticornis*, both sharing many hypopygial characters especially the extension of the membrane of sternite 8 and the long anterior extension of the median part of the adminiculum.

Brief description

Body length 16 mm (♂), 19 mm (♀), wing length 15 mm (♂, ♀), body colour saturated yellow. Antennae 13-segmented in both sexes, length 7.2 mm (♂), 3.1 mm (♀); scape and pedicel yellowish, first flagellar segment yellow-brown to brown, segments two and beyond completely dark brown to black and in ♂ strongly incised (fig. 255). Head largely shining; sides of rostrum light brown; palps yellowish; occipital marking brown, narrowly triangular (♀) or largely obliterated with a narrow line left on anterior part of vertex (♂). Thorax completely shining except the dull yellow-brown median part of pronotum; stripes black, sometimes slightly lighter caudally, lateral ones on scutum 1 straight; antero-lateral corners of scutum 2 yellowish or narrowly light brown; scutellum pale yellow-brown, mediotergite with a yellow-brown stripe and posterior spot; pleura with red-yellow to light brown markings. Tarsal claws untoothed. Wings with a hyaline brown tinge, pterostigma dark brown, wings without dark shades. Dorsal stripe on abdomen (dark)brown and more or less continuous, slightly broader than the lateral stripes on scutum 1, spot on tergite 7 in both sexes distinctly broadened caudad; tergites laterally marked with dark brown dashes; ventral markings on sternites long and narrow; eighth segment largely dark brown, terminal parts yellow. Hypopygium and internal structures figs. 256-263; sternite 8 with a short finger-like extension on caudo-median membrane and with bundles of luxuriant fair hairs on ventral surface; median part of adminiculum with two long and flat extensions anteriorly. Ovipositor and internal structures figs. 264-266.

Biology and distribution (map 11)

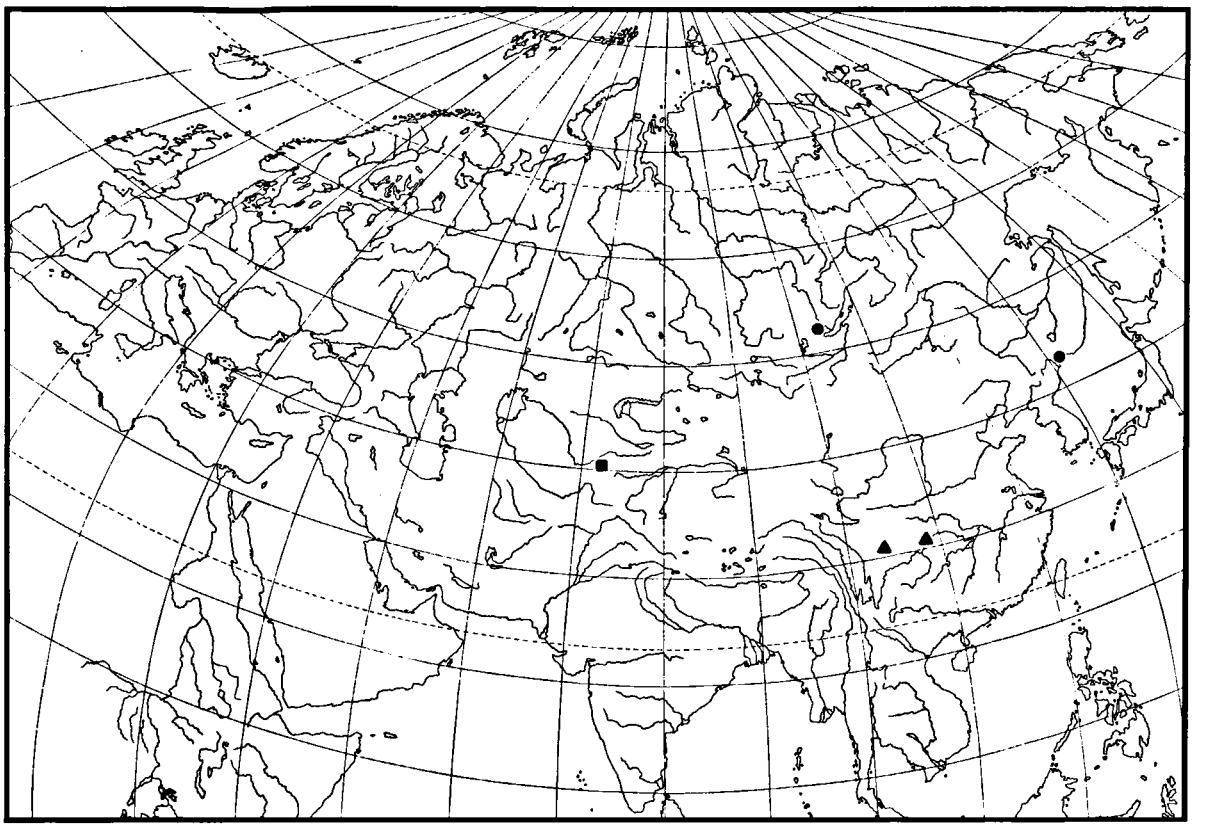
The type specimen was found in a broadleaf forest (Savchenko, 1973); the recorded collecting dates are July 12 and August 19. This species, know from two specimens only, occurs in central (Irkutskaya oblast) and eastern Asia (southern part of the Primorskiy Kray). The statement of Savchenko (1973, p.97) that *barbigera* also occurs in northern China and presumably central Japan is probably an error.

Nephrotoma laticrista Savchenko, 1966
Figs. 267-271, map 11

Savchenko, 1966a: 262-64, descr, figs. hypop, biol, comp; Savchenko, 1973: 276, comp, distr; Oosterbroek, 1980: 368, distr.

Material examined

Type material: The description of *Nephrotoma laticrista* Savchenko, 1966 was based on the ♂ holotype only, labelled: "Gul'cha river, below the Akbasag, Alayskiy Khrebet, 2300 m. Zaitzev 13-VIII-965" (translation, label in Russian) "Holotypus Pales laticrista Sav.



Map 11. Distribution of *N. barbigera* (dots), *N. laticrista* (square) and *N. profunda* (triangles), based on material examined.

1966", situated in the Kirkizskaya SSR, coordinates 40°20′N 73°26′E. Condition good, dissected genitalia in a micro-vial on the same pin; preserved in the ASL.

Diagnostic notes

N. laticrista can be identified by the black antennal flagellum, the rather large occipital marking, the black and straight thoracic stripes, the yellow antero-lateral corners of scutum 2, the rather narrow and posteriorly obliterated abdominal dorsal stripe and the hypopygial characters. The species strongly resembles *barbigera* in general appearance, differences are mentioned under the diagnostic notes of *barbigera*. Some differences from the somewhat similar species *libra* are the shining vertex (largely opaque in *libra*) and the anterior marking on the mediotergite (absent in *libra*).

Brief description

Male: Body length 16 mm, wing length 15 mm, body colour bright yellow. Antennae 13-segmented, length 5.6 mm; scape yellow, pedicel dirty yellow to brownish, flagellum nearly uniformly black-brown, flagellar segments two and beyond reniform (fig. 267). Rostrum shining yellow with narrow brown lines dorsally and dark brown spots laterally; palps brown-yellow; vertex largely shining with a broad, dark brown occipital marking reaching to base of tubercle. Thorax completely shining except the dull median part of pronotum; stripes black, lateral ones on scutum 1 straight, median one somewhat broadened at anterior end and slightly invaginated posteriorly; antero-lateral corners of scutum 2 yellow, scutellum yellow-brown, mediotergite with a dark yellow anterior stripe and a brownish

posterior spot; pleura with light brown markings, ventral parts of katepisternum and meron black-brown. Tarsal claws untoothed. Wings with a hyaline brown tinge, pterostigma dark brown with 9-12 macrotrichia, wings without dark shades. Dorsal stripe on abdomen dark brown, more or less continuous on tergites 2-5, about as broad as lateral stripes on scutum 1; lateral stripes as dotted lines; sternites ventrally marked with narrow lines; tergites 8, 9 and sternite 8 largely dark brown. Hypopygium and internal structures figs. 268-271; hind margin of sternite 8 with a deep U-shaped incision, lined with bundles of long, fair hairs; medisternal appendage of sternite 9 solid and sclerotized; adminiculum with broad and dorsally curved gonapophyses, median part cone-shaped and slightly bulged anteriorly; inner dististyle with a broad, slightly frayed crest and a ridge-like lateral projection; sp2 with only slightly extended transparent ridges along base.
Female: unknown.

Biology and distribution (map 11)

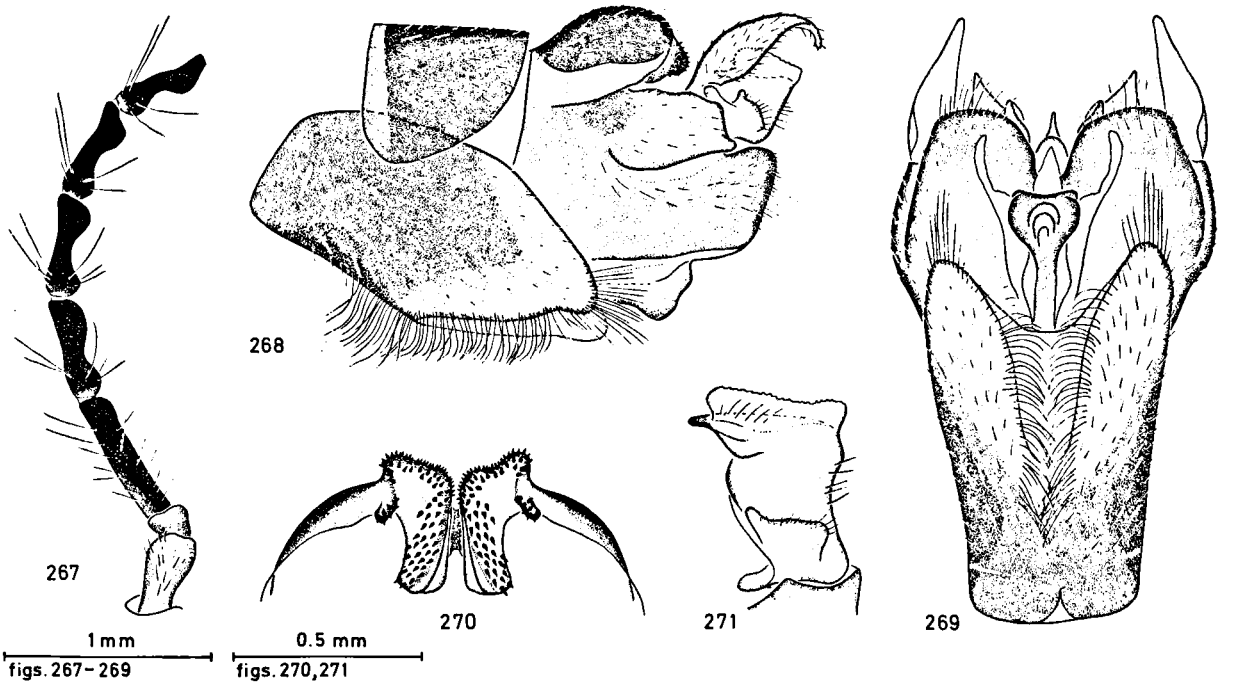
The species is known only from the ♂ holotype, recorded from August 13 on 2300 m altitude in central Asia, Kirkizskaya SSR.

Nephrotoma profunda Alexander, 1935
Figs. 272-282, map 11

Alexander, 1935: 228-29, descr, comp, pl. 1, fig. wing, pl. 2, figs. hypop; Wu, 1940: 5, distr; Savchenko, 1973: 87, descr, note, distr, biol (as *Pales scurra profunda*); Oosterbroek, 1979b: 182, fig. hypop, 186, notes, comp, descr hypop.

Material examined

Type material: The original description of *Nephrotoma profunda* Alexander, 1935 was based on "numerous males and females", all topotypic with the same date. The ♂ holotype is labelled: "Chengtu 1933" "Szechwan China DCGraham V-10-14-ziT 1700 ft." "HOLOTYPE Nephrotoma profunda C. P.



Figs. 267-271. *N. laticrista*; ♂. 267. basal segments of antenna. 268. hypopygium, lateral view; 269. hypopygium, caudoventral view; 270. tergite nine, ventral view; 271. id, outside.

Alexander", condition fair, preserved in the collection of the USNM. The following paratypes were studied: the ♀ allotype and 11♂, 4♀, 5 specimens of undefined sex in the collection of the USNM; 15♂, 2♀ in the C. P. Alexander-collection, USNM; 4♂, 3♀ in the BMNH. The coordinates of the type-locality are 30°37′N 104°06′E.

Other material: 1♀ from Chengtu, 1700 feet (520 m), 17-22-V-1933, USNM; 1♀ from Prov. of the Mo-Tau-Kai, Wan-hsien (30°34′ N, 108°20′ E), 1280-1340 m, 26-IX-1948, CAS; both in Szechwan province, China.

Diagnostic notes

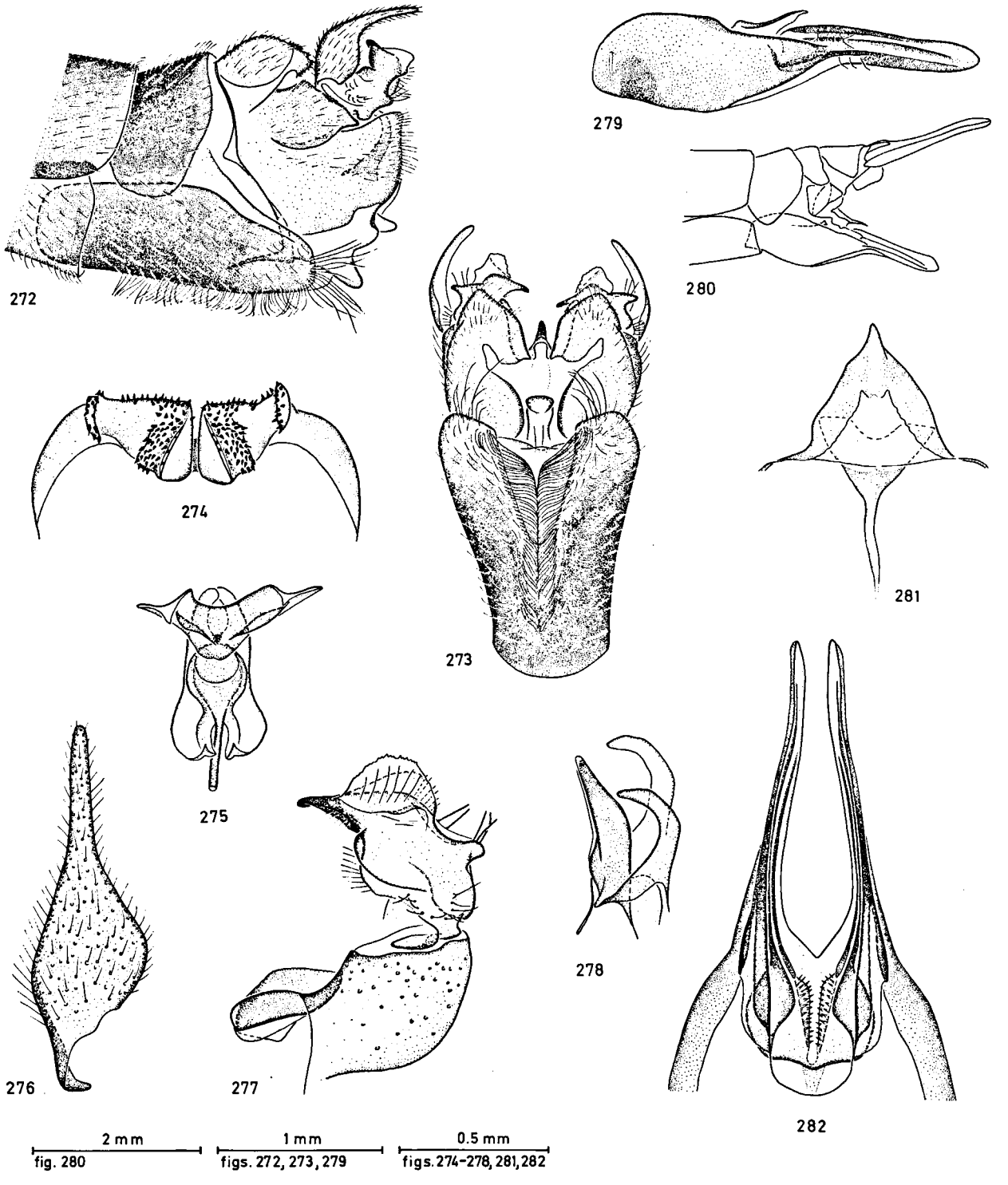
Some diagnostic characters of *profunda* are the absence of a distinct occipital marking, the grey-brown spots along the dorso-caudal eye-margins, the straight red-brown thoracic stripes, the (dark)brown tinted antero-lateral corners of scutum 2, the (dark)brown anterior stripe of the mediotergite and the long sternite 8 with the dense bundles of incurved golden hairs in ♂. In general appearance *profunda* strongly resembles *microcera*, a species from Japan and Korea, and to a lesser extent *scurra*, from which it differs in the lack of an occipital marking, the dark brown pterostigma and the broad abdominal dorsal stripe (compared to the (small) triangular occipital marking, the (light)brown pterostigma and the narrow abdominal dorsal stripe in *scurra*).

Brief description

Body length 12-15 mm (♂), 15-19 mm (♀), wing length 12-14.5 mm (♂), 12.5-15 mm (♀), body colour yellow to dark yellow. Antennae of both sexes 13-segmented and short, length 2.8-3.6 mm (♂), 2.4-2.9 mm (♀); scape and pedicel yellowish, first flagellar segment dirty to brown-yellow, remainder of flagellum more or less uniformly (light) brownish or weakly bicoloured with the basal nodes more pale; flagellar segments in both sexes cylindrical, verticillar hairs distinctly longer than segments. Rostrum shining with (dark)brown sides; palps yellow-brown, basally more dark; frons and tubercle opaque, remainder of head shining yellow, no distinct occipital marking, sometimes a small dash in centre of vertex; elongated grey-brown spots along dorsal and caudal eye-margins. Median part of pronotum dull (light)brown, remainder of thorax shining; stripes red-brown to dark brown, lateral ones on scutum 1 straight; transverse suture brownish, antero-lateral corners of scutum 2 broadly brown to dark brown tinted; scutellum yellow-brown, mediotergite yellow with a narrow (dark) brown anterior stripe and a red-brown posterior marking; pleura with red-yellow to red-brown markings. Tarsal claws untoothed. Wings with a yellow-brown tinge; pterostigma dark brown with usually some macrotrichia, bases of cells r3, r4+5 and wingtip narrowly brown shaded. Dorsal stripe on abdominal tergites 1-7 dark brown, slightly interrupted at posterior margins, usually not broader than scutellum, separate spots frequently broadened caudally in ♀; tergites laterally marked with two elongated dark brown dashes on each side; ventral markings on sternites narrow and elongated; tergite 7 in both sexes usually with a broad dark band along hind margin, in ♂ segment 8 largely dark brown, in ♀ tergite 8 and base of sternite 8 dark brown; remainder of (sub)terminal segments yellow to red-yellow. Hypopygium and internal structures figs. 272-278; sternite 8 long and with a dense tuft of incurved golden hairs along incision and midventrally, sternite 9 with a distinct medisternal appendage and with angularly extended caudo-lateral corners; inner dististyle with a broad, serrate crest and a short narrow extension at posterior margin. Ovipositor and internal structures figs. 279-282.

Biology and distribution (map 11)

N. profunda is known from only two localities, at altitudes of 520 m and about 1300 m, and from two very different dates: May 10-22 and September 26. According to the long, completely topotypic type-series, the species may be abundant locally. Both localities are situated in Szechwan province in central China.



Figs. 272-282. *N. profunda*; 272-278, ♂; 279-282, ♀. 272. hypopygium, lateral view; 273. hypopygium, caudo-ventral view; 274. tergite nine, ventral view; 275. semen pump, dorsal view; 276. od, outside; 277. id, outside; 278. adminiculum, lateral view; 279. left hypovalva, lateral view; 280. ovipositor, lateral view; 281. fused valvulae and furca, dorsal view; 282. hypovalvae, dorsal view.

Nephrotoma sublunulicornis (Savchenko, 1957)

Figs. 283-294, map 12

Savchenko, 1957: 213-15, descr, fig. hypop, comp, 222, comp, distr (as *Pales*); Mannheims & Savchenko, 1967: 156, distr; Savchenko, Violovich & Narchuk, 1972: 75, 79, biol, 82, distr, 83, biol, 93, loc (= *scurra*); Mannheims & Savchenko, 1973: 161-62, locs, biol, distr; Savchenko, 1973: 92-93, descr, figs. hypop, distr, locs (partly), biol (as *Pales*); Oosterbroek, 1980: 368, distr.

Material examined

Type material: Savchenko (1957) based his description of *Pales sublunulicornis* on 17 specimens (description says incorrectly 11 ♂, 6 ♀; presumably 10 ♂, 7 ♀). In the Academy of Sciences, Leningrad, all this material could be found and was studied, except 1 ♀ from Kobdo (= Hovd), Mongolia, 15-VII-1926 (Kulik). No specimen of the type-series carried a type-label. Designated as lectotype is the ♂ from Chitinskaya obl., Unda 40 km from Nerchinsk, VI-1912, Pisarevskich (labels in Russian). Paralectotypes as follows: 1♂ from Yakutskaya ASSR, Yakutsk, 6-VII-1927, Yakutskiy muzei (original description says 1937); 2♂ from Krasnoyarskiy Kray, Yurty, Kanskogo rayon, 9-VI-1912, Misjin i Verchovskiy (original description says 9-VII-1912; both specimens are *occipitalis*); 2♂ from Mongolia, near Ulan-Bator, 23-26-VI-1905, Kozlov; 2♂, 2♀ from the same locality, 1-2-VII-1905, Kozlov (original description says 1♂, 3♀); 2♂, 4♀ from Mongolia, Tam she, valley of the Toly river (presumably near Ulan-Bator), 20-VI-1905 (1♂), 29-VI-1905 (2♀, original description says 2♂), 4-VII-1905 (1♂, 2♀; Kozlov) and finally the above mentioned ♀ from Kobdo.

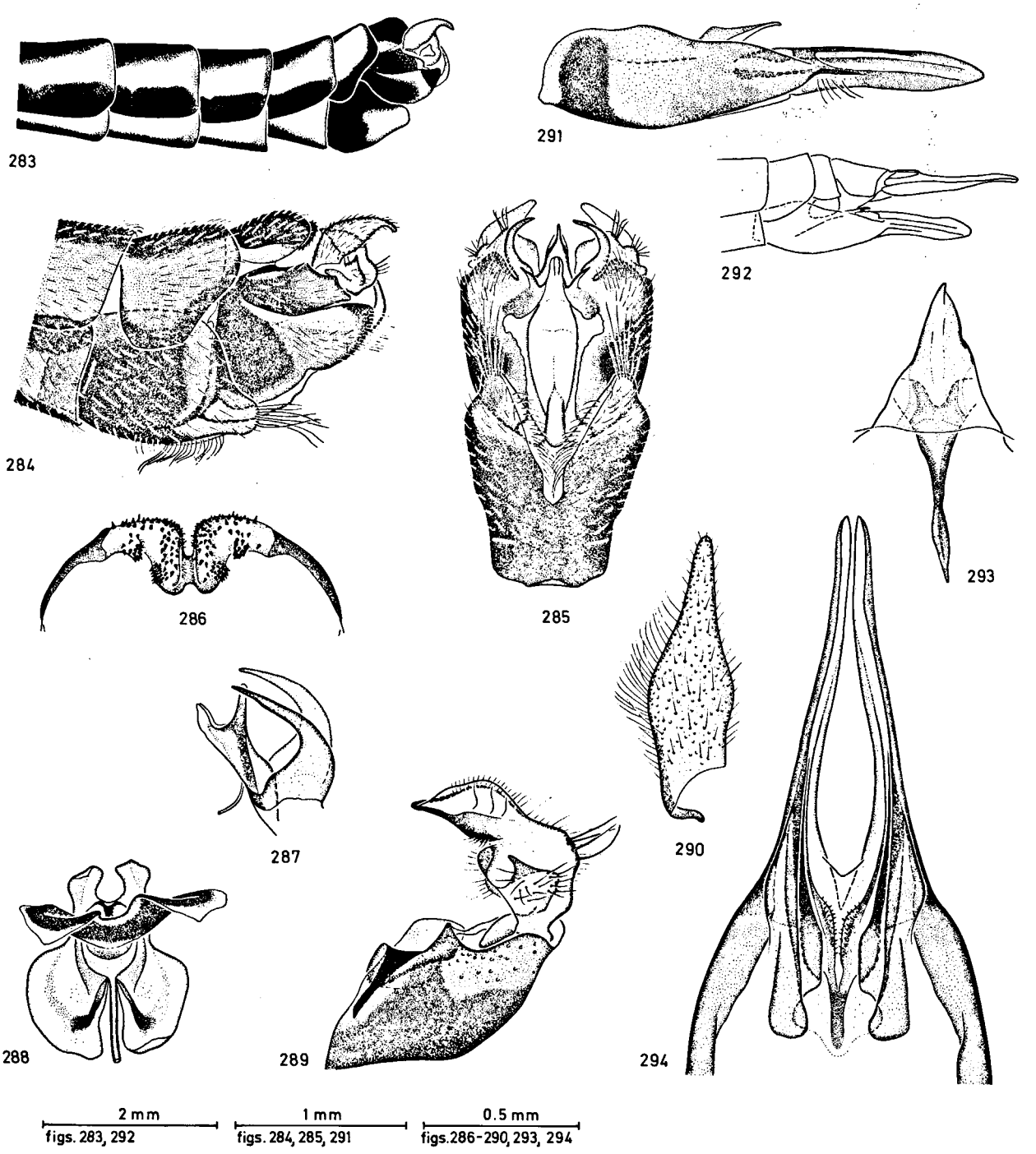
Other material: 1♂ from the USSR (Bestyakh on the Lena river, near Yakutsk, 14-VI-1912, ASL) and 2♂, 2♀ from Mongolia: Bulgan aimak (20 km W of Bajannuur, 1100 m, 17-VI-1966, 2♂, MNM), Hövsgöl aimak (8 km N of Alag-erdene, Egiyn river, 1600 m, 17-VII-1968, 1♀, MNM), Uvs aimak (6 km SW of Baruunturuun, 1350 m, 24-VI-1968, 1♀, MNM).

Diagnostic notes

N. sublunulicornis can easily be recognized by the black antennal flagellum, the brown dorsal surface and yellow sides of the rostrum, the prolonged occipital marking, the black and straight thoracic stripes, the not or weakly tinted antero-lateral corners of scutum 2, the narrow anterior stripe of the mediotergite, the black-brown markings of the pleura, the pale pterostigma of the wing and hypopygial characters. There is some similarity between *sublunulicornis* and *dorsalis* (having polymerous antennae), *lunulicornis* and *scurra* (both with the sides of the rostrum brownish and the antero-lateral corners of scutum 2 dark to black-brown) and the closely related holarctic species *occipitalis* (with 14-to 15-segmented antennae in ♂, without a brown dorsal surface of the rostrum, with somewhat caudally fading thoracic stripes and pale to brown spotted pleura).

Brief description

Body length 12.5-15 mm (♂), 15-19 mm (♀), wing length 13-14 mm (♂), 13.5-15.5 mm (♀), body colour (bright)yellow. Antennae of both sexes 13-segmented, length about 3.8 mm (♂), 2.9-3.1 mm (♀); scape yellowish, pedicel brown, flagellum completely dark brown to black; flagellar segments two and beyond in ♂ weakly incised, in ♀ more or less cylindrical. Rostrum shining, nasus and dorsal surface largely (dark)brown, sides more or less yellow; palps (dark)brown; tubercle and anterior part of vertex opaque orange-yellow, remainder of vertex and postgenae shining (dark)yellow, occipital marking black-brown, narrowly prolonged and reaching to top of tubercle; postgenae with dark brown spots on both sides of neck-attachment. Median part of pronotum dull brownish, remainder of thorax shining; stripes black, lateral ones on scutum 1 straight; transverse suture weakly tinted, antero-lateral corners of scutum 2 sordid yellow to pale brown tinted; scutellum brown with a dark brown median line, sometimes vague, mediotergite with a dark brown, very narrow stripe anteriorly and a broad dark brown caudal marking, posterior



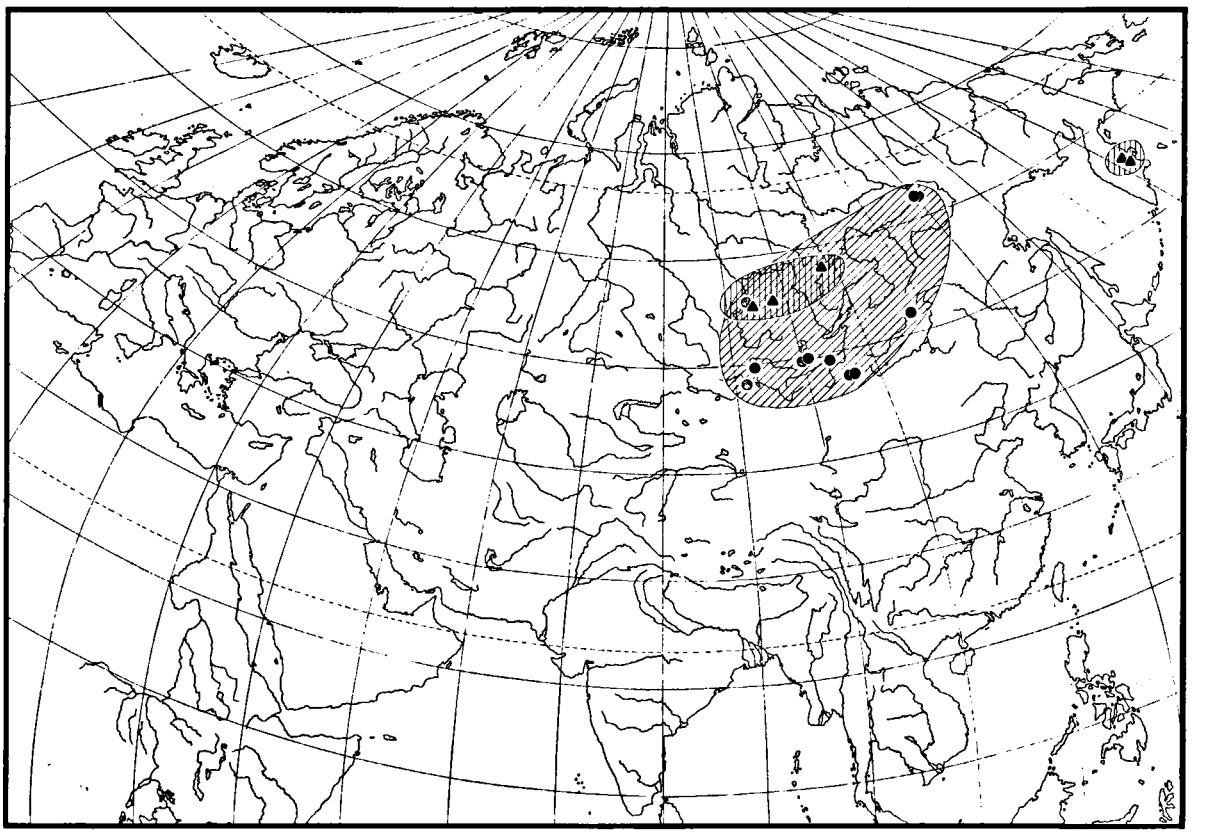
Figs. 283-294. *N. sublunulicornis*; 283-290, ♂; 291-294, ♀. 283. distal segments of the abdomen, lateral view; 284. hypopygium, lateral view; 285. hypopygium, caudo-ventral view; 286. tergite nine, ventral view; 287. adminiculum, lateral view; 288. semen pump, dorsal view; 289. id, outside; 290. od, outside; 291. left hypovalva, lateral view; 292. ovipositor, lateral view; 293. fused valvulae and furca, dorsal view; 294. hypovalvae, dorsal view.

margin banded with black; pleura with dark brown to black markings. Tarsal claws untoothed. Wings with a hyaline-brown tinge, pterostigma light brown, wings not shaded. Dark brown dorsal abdominal stripe on tergites 1-8 in ♂ about as broad as scutellum, interrupted to continuous, in ♀ broader; tergites laterally marked with black-brown dashes, hardly interrupted; ventral markings on sternites forming a continuous stripe; sternite 8 in ♂ largely black-brown, in ♀ with a dark brown basal band, tergite 9 completely and sternite 9 largely dark brown in ♂ (fig. 283), (sub)terminal segments in ♀ red-brown to dark yellow. Hypopygium and internal structures figs. 284-290; hind margin of sternite 8 deeply incised, closing membrane set with incurved yellow hairs; central part of adminiculum with two flat and narrow extensions anteriorly. Ovipositor and internal structures figs. 291-294.

Biology and distribution (map 12)

The only information concerning the habitat of *sublunulicornis* is given by Mannheims & Savchenko (1973), who mention the species from the "Caragana-Steppen mit sandigen Boden". The species is recorded from altitudes up to 1600 m and is on the wing from mid-June till mid-July (1 ♀ of June 6 in Savchenko, 1973, identification not checked).

N. sublunulicornis is a species from central Asia and distributed from western and central Mongolia to Chitinskaya obl. and Yakutsk in the USSR. An additional locality in Mannheims & Savchenko, 1973, is Mongolia: Hövsgöl aimak, 8 km N of Burenchaan, Delger mörön river, 1450 m. Some data in the literature erroneously refer to *sublunulicornis*: the 2 ♂ paralectotypes from Krasnoyarskiy Kray, Yurti, belong to *occipitalis*; a ♀ from Altayskiy Kray, Teletskoye Lake, 25-VI-1909 (in Sav-



Map 12. Distribution of *N. sublunulicornis* (dots and oblique hatching) and *N. occipitalis* (triangles and vertical hatching), based on material examined (black marks) and literature (stippled dots).

chenko e.a., 1972 and Savchenko, 1973) is in fact *scurra* and a ♀ from Irkutskaya obl., Tibel'ti, 12-VII-1912 (Savchenko, 1973) is *barbigera*. Another ♀ from Krasnoyarsk, 6-VI-1903 (Savchenko, 1973) could not be checked.

Nephrotoma occipitalis (Loew, 1864)
Figs. 295, 296, map 12

Loew, 1864: 65, descr (as *Pachyrrhina*); Dietz, 1918: 109, key, 117, comp, descr (as *Pachyrhina snowii alternata*); Savchenko, 1972: 740, distr, loc (as ? *stejnegeri*); Savchenko, 1973: 93, loc (Yurti, as *Pales sublunulicornis*), 99-100, figs. hypop, descr, distr, locs, biol (as *Pales* ? *stejnegeri*); the species is treated in detail by Tangelder, 1983: 119, 120, key ♂, 122, key ♀, 127-32, refs, type mat, syn, diag notes, descr, figs. hypop & ovipos, biol, distr (nearctic material only).

N. occipitalis was hitherto only known from North America, where it is distributed from Newfoundland in the east to Alaska in the northwest. Study of the *Nephrotoma*-collection of the Academy of Sciences in Leningrad revealed that this species is also represented in north-eastern and central Asia by six males, which were incorrectly identified as ? *stejnegeri* and *sublunulicornis* by Savchenko (1973), who did not have at his disposal the proper material for comparison. The discussion of the species will be brief and supplementary to the information in Tangelder (1983).

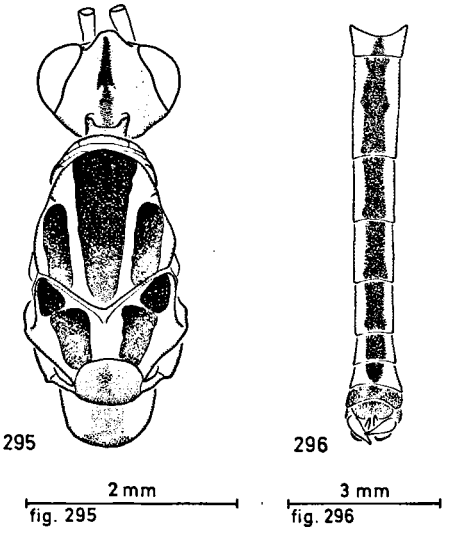
Material examined

Type material: The description of *Pachyrrhina occipitalis* Loew, 1864 was based on the ♀ holotype only, from Yukon, preserved in the MCZ, type no. 10314. *Pachyrhina snowii alternata* Dietz, 1918 was described from a ♂ holotype and a ♂ paratype, both from Colorado, USA, dates: 20-VII-1911 and 19-VIII-1915, preserved in the ANSP, type no. 6440.

Other material: 6 ♂ (ASL) from the USSR: Krasnoyarskiy Kray (Yurti, 9-VI-1912, 2♂; valley of the Kaltat, branch of the Bazaikha river, near Krasnoyarsk, 22-VI-1954, 1♂); Irkutskaya obl. (Padun at the Tunguske river, 18-VI-1867, 1♂); Kamchatka (Yelovka, 2-VII-1929, 1♂; Kamaki at the Kamchatka river, 9-VII-1909, 1♂).

Diagnostic notes

N. occipitalis can be recognized by the following characters: the 14- to 15-segmented antennae of the ♂ (13-, sometimes 14-segmented in ♀) with the grey-brown flagellum, the usually narrow and elongated (dark)brown occipital marking, the straight brown to black-brown and caudally somewhat fading thoracic stripes (fig. 295), the hardly tinted to red-brown antero-lateral corners of scutum 2, the yellow to yellow-brown pterostigma, the rather broad and usually continuous abdominal dorsal stripe (fig. 296) and in ♂ the deep incision of sternite 8, closed by a membrane which is set with yellow hairs and the finger-like, sometimes slightly bifid medisternal appendage of sternite 9. In general appearance *occipitalis* resembles *scurra*, which has 13-segmented antennae, dully dark brown to black antero-lateral corners of scutum 2 and a narrow and interrupted abdominal dorsal stripe, and the closely related *sublunulicornis*, which differs from *occipitalis* in the 13-segmented antennae, the largely (dark)brown dorsal surface of the rostrum, the caudally unfaded thoracic stripes and the black-



Figs. 295-296. *N. occipitalis*, ♂ from Krasnoyarskiy Kray, USSR. 295. head and thorax, dorsal view; 296. abdomen, dorsal view.

brown pleural markings. Compared to the nearctic material, the palaearctic specimens of *occipitalis* are about intermediate between the lightly and darkly coloured forms (Tangelder, 1983). There are no distinct differences in hypopygial characters. The specimens from Kamchatka are very small (9-10 mm) and do have a somewhat expanded occipital marking.

Biology and distribution (map 12)

In the Nearctic region *occipitalis* is a widely distributed and locally abundant species, but in the Palaearctic region the species is scarce. There is no information about the habitat or the altitude of the palaearctic specimens of *occipitalis*; the few records lay between June 9 and July 9.

The species is known from three localities in Central Asia (Krasnoyarsk and Irkutsk regions) and from two localities on the Kamchatka peninsula. The locality "14 km east of Ulan-Bator" mentioned by Savchenko (1972) for *?stejnegeri* presumably does not refer to *occipitalis*, because it concerns a ♂ with 13-segmented antennae.

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