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The western palaeartic species of *Nephrotoma* Meigen, 1803 (Diptera, Tipulidae) Part 3

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ABSTRACT

This study deals with the *dorsalis* group and the *brevipennis* group. The western palaeartic members of the *dorsalis* group are *N. dorsalis dorsalis* (Fabricius, 1781), *N. quadristriata* (Schummel, 1833), *N. lunulicornis lunulicornis* (Schummel, 1833), *N. scurra* (Meigen, 1818), *N. austriaca* (Mannheims & Theowald, 1959), and *N. helvetica* (Mannheims & Theowald, 1959). The eastern palaeartic subspecies *dorsalis sachalina* Alexander, 1924, and *lunulicornis angustistria* Alexander, 1925, are briefly discussed. A description is provided of *N. profunda* Alexander, 1935, formerly treated as a subspecies of *scurra*.

The *brevipennis* group assembles the *Nephrotoma* species from Madeira, *N. brevipennis* (Wollaston, 1858), *N. lucida* (Schiner, 1868), and *N. antithrix* (Mannheims, 1962). *N. lucida* is taken out of synonymy with *brevipennis*.

INTRODUCTION

The subject of part three are the western palaeartic species of the *dorsalis* group and the species from Madeira. Both Mannheims (1951a) and Savchenko (1973b) ascribed the species discussed in this paper to one group. The present survey revealed that we are dealing here with two very distinct species groups. Hence the Madeiran species are treated separately as the *brevipennis* group.

MATERIAL AND METHODS

The general statements made in part one of this revision about material, figures, terminology, abbreviations, etc., and the remarks made in the second part about the application of the term "sternum", apply to this part also. It should be noted that the drawings of the copulatory organs are made after macerated abdominal terminalia again. Consequently comparison of dried specimens with these illustrations is sometimes less instructive.

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THE *DORSALIS* GROUP

The name *dorsalis* group was used for the first time by Mannheims (in Mannheims & Pechlaner, 1963) for the species *N. dorsalis* (Fabricius), *N. quadristriata* (Schummel), *N. lunulicornis* (Schummel), *N. scurra* (Meigen), *N. austriaca* (Mannheims & Theowald), and *N. helvetica* (Mannheims & Theowald). Mannheims did not then define this group and the species mentioned above were incorporated by Savchenko (1973b) in his *scurra* group together with *N. brevipennis* (Wollaston) from Madeira and a number of mainly eastern palaeartic species, namely, *N. minuticornis* Alexander, *N. sublunulicornis* (Savchenko), *N. flavonota* (Alexander), *N. barbiger* (Savchenko), *N. ramulifera* (Tjeder), and *N. stejnegeri* Alexander. Savchenko defined the *scurra* group on colouration (extensively yellow body colour and straight lateral prescutal stripes, because of the latter character the Madeiran species were assigned to the *scurra* group) and hypopygial characters (absence of lateral horns on the posterior extension of tergite 9, presence of a membranous crest on the id, presence of a protruding membranous connection between the two halves of sternite 9, sternite 8 medially incised). The name *dorsalis* group is retained here because I am not informed whether the characters specific for the western palaeartic species as a group, do hold for the species assembly of Savchenko's *scurra* group. The western palaeartic species share the following characters:

- 1) lateral prescutal stripes straight,
- 2) id with a distinct crest,
- 3) ventral appendages of the adminiculum prolonged on ventral, membranous connection between the two halves of the ninth sternite,
- 4) lateral appendages of the adminiculum basally confluent with the ninth sternite,
- 5) posterior appendages of the aedeagus very close to each other,
- 6) male sternite eighth with a distinct, medial incision,
- 7) fused valvulae without a sclerotized connection with tergite nine (fig. 6).

The distribution of the species dealt with in this study is as follow:
dorsalis, occupies a widely disjunct area in the palaeartic (map 1),
quadristriata, has a fragmented distribution range in Europe and central Asia (map 2),
lunulicornis, widely distributed throughout the palaeartic (map 3),
scurra, occupies almost the entire palaeartic between 40° and 70° N.L. (map 4),
austriaca, is known from several localities in central Europe (map 5),
helvetica, is recorded from three localities in Valais, Switzerland (map 6).

It is feasible that a larger part of the eastern palaeartic members of Savchenko's *scurra* group is closely related to species of the *dorsalis* group. The same applies to about forty per cent of the Nearctic species.

***Nephrotoma dorsalis* (Fabricius, 1781)**

Figs 1—8, 16, 30, diagram 1, map 1

N. dorsalis, the type-species of *Nephrotoma*, is characterized by having nineteen antennal segments in the male sex and fifteen in the female (fig. 4). This state of character is found again in the Nearctic *N. eucera* (Loew) only. The second and following flagellar segments of the male antennae are distinctly reniform. The occipital marking is dark brown and basally half as broad as the neck (in *austriaca* as broad as the neck). The wing-stigma is distinct, brown to dark brown. Males are easily recognized by the characteristic, bifid shape of the eighth sternite (fig. 1). The female cerci are relatively broad (fig. 30).

N. dorsalis has a widely disjunct distribution; it is represented on Hokkaido, South Sakhalin and the southern Kurile by the subspecies *sachalina* Alexander, 1924 (map 1).

***Nephrotoma dorsalis dorsalis* (Fabricius, 1781)**

Tipula dorsalis Fabricius, 1781, Species Insectorum, 2: 403; 1787: 322; Gmelin, 1790: 2814; Fabricius, 1794: 237; 1805: 28; Zimsen, 1964: 450.

Nephrotoma dorsalis: Meigen, 1803: 262; 1804: 80—1, figures; Olivier, 1811: 196; Meigen, 1818: 202—3, figures; Macquart, 1826: 79; 1834: 91, figures; Staeger, 1840: 26; Zetterstedt, 1851: 4005—6; van der Wulp & Snellen van Vollenhoven, 1853: 145; Walker, 1856: 317—8; Zetterstedt, 1860: 6545; Schiner, 1864: 502—3; van der Wulp, 1866: 18; Grzegorzek, 1873: 27; van der Wulp, 1877: 383, figures; Westhoff, 1880: 49—50, biology; Wallengren, 1882: 15; Westhoff, 1882: 48, biology; Huguenin, 1888: 16—7, figures; Thalhammer, 1900: 20; Jacobs, 1903: 352; Wahlgren, 1905: 133; Czizek, 1911: 51—2, figures; Lundström, 1912: 48; Lundström & Frey, 1916: 23; Nielsen, 1918: 11; Riedel, 1918/1919: 5; Nielsen, 1919: 10; Riedel, 1919b: 18; Goetghebuer & Tonnoir, 1921: 121; Alexander, 1924b: 597; Alfken, 1924: 434; Pierre, 1924a: 24, figures, biology; Nielsen, 1925: 152, figures; Alfken, 1930: 49; Edwards, 1939: 244; Grensted, 1944: 176; Coe, 1950: 10; Tjeder, 1955b: 246—7; Brindle, 1960: 86, 101, figures, biology; Freeman, 1967: 129—30, biology; Mannheims, 1967a: 200, biology; 1967b: 152; Theowald, 1967: 21, 64, biology; Cramer, 1968: 142—143, 172, 174, 177, 186, biology; Freeman, 1968: 342, 346, biology; Sary & Martinovský, 1969: 8; Theowald, 1971: 220; Stubbs, 1973: 103—7, figures, biology; Theischinger, 1977: 3.

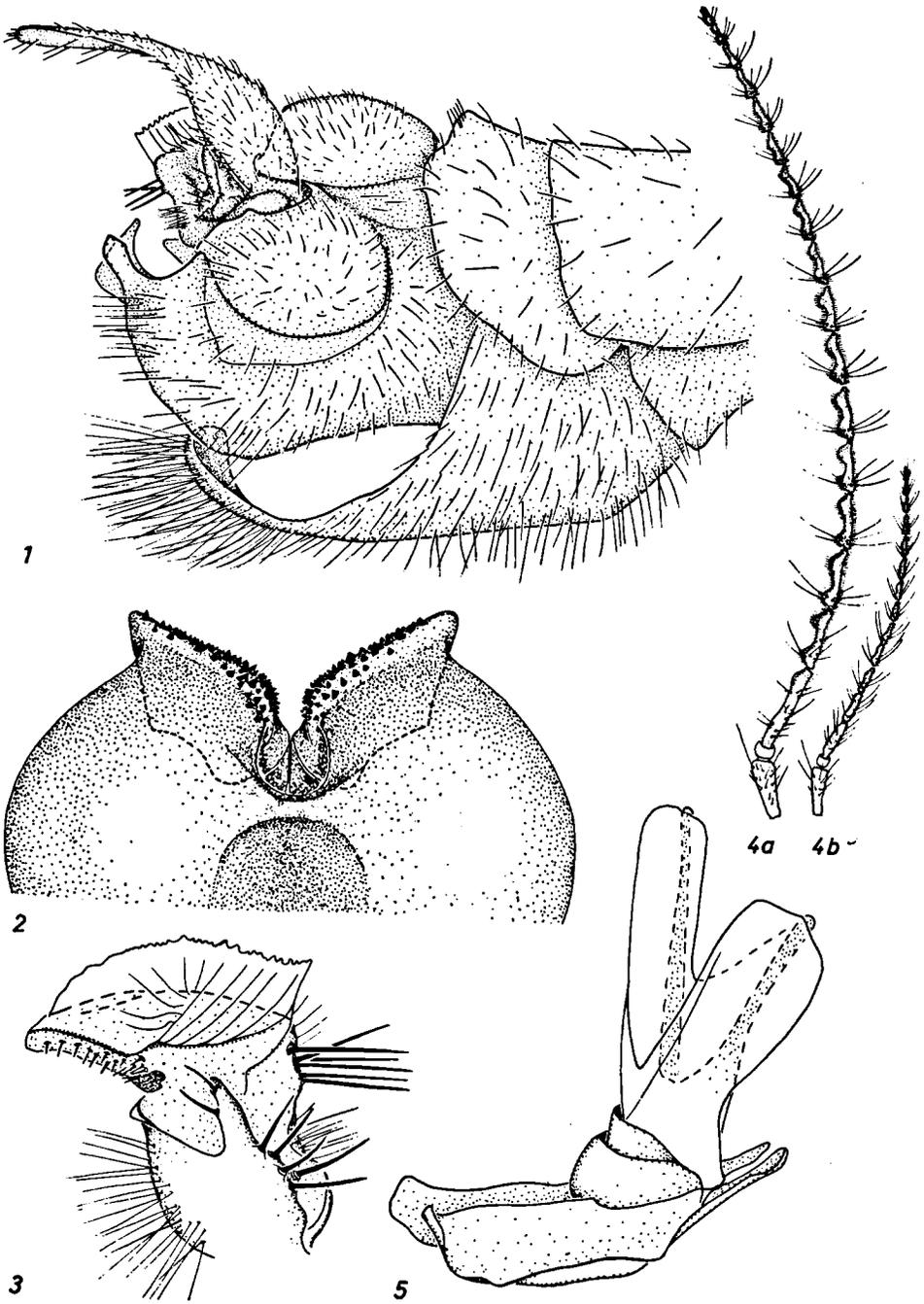
Pales dorsalis: Audcent, 1932: 9; Mannheims, 1951a: 17, 32—4, 44—5, figures; 1951c: 228; Stäckelberg, 1951: 741; Fischer, 1952: 120; Mannheims, 1954b: 31, 40; Theowald & Mannheims, 1956: 248—9; Theowald, 1957a: 224, figures; 1957b: 10—1; Mannheims & Theowald, 1959: 17; Hemmingsen, 1962: 141; Höchstetter, 1962: 106; Zinovjev & Savchenko, 1962: 569; Mannheims & Pechlaner, 1963: 6, 14, 23—4, biology; Mannheims, 1964c: 107—8; 1965: 4; 1966a: 276; 1967e: 317; Savchenko, 1966a: 478—80, figures; 1966c: 95; 1966d: 120; Savchenko & Krivolutzkaya, 1966: 56, biology.

Pales dorsalis dorsalis: Savchenko, 1973b: 101—3, figures, biology.

Pachyrhina lunulicornis: Beling, 1878: 41—2.

Type-material

The types of *Tipula dorsalis* are not preserved (Zimsen, 1964; Mannheims, i.l.). Fabricius' *dorsalis* belongs to the *dorsalis* group ("Antennae porrectae, obtuse serratae"), and is almost certainly identical with *dorsalis* Fabricius



Figs 1—5. *N. dorsalis dorsalis*. 1, hypopygium, lateral view; 2, posterior extension of tergite 9, dorsal view; 3, id., from outside; 4, antennae (after Mannheims, 1951a), a: male, b: female; 5, aedeagus.

sensu Meigen (= *dorsalis* Fabricius auct.), which is the only European *Nephrotoma* with nineteen antennal segments in the male sex. The original description, however, does not account for the number of antennal segments. Meigen (1803) designated *dorsalis* Fabricius as the type-species of *Nephrotoma* by monotypy and characterized *Nephrotoma* among others by the number of antennal segments. In 1805, Fabricius refers under *dorsalis* to Meigen (1804), in which paper the latter author again mentioned the nineteen antennal segments of *dorsalis*. Moreover, the introduction of Meigen (1818) suggests that Meigen examined original material out of the Fabricius collection.

Other material: 149 males and 102 females from the following countries: Norway, Sweden, Ireland, Great Britain, the Netherlands, Belgium, West Germany, Poland, Czechoslovakia, France, Switzerland, Italy, Austria, Rumania, Bulgaria and the U.S.S.R. (Latviya).

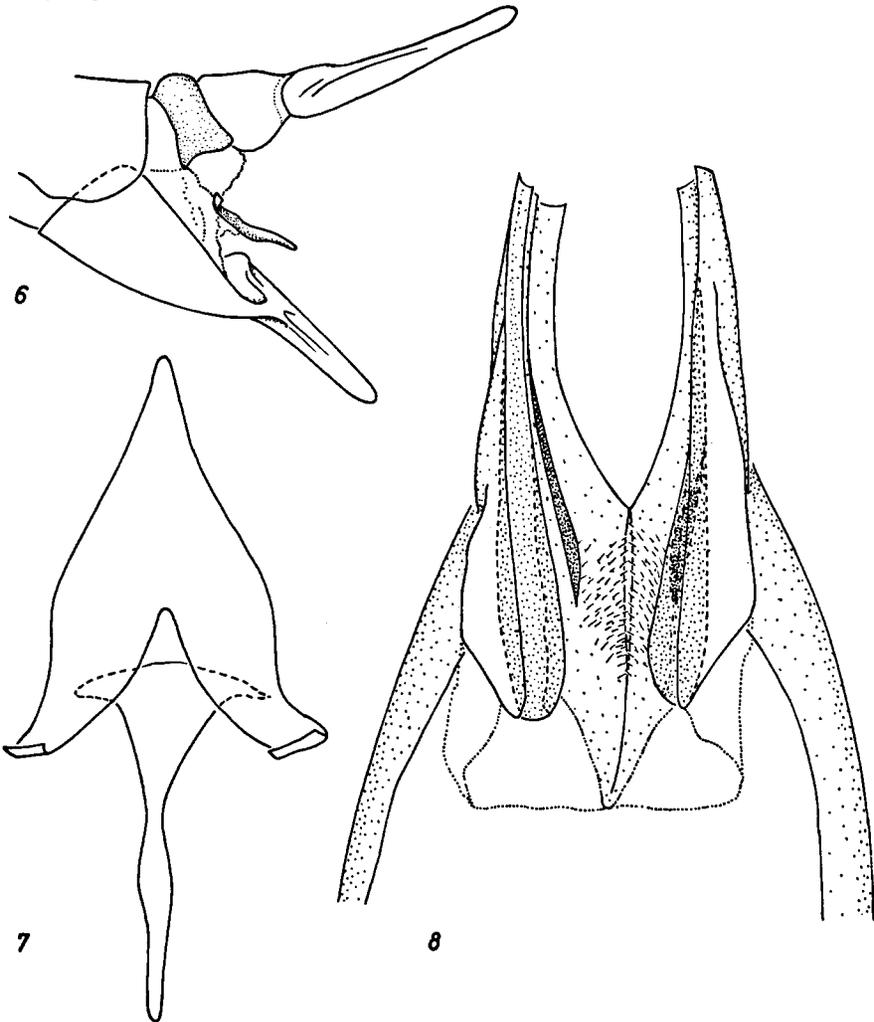
Description

Body length male: 12—17 mm, female: 14—19 mm; wing length: 12—16 mm.

Head male: Antennae (fig. 4a) 19-segmented, rarely with 17, 18 or 20 segments. Scape and pedicel yellow, sometimes in part or entirely (pedicel) darkened; flagellar segments brown to dark brown; first flagellar segments 1.2—1.4 × length of second one; second and following basal flagellar segments distinctly reniform (fig. 4a); verticils up to as long as flagellar segments. Palpi yellow, in part brownish. Nasus and rostrum yellow, lower lateral half of rostrum sometimes brownish. Genae and postgenae pale yellow. Vertex yellow. Frontal tubercle less conspicuous. The occipital marking is dark brown and half as broad as the neck, narrowly triangular or with slightly convex lateral margins, usually bluntly ending on top of frontal tubercle. Hairs on vertex and postgenae sparsely set.

Thorax male: Yellow, dorsal part of pronotum medially tinged with brown, lateral parts of pronotum frequently darkened along zone of contact with anepisternite. Prescutal and scutal stripes dark brown. Lateral prescutal stripes straight. Scutellum more or less transparent, yellow, median region usually with a narrow, longitudinal, brown line. Parascutellae yellow. Mediotergite laterally yellow, median region with a longitudinal, brown stripe, distinctly widening towards mediotergite hind margin. Pleural markings faint to brown, those of sternopleuron, meron and posterior half of katatergite always dark brown. Anatergite yellow, sometimes in part brown. Sternum 1 yellow. Coxae and trochanters yellow. Femora basally yellow, steadily growing darker apically, tips broadly dark brown. Tibiae and tarsi brown to dark brown. Wings light brown toned; wing-stigma distinct, brown to dark brown, usually with macrotrichiae; basal part of vein R4+5, cross-vein R-M and wing-tip in general with a broad, brown shade. Halteres yellow.

Abdomen male: Tergite 1 laterally broadly yellow, dorsally ranging from yellow to dark brown. Tergites 2—6 with a moderately broad, brown to dark brown, dorsal stripe, which is usually interrupted by lighter colouration of the hind margins of the tergites. Dorsal stripe more or less straight but lateral margins irregular. Tergites 2—6 laterally yellow with a dark brown stripe at lateral margin, interrupted in front of middle of tergites. Tergites 7 and 8 almost entirely dark brown to black, tergite 7 sometimes laterally broadly yellow. Sternites 2—6 yellow or with a narrow, more or less straight, ventral stripe. Sternite 7 as preceding sternites or dark brown except broadly yellow hind margin. Sternite 8 dark brown except brownish yellow posterior margin, posterior corners and margins of median incision.



Figs 6—8 *N. dorsalis dorsalis*. 6, ovipositor, lateral view; 7, furca and fused valvulae, dorsal view; 8, hypovalvae, dorsal view.

Hypopygium: Tergite 9 (fig. 2) distinctly swollen, the posterior margin broadly excavate medially. Posterior extension of tergite 9 divided in two parts which underlie tergite 9 and are densely set with small black spines. Basal part of od (fig. 1) moderately broad, apical part very long and slender. Id (fig. 3) small with a serrate crest and an upright projection laterally. Shell-like deformation at upper margin of sternite 9, between base of od and tergite 9, large (fig. 16). Sternite 9 with tooth like projections at upper corners. Sternite 8 extended and on median line divided soon after base so that the extended lateral parts form a pair of lobes. Adminiculum (fig. 16) with elongate ventral rods and bilobe lateral appendages of which the basal half is linked with sternite 9. The two ventral rods form small, bulbous appendages ventrally and are medially membranously connected. Aedeagus as in fig. 5, the posterior appendages are close to each other.

Female: Resembling the male. Antennae (fig. 4b) 15-segmented, very rarely with 14 segments; first flagellar segment 1.3—1.6 × length of second one. Verticils up to 2.0 × length of flagellar segments. Abdominal dorsal stripe broader than in the male, especially on posterior part of tergites 2—6, where the more or less triangular spots sometimes narrowly extend along hind margins of the tergites to contact the lateral stripe. Sternites 2—7 with a distinct ventral stripe, hind margins yellowish. Tergite 8 dark brown. Tergites 9, 10 and cerci reddish brown. Sternite 8 anteriorly dark brown, posteriorly reddish brown, sometimes with irregular darkened spots laterally. Hypovalvae reddish brown. Cerci relatively short and broad (figs 6, 30). Connection between fused valvulae and tergite 9 not sclerotized (fig. 6). Egg-slide of hypovalvae anteriorly without a vertical septum (fig. 8). Furca and fused valvulae as in fig. 7.

Biological (diagram 1)

N. d. dorsalis is found in a variety of habitats, with a preference for clearings in damp woods and brushwood vegetations along rivers and ponds.

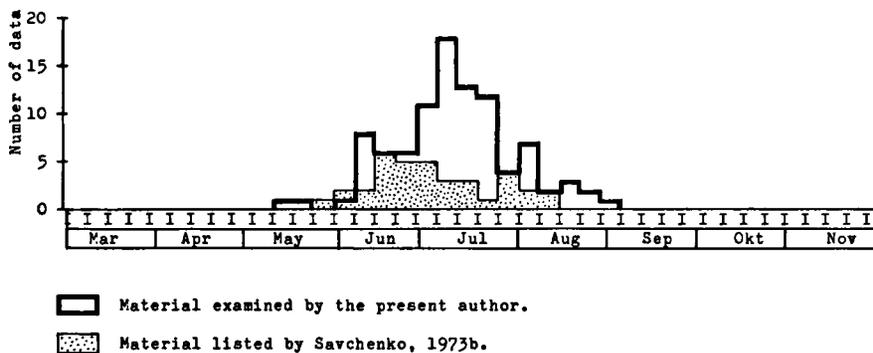


Diagram 1. Period of flight of *N. dorsalis dorsalis*.

The period of flight in northwestern Europe is from June until August with a distinct peak in July (early and late dates are: 14—15.V., Vienna, 27.VIII. & 31.VIII., Amsterdam); in the European part of the U.S.S.R. and in East Asia *d. dorsalis* is most abundant in June. Only few data refer to the developmental stages. According to Cramer (1968) the eggs hatch after 9—15 days and Beling (1878) mentions a pupal stage of seven days.

Distribution (map 1)

The distribution in the British Isles is based among others on data kindly provided by Mr. A. E. Stubbs (pers. comm., 1977). Pierre (1924a) lists the following localities for France: Lyonnais, Pyrénées, Meudon, Forêt de Chantilly, Aulnay and Rambouillet. Swiss localities are Locarno, Katzenssee, Cudrefin, Strada, and Forêt de Finges (Pfywald) near Sierre. In Italy this species is known from Tarvisio (Mannheims & Theowald, 1959) and near Turin ?; Fabricius (1781) got his Italian *dorsalis* specimens from Dr. Allioni, who lived in Turin. The collection of Carlo Allioni, placed in the Zoological Museum of the University of Turin was destroyed by fire (Zimsen, 1964; den Hollander, 1975). There are no published records from the Balkan but specimens were examined from Sinaia and the Oituz Valley (Rumania) and from Yakoruda (Bulgaria). Information on the range of *dorsalis* in the eastern palaearctic is provided by Savchenko (1973b).

Nephrotoma dorsalis sachalina Alexander, 1924

Of *dorsalis* two subspecies are known, the nominate one and *d. sachalina*, which occurs on Hokkaido, South Sakhalin and the southern Kurile. It differs from the nominate subspecies in hypopygial characters mainly (tergite 9: the two halves of the posterior extension are broader, the small black spines are less distinct and the median incision more excavate; id: anterior beak very short, dorsal crest more sclerotized, laterally without a large, upright projection; adminiculum: lateral appendages very large and of a complicated structure; see also fig. 56 in Savchenko, 1973b; further references: Alexander, 1924b: 597; 1966: 120; Savchenko, 1966a: 479; Savchenko & Krivolutzkaya, 1966: 56; Savchenko, 1970: 120).

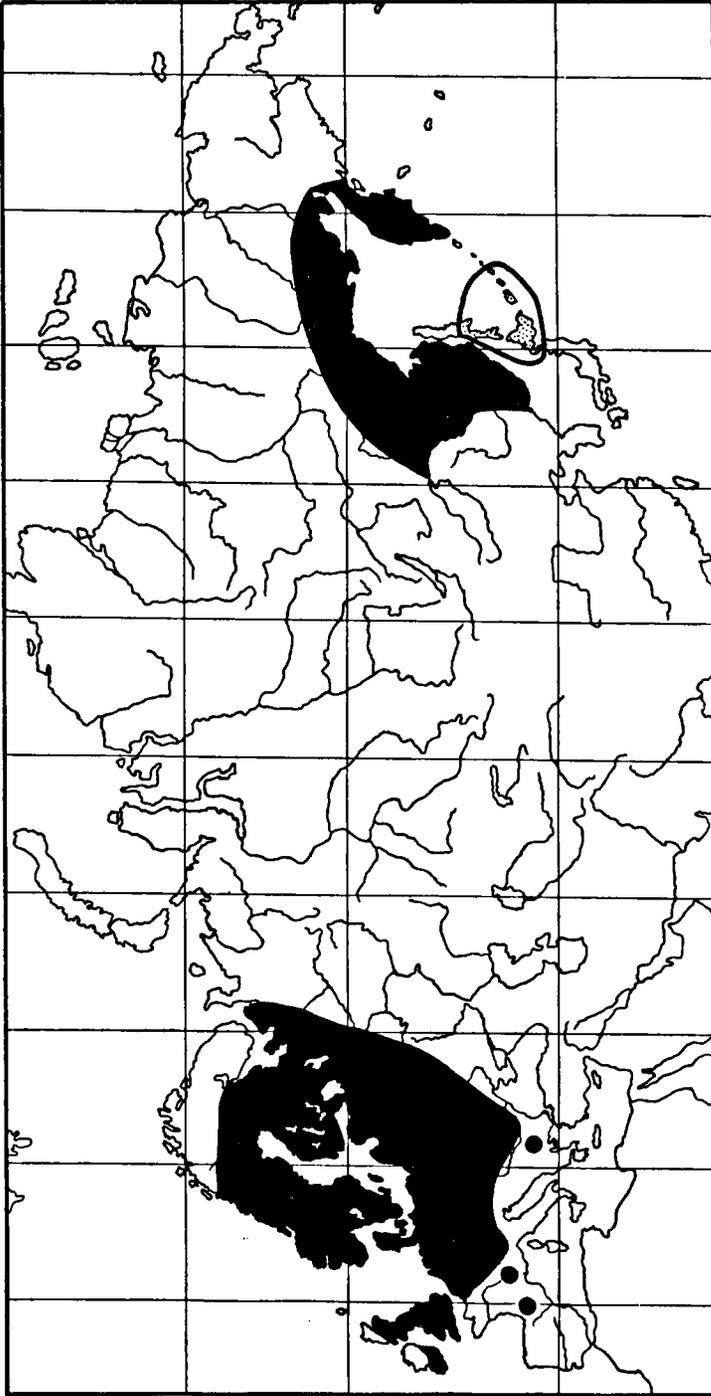
Nephrotoma quadristriata (Schummel, 1833)

Figs 9—12, 14, 24, diagram 2, map 2

Tipula quadristriata Schummel, 1833, Beiträge zur Entomologie, Breslau, 3: 109—111, figures.

Pachyrhina quadristriata: Schiner, 1864: 508; Riedel, 1910: 424—5, figures; Czizek, 1911: 59—60; Nielsen, 1919: 10; Riedel, 1919b: 18; Pierre, 1924a: 29, figures.

Pales quadristriata: Mannheims, 1951a: 32—4, 44—6; 1951b: 139; Stackelberg, 1951: 741; Fischer, 1952: 120; Mannheims, 1954b: 31, 40; Theowald, 1954b: 194; Theowald, 1956: 157; 1957a: 230; 1957b: 10—1; Mannheims & Theowald, 1959: 17; Hemmingsen, 1962: 141; Mannheims & Pechlaner, 1963: 6, 14, 23—5, biology; Mannheims, 1964c: 107; 1965: 7; Mannheims, 1966a: 276; Savchenko, 1966a: 476—8, figures; 1966d: 120; Savchenko & Violovich, 1967: 354; Savchenko, 1973b: 94—6, figures, biology.



Map 1. Distribution of *N. dorsalis*; black and larger dots: *N. dorsalis dorsalis*, heavy line and stippled: *N. dorsalis sachalina*.

Nephrotoma quadristriata: Nielsen, 1925: 153—5, figures; 1933: 245; Edwards, 1939: 243; Nielsen, 1941a: 90; 1941b: 96; Coe, 1950: 10; Tjeder, 1955b: 246—7; Mannheims, 1967a: 200 (= *lunulicornis*); 1967c: 152; Theowald, 1971: 220, 228; Mannheims & Savchenko, 1973: 162; Stubbs, 1973: 103—7, figures, biology.

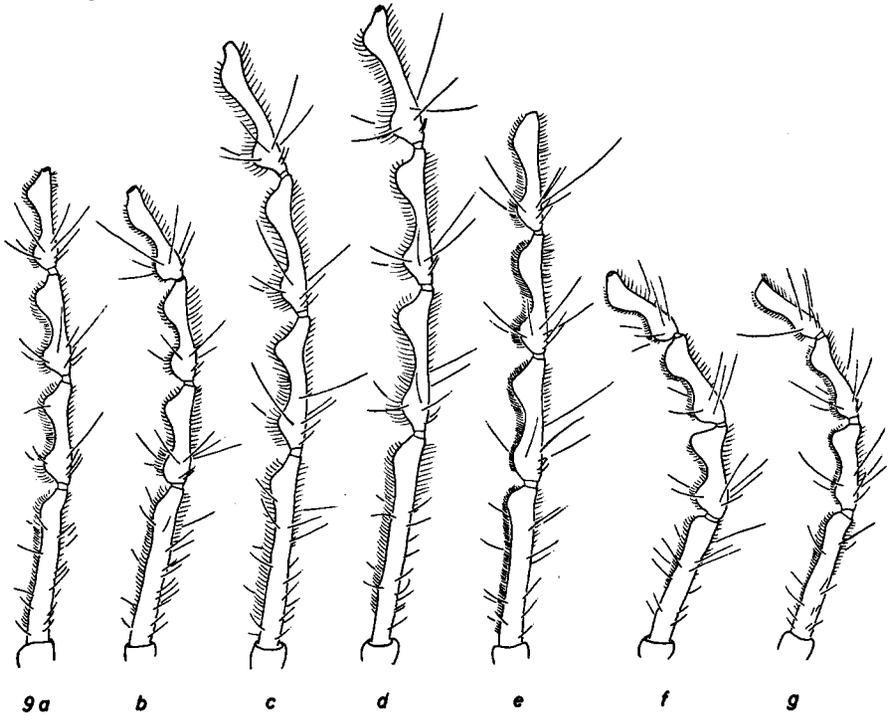
Pachyrhina schummeli Riedel, 1910, Deutsche entomologische Zeitschrift, 1910: 425—5, figures; Dodonov, 1924: 124—5; Pierre, 1924a: 30; Zsilady, 1939: 120.

Pales schummeli: Mannheims, 1951a: 45; 1951b: 139; Savchenko, 1973b: 94.

Nephrotoma duchazaudi Alexander, 1925, Annals and Magazine of Natural History, (9), 15: 405—6; Wu, 1940: 4.

Pales duchazaudi: Savchenko, 1957: 215; 1973b: 94.

Identification of *quadristriata* males is facilitated by hypopygial characters, for example the shape of sternite eight (fig. 10). Moreover the second and following flagellar segments are distinctly reniform (fig. 9), the wing-stigma is at most brown coloured and the pleural markings are usually faint. Apart from the two last-mentioned characters (found in *scurra* too) females are to be recognized by the length of the first flagellar segment, ranging from $1.8\text{--}2.2 \times$ the length of the second one. In females of the other species this ratio does not exceed 1.7. The abdominal dorsal stripe in *quadristriata* females is about as broad as the mediotergite, whereas in females of *scurra* this stripe is very narrow.



Figs 9 a—g. *N. quadristriata*, basal flagellar segments after males from: a, Terschelling, the Netherlands; b, Wales; c, Aosta, Italy; d, South Styria, Austria, paratype of *schummeli*; e, Bryansk, western Russia; f, Uvs Aimak, Mongolia; g, river Tarim, China, holotype of *duchazaudi*.

N. quadristriata is distributed throughout Europe and central Asia, the area occupied seems to be fragmented (map 2).

Type-material & Synonymy

Tipula quadristriata Schummel, 1833: The Schummel collection, which was already destroyed on the greater part, was sold (Horn & Kahle, 1937) and the types are lost. The interpretation of this species is based on the extensive original description with additional figures.

Pachyrhina schummeli Riedel, 1910: Riedel described *schummeli* after three males. A male from the Berlin Museum was designated as lectotype by Mannheims (1951b) and examined by the present author in 1976. It bears the following labels: Stelvio, 8.09/Pachyrhina Schummelii Rdl det. M. P. Riedel/Type Riedel/ex Coll. Berlin/Holotypus des Mannhs/Pales quadristriata Schumm. det. Mannheims/Pales quadristriata Schumm. E. N. Savchenko. It is in all probability the male mentioned by Riedel (1910) from "Franzenhöhe unterhalb des Ortlermassivs". A male paralectotype (labeled: lunulicornis ♂/Süd-Steiermark, prof. G. Strobl/Pachyrhina Schummelii det. M. P. Riedel/Type/Paratypoid design. Mannheims 1951/Pales quadristriata Schumm. Mannheims det. 1951: specimen from the Helsinki Museum) was examined during this study also. The synonymy with *quadristriata* was established for the first time by Mannheims (1951a).

Nephrotoma duchazaudi Alexander, 1925: The synonymy of *duchazaudi* with *quadristriata* was already under consideration by Savchenko (1973b) and is confirmed here after examination of the male holotype of the former (MNHNP, v! 0 1978, labeling: Museum Paris, Mongolie, Bords du Tarim, Mssiion de Lacoste, Dr. DuChazaud, 1909/Juillet/Holotype, Nephrotoma duchazaudi, C. P. Alexander).

Other material: 59 males and 72 females from the following countries: Great Britain, the Netherlands, West Germany, East Germany, Poland, France, Spain, Switzerland, Italy, Austria, Albania, the U.S.S.R. (Kiyev), and Mongolia.

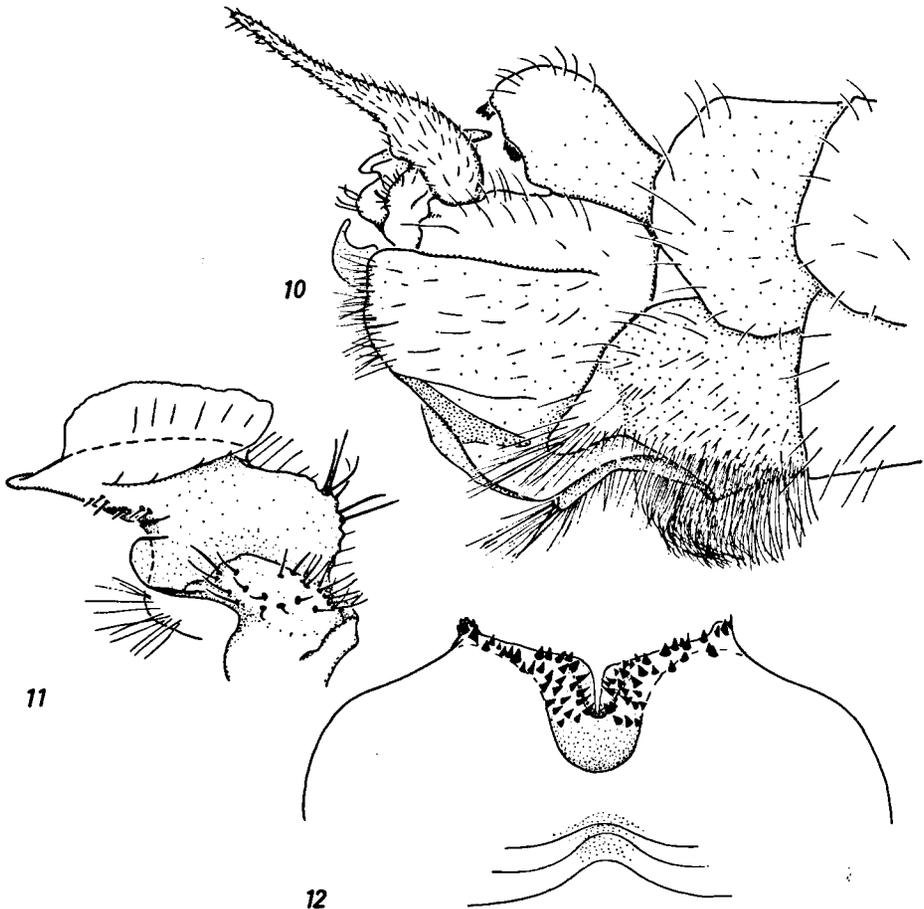
Description

Body length male: 11—15 mm, female: 14—20 mm; wing length: 11—16 mm.

Head male: Antennae 13-segmented. Scape yellow; pedicel brownish yellow; flagellar segments dark brown; first flagellar segment 1.3—1.6 × length of second one (see discussion); second and following basal flagellar segments reniform (fig. 9); verticils up to as long as flagellar segments. Palpi yellowish brown to dark brown. Nasus and dorsal part of rostrum tinged with brown, dorsal region usually yellow; lower lateral half of rostrum brownish. Genae and postgenae pale yellow; vertex yellow to brownish yellow. Large elongate spot along eye-margin between eye and neck usually present and

dark brown, sometimes inconspicuous. Frontal tubercle small. Narrow occipital marking usually distinct, dark brown, ending on top of frontal tubercle, sometimes less developed. Vertex and postgenae sparsely set with moderately long hairs.

Thorax male: Yellow dorsal part of pronotum medially sometimes tinged with brown; lateral parts of pronotum yellow, upper half and/or along anepisternite sometimes brownish. Prescutal and scutal stripes dark brown to black; lateral prescutal stripes straight. Scutellum transparently yellow, sometimes with a narrow, longitudinal, brown stripe medially. Parascutellae yellow. Lateral parts of mediotergite broadly yellow; median region with a longitudinal, brown stripe; posterior half of mediotergite transparently brownish yellow. Pleural markings usually hardly indicated, sometimes lower half of sternopleuron and posterior half of katatergite dark brown. Upper



Figs 10—12. *N. quadristriata*. 10, hypopygium, lateral view; 11, id, from outside; 12, posterior extension of tergite 9, dorsal view.

half of anatergite usually brownish, lower half yellow. Sternum 1 yellow. Coxae and trochanters yellow. Femora basally yellow, steadily growing darker apically, tips narrowly dark brown. Tibiae brown, tips dark brown. Tarsi brown to dark brown. Wings light brown toned; wing-stigma less distinct, light brown, rarely brown, with macrotrichiae; wing-tip sometimes with a few (rarely up to 10) macrotrichiae between veins R4+5-M1 and between M1-M2; basal part of vein R4+5, cross-vein R—M and wing-tip with a minor brown shade. Halteres yellow, knob slightly darkened.

Abdomen male: Dark brown dorsal stripe narrow, more or less straight, usually interrupted on anterior and posterior part of tergites, especially so on tergites 4, 5 and 6. Stripe confined to tergites 1—6, sometimes also 7 and 8, usually distinctly broadened on tergite 7 and tergite 8 almost completely dark-brown, except lighter coloured posterior margin. Lateral parts of tergites broadly brownish yellow with a dark brown stripe at lateral margin, interrupted in front of middle of tergites. Sternites yellow with a narrow, median, dark brown stripe, interrupted on anterior and posterior parts of sternites. Sternite 8 usually dark brown with lighter coloured posterior corners.

Hypopygium: Posterior extension of tergite 9 (fig. 12) with a small median incision and with small, protruding lateral corners. Od very long and slender (fig. 10). Id as in fig. 11. Median incision of sternite 8 widely V-shaped, terminating in lighter coloured lateral corners and bearing a dense tuft of downwardly directed, long, distinctly incurved, golden hairs medially (fig. 10). Adminiculum as in fig. 14, the ventral appendage form the sclerotized lateral parts of the broad, membranous ridge which is the ventral connection between the two parts of sternite 9. In dried specimens this ridge sometimes has a flap-like appearance. Aedeagus as in *d. dorsalis*.

Female: Resembling the male. First flagellar segment 1.8-2.2 × length of second one; verticils up to 1.8 × length of flagellar segments. Occipital marking usually less developed. Abdominal dorsal stripe in general very conspicuous, about as broad as mediotergite, sometimes less broad on tergite 1, anterior half of tergite 2 and the anterior parts of following tergites. Dorsal stripe usually interrupted by lighter coloured tergite hind margins, rarely extending along hind margins. Sternites and lateral parts of tergites as in the male. Tergite 8 dark brown with a broadly lighter coloured hind margin. Tergites 9, 10 and cerci reddish brown. Sternite 8 reddish brown except for dark brown anterior margin, rarely with dark reddish brown oval spots laterally. Hypoalvae reddish brown. Hypoalvae, furca and fused valvulae as in fig. 24; sternite 8 posteriorly less broad and gradually narrowing to the point where it meets the hypoalvae. Cerci as in *helvetica*.

Biology (diagram 2)

Pechlaner (in Mannheims & Pechlaner, 1963) collected *quadristriata* in Tirol in scrub vegetations of well-marshes and along mountain streams, at

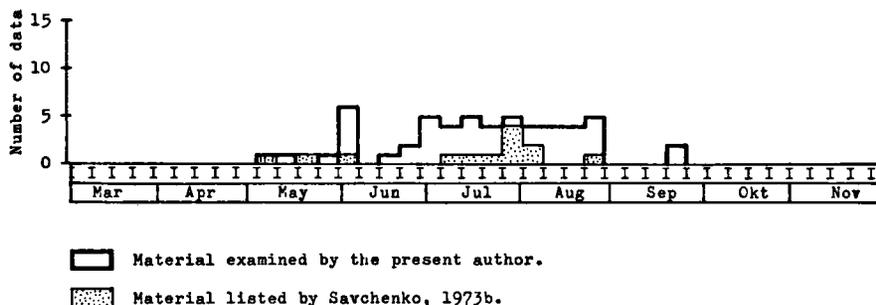


Diagram 2. Period of flight of *N. quadristriata*.

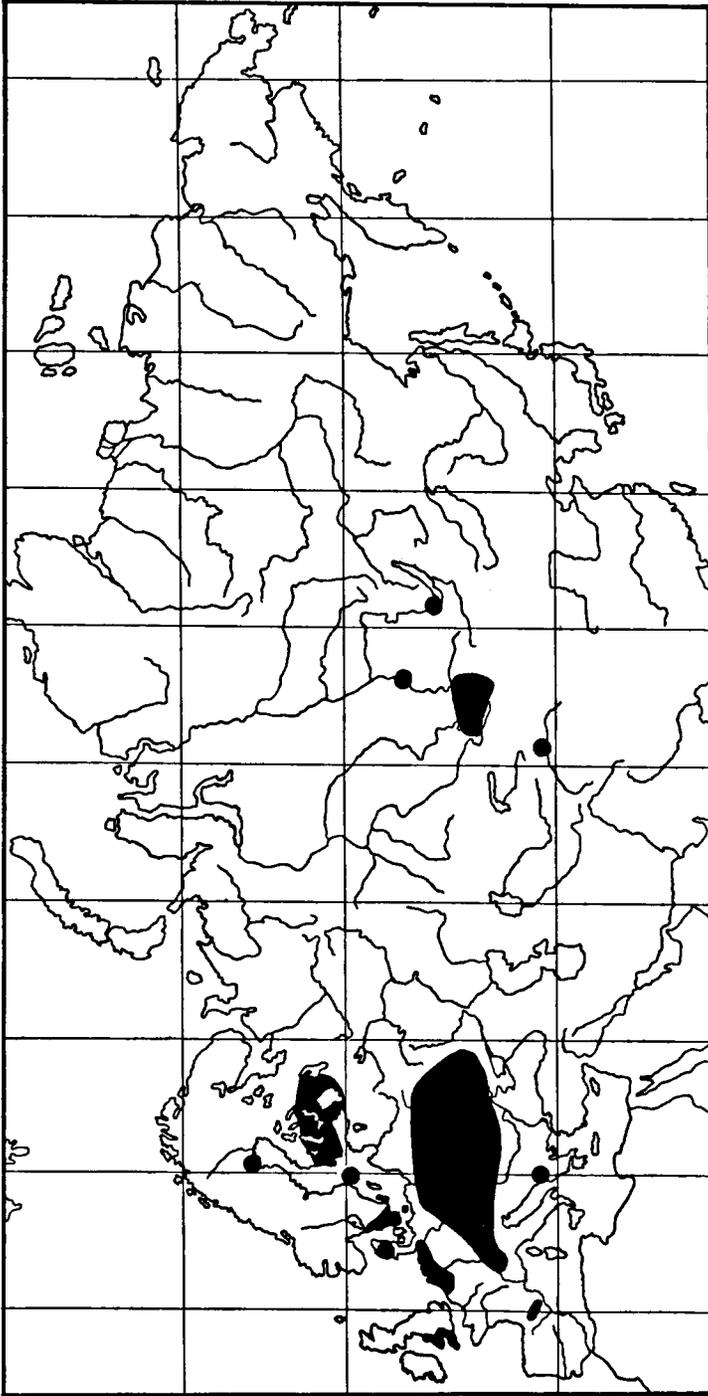
altitudes of 800—1500 m. He also mentions, as does Savchenko (1973b), clearings in deciduous forests. Stubbs (pers. comm., 1977) states that *quadristriata* in Great Britain has a marked affinity with certain west coast sand dunes, occurring around the edge of sparsely vegetated slacks.

The period of flight is from May (6.V, 16.V, the Netherlands; 9.V, Ukraine) until the end of August (20.IX, 23.IX, the Netherlands). In Central Asia *quadristriata* has been recorded from 1.VI-25.VIII.

Distribution (map 2)

The distributional range of *quadristriata* seems to be very fragmented. The Swedish records are apparently coastal (Tjeder, 1955b) as is true for the localities in Britain (Wales: Newborough, Cricceith, Harlech, Portmadoc, Dyffryn near Llanabar, Gower; S.W. England: Braunton, Studland: see Stubbs' comment under biology), Belgium (Coxyde Bains, Theowald, 1971), and West German (Wilhelmshaven, Hamburg). In the Netherlands a number of localities are coastal (Terschelling, Heemstede, Oostvoorne, Valkenisse near Biggekerke) but others are not (Emmeloord, Marknesse, Nijetrijne, Leusden, Baarn, Sloten NH). In Denmark Nielsen (1919, 1925, 1941a, 1941b) mentions coastal (Bornholm) as well as inland (Silkeborg) localities. In central western Europe the species is known from one locality in France (Fet de la Joux, referring to one of the two "Forêt de la Joux" in the Jura; 1 ♀, MNHNP, v! 0 1976), from Schwaben (West Germany, Fischer, 1952), Switzerland (Cudrefin, Siders, Locarno, Strada), from the Italian Alps (Entrèves, Valle di Ferret, Stelvio, Condino) and Austria. Outrange localities are Torla and Pont de Suert-Veilla at the southern slopes of the Pyrenees and "S. Albania" (1 ♂, without locality, alt. 1036 m, v! 0 1977, BMNH).

The localities from which *quadristriata* has been reported in central Asia lie in the following regions: Tuvinskaya obl. (Savchenko & Violovich, 1967), Uvs Aimak, Bayan-Ölgiy Aimak, Hovd Aimak (Mannheims & Savchenko, 1973), Gorno-Altayskaya avt. obl., Krasnoyarsk, Tuvinskaya obl., Irkutskaya obl., Vost. Kazakhstanskaya obl. (Savchenko, 1973b). The type-locality of



Map 2. Distribution of *N. quadristriata*.

duchazaudi, Mongolie, bords du Tarim, probably refers to the T'a-li-mu river in Sinkiang, China.

Discussion

The flagellar segments of *quadristriata* show some variability in length. Especially in males from northern Europe and central Asia these segments are relatively short (figures 9 A-G are drawn after males from the Netherlands, Great Britain, Italy, Austria — paratype of *schummeli* — western Russia, Mongolia, and China — holotype of *duchazaudi* —). Riedel (1910) characterized *schummeli* by the antennal shape and length (see also Mannheims, 1951a: 45) but the differences found in the antennal length are not interpreted here as a base for infraspecific ranking, a view sustained by Savchenko (pers. comm., 1978).

***Nephrotoma lunulicornis* (Schummel, 1833)**

Figs 15, 19—23, 31, diagram 3, map 3

The male hypopygium of *lunulicornis* is very characteristic, the ninth sternite ventrally bears a flattened projection that protrudes between the distinctly bifid sternite eight (fig. 20). The male flagellar segments are nodulose basally. In both sexes the wing-stigma as well as the occipital marking are conspicuous, the latter basally about half as broad as the neck. Discrimination of *lunulicornis* and *dorsalis* females is, apart from the number of antennal segments, thirteen in *lunulicornis* and fifteen in *dorsalis*, facilitated by the shape of the cerci (figs 30 & 31). In females of *austriaca* the occipital marking is basally about as broad as the neck, the verticils range up to 1.1 × the length of the flagellar segments (in *lunulicornis* females up to 1.6), and the furca is slightly bifurcate (distinctly so in *lunulicornis*, fig. 23).

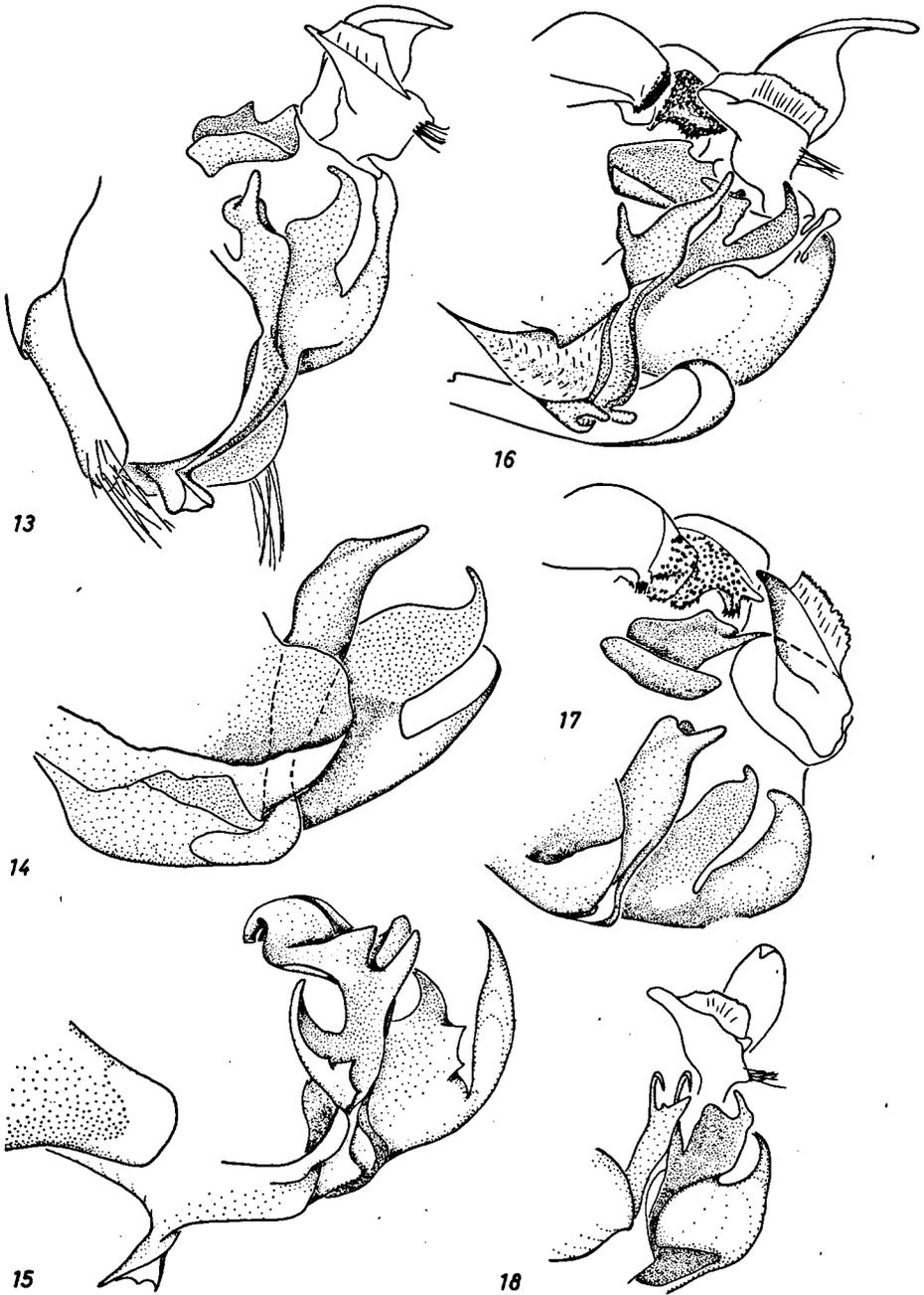
N. lunulicornis, widely distributed throughout Europe and central Asia, is represented in the Tuva region and eastern Asia by the subspecies *angustistria* Alexander, 1925 (map 3).

***Nephrotoma lunulicornis lunulicornis* (Schummel, 1833)**

Tipula lunulicornis Schummel, 1833, Beiträge zur Entomologie, Breslau, 3: 107—8, figures.

Pachyrhina lunulicornis: Schiner, 1864: 504; van der Wulp, 1866: 17; Grzegorzek, 1873: 26; Kowarz, 1873: 455; van der Wulp, 1877: 378, figures; Beling, 1878: 41—2, (= *dorsalis dorsalis*); Westhoff, 1882: 48, figures, biology; Bergroth, 1888: 655; Huguenin, 1888: 18; Strobl, 1895: 85, biology; 1898: 292, biology; van der Wulp & de Meijere, 1898: 28; Strobl, 1900c: 192; Thalhammer, 1900: 20; Jacobs, 1903: 352; Wahlgren, 1905: 132; Lundström, 1907: 24; Riedel, 1910: 421—5, 431; Czižek, 1911: 59—61, 63, 73; Lundström, 1912: 47; Riedel, 1918/1919: 5; Nielsen, 1919: 11; Riedel, 1919b: 18; Goetghebuer & Tonnoir, 1921: 123; Pierre, 1921a: 24 (= *alluaudi* or *subanalis*); Brolemann, 1923: 492—5, figures; Dodonov, 1924: 124; Pierre, 1924a: 29, figures, biology; Lackschewitz, 1927: 4; Zangheri, 1949: 12; Simova, 1959: 127.

Pales lunulicornis: Audcent, 1932: 10; Mannheims, 1951a: 32—4, 44—6; 1951c: 228; Stackelberg, 1951: 741; Fischer, 1952: 120; Brauns, 1954: 70, biology; Mannheims, 1954b: 31, 40; Savchen-



Figs 13—18. Hypopygia, inside view (upper left part of sternite 9 and left lateral appendage of adminiculum removed) after males from: 13, *austriaca*; 14, *quadristriata*; 15, *lunulicornis lunulicornis*; 16, *dorsalis dorsalis*; 17, *scurra*; 18, *helvetica*.

- ko, 1954: 635, biology; Theowald & Mannheims, 1956: 248—9; Savchenko, 1957: 222; Theowald, 1957a: 227, biology; 1957b: 10—1; Mannheims & Theowald, 1959: 17 (= *austriaca*); Erhan & Theowald, 1961: 249; Hemmingsen, 1962: 141; Höchstetter, 1962: 106; Mannheims, 1963: 39; Mannheims & Pechlaner, 1963: 6, 14, 23—25, figures, biology; Röseler, 1963: 446, biology; Mannheims, 1964c: 107—8; 1965: 7; Mannheims, 1966a: 276; Savchenko, 1966a: 474—7, figures; 1966d: 120; Zangheri, 1969: 1024; Simova, 1974: 26; 1977: 26, 79—80, figures.
- Pales lunulicornis lunulicornis*: Savchenko, 1973b: 89—91, figures, biology.
- Nephrotoma lunulicornis*: Nielsen, 1925: 151—2, figures; Alexander, 1931: 145, biology; Lackshewitz, 1933: 249; 1935b: 17, 22; Edwards, 1939: 244; Grensted, 1944: 176; Coe, 1950: 10; Tjeder, 1955b: 246—7; Coe, 1960: 44, biology; Mannheims, 1967c: 152; Theowald, 1967: 20, 64, biology; Theowald, 1971: 220; Savchenko, Violovich & Narchuk, 1972: 77—8, 82—3, 93, biology; Stubbs, 1973: 103—7, figures, biology; Klopp, 1974: 157, figures, biology; Stewart, 1975: 185, biology; Mannheims & Thomas, 1976: 384.
- Tipula picta* Meigen, 1838, Systematische Beschreibungen, 7: 35—6.
- Pachyrhina picta*: Riedel, 1910: 434; Czižek, 1911: 77—8.
- Pales picta*: Mannheims, 1951a: 45; 1951c: 228; 1964c: 107.
- Nephrotoma picta*: Klopp, 1974: 157.
- Pales quadristriata*: Mannheims, 1967a: 200.

Type-material & Synonymy

Tipula lunulicornis Schummel, 1833: The Schummel collection, being already destroyed on the greater part, was sold (Horn & Kahle, 1937) and the types are apparently lost. The original description however is very clear (as are in general all Schummel's descriptions) which is true also for the description made by Schiner (1864) after "Schummel'schen Originalstücken".

Tipula picta Meigen, 1838: One female in the Meigen collection (MNHNP; v! M 1950; v! O 1976). This species was interpreted by Czižek (1911) as synonymous with *cornicina*, by Riedel (1910) and Mannheims (1951a) as with *scurra*. Examination of the type revealed its synonymy with *lunulicornis*.

Other material: 61 males and 57 females from the following countries: Norway (Lillehammer), Sweden, Great Britain, the Netherlands, Belgium, West Germany, East Germany, Czechoslovakia, France (Meurthe et Moselle, Hautes Pyrénées), Andorra, Switzerland, Italy (Novara), Austria, Yugoslavia and Bulgaria (Yakoruda).

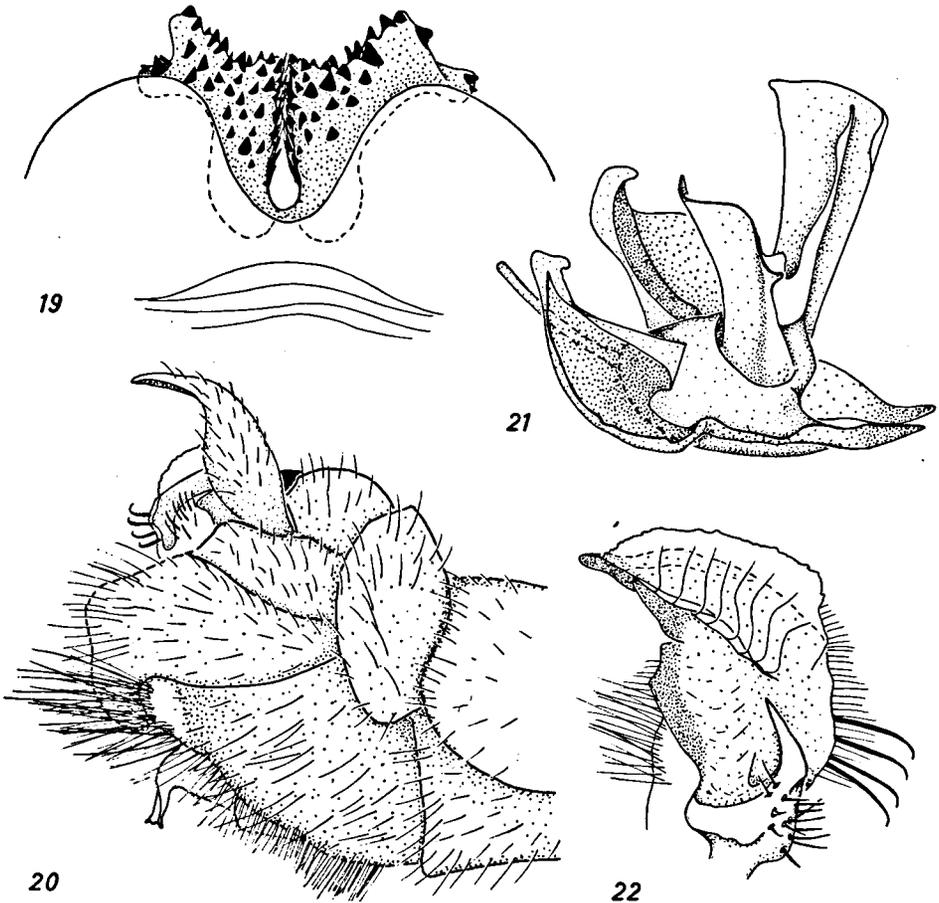
Description

Body length male: 11—15 mm, female: 14—20 mm; wing length: 11—17 mm.

Head male: Antennae 13-segmented. Scape yellow, apically darkened; pedicel brown to dark brown; flagellar segments dark brown, sometimes pedicel and basal flagellar segments distinctly lighter coloured than antennal apex; first flagellar segment 1.2 × length of second one; second and following flagellar segments nodulose basally; verticils up to 0.8 × length of flagellar segments. Palpi brown to dark brown. Nasus brown. Dorsal part of rostrum brownish, medially yellow; lower lateral half of rostrum brown.

Genae and postgenae pale yellow. Vertex brownish yellow, between eyes and neck usually with distinct, brown to dark brown, elongate spots along eye-margin. Frontal tubercle small. Narrow triangular occipital marking distinct, dark brown, ending on top of frontal tubercle. Hairs on vertex and postgenae moderately long and usually sparsely set. Dark brown markings on postgenae small, brown to dark brown.

Thorax male: Pronotum dorsally yellow, laterally, especially where in contact with anepisternite, dark brown. Prescutal and scutal stripes dark brown to black. Lateral prescutal stripes straight. Scutellum more or less transparent, brownish yellow, sometimes with a narrow brown stripe medially. Parascutellae yellow. Mediotergite laterally yellow, median region ranging from transparent to dark brown, posterior part broadly dark brown.



Figs 19—22. *N. lunulicornis lunulicornis*. 19, posterior extension of tergite 9, dorsal view; 20, hypopygium, lateral view; 21, aedeagus; 22, id, from outside.

Pleural markings usually distinct, ranging from brown to black. Anatergite brown. Sternum 1 yellow. Coxae yellow, basally darkened. Trochanters yellow. Femora basally yellow, steadily growing darker towards dark brown tips. Tibiae and tarsi brown to dark brown. Wings light brown toned; wing-stigma distinct, brown to dark brown, with macrotrichiae; basal part of vein R4 + 5, cross-vein R-M and wing-tip with a brown shade. Halteres brownish.

Abdomen male: Tergites 1—6 with a narrow, more or less straight, brown to dark brown dorsal stripe; hind margins of the tergites lighter coloured. Tergites 1—6 laterally yellowish brown, with a dark brown to black stripe at lateral margin, with small intervals in front of middle of tergites. Anterior part of tergite 7 yellowish brown, posterior part dark brown to black. Tergite 8 dark brown to black. Sternites 1—6 yellow, with a narrow, median, dark brown stripe at anterior parts of sternites. Sternite 7 usually dark brown to black, sometimes laterally yellowish brown. Sternite 8 dark brown to black, posterior corners pale yellow.

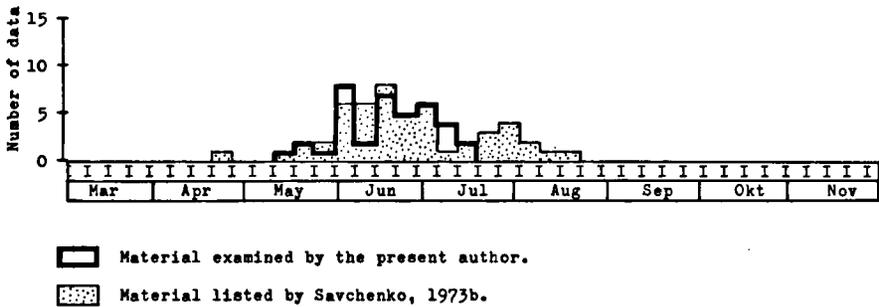
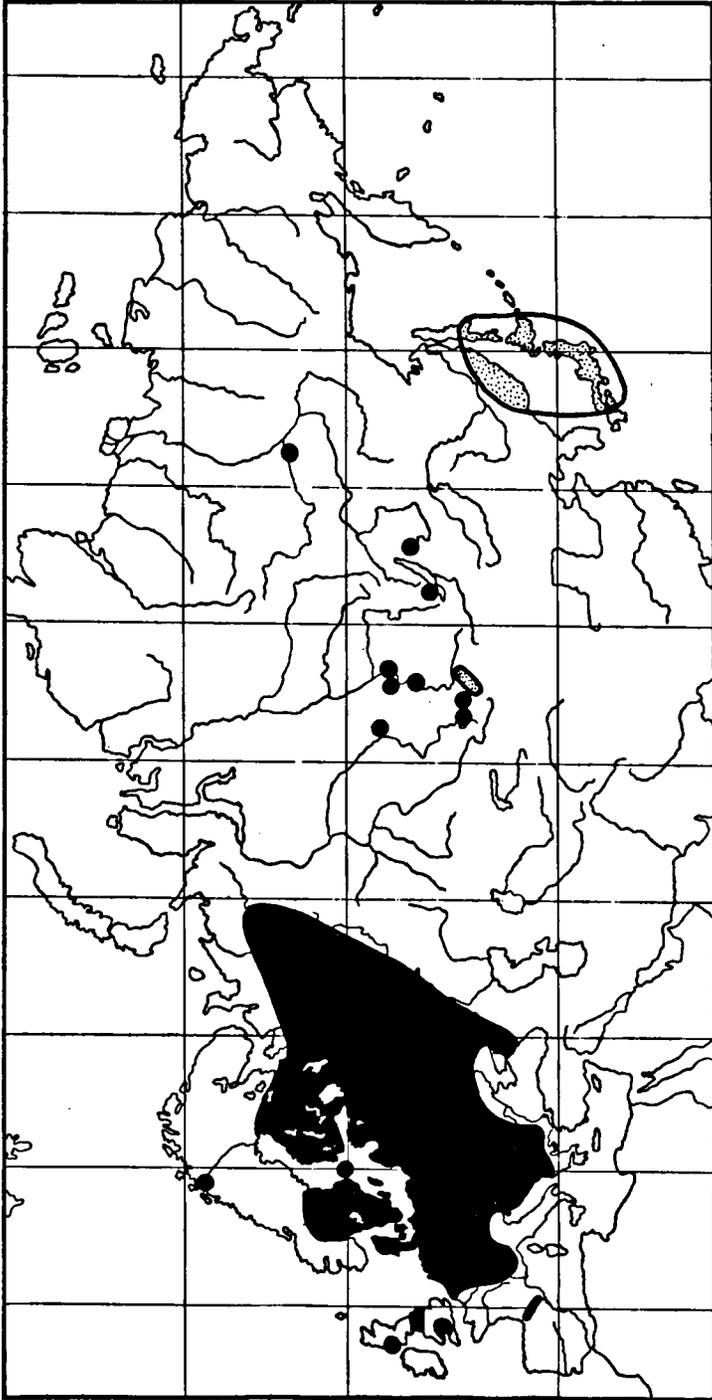


Diagram 3. Period of flight of *N. lunulicornis lunulicornis*.

Hypopygium: Tergite 9 (fig. 19) with a widely incised outer margin and a distinctly developed posterior extension. The latter bears relatively large black spines, has protruding lateral corners and a long and narrow median incision. Basal part of od (fig. 20) moderately broad, apical part slender. Id (fig. 22) with a distinct crest and an acute projection laterally. Sternite 8 soon after base with a median incision that gradually widens, terminating laterally in brighter coloured, more or less rounded knobs which bear long golden hairs. The basal part of the incision is closed by a membrane. Basal part of adminiculum (fig. 15) laterally linked with sternite 9; ventral appendages of adminiculum membranously connected with the small, flattened projection that sticks out between the lateral parts of sternite 8. Aedeagus as in fig. 21.

Female: Resembling the male. First flagellar segment 1.2—1.6 × length of second one; verticils up to 1.6 × length of flagellar segments. Abdominal colouration as described for the male; dorsal stripe usually broader and not interrupted by lighter coloured tergite hind margins, but narrowly extending along tergite hind margins. Tergite 8 usually entirely dark brown to black.



Map 3. Distribution of *N. lunulicornis*; black and larger dots: *lunulicornis lunulicornis*, heavy line and stippled: *lunulicornis angustistria*.

Tergite 9 ranging from yellowish brown to black. Tergite 10 and cerci reddish brown. Sternites with a broad, dark brown to black, median stripe. Sternite 8 entirely dark brown to black or posteriorly lighter coloured with large, oval, black dots laterally. Hypovalvae reddish brown. Egg-slide of hypovalvae (fig. 23) densely set with small bristles and anteriorly without a vertical septum; fused valvulae broad, furca distinctly furcate. Cerci relatively long and slender (fig. 31).

Biology (diagram 3)

N.l. lunulicornis is a woodland species, especially frequent at moist, shaded places near streams and rivers, or clearings and edges of deciduous forests. In addition Strobl (1895) mentions marshes and reed-plots, and Coe (1960) highland meadows. The larvae live in humic woodland soils. The main period of flight (diagram 3) is in June. Early dates are 22.IV and 9-10.V (Kiev), late records are 12.VIII (Krasnoyarsk) and 19.VIII (Vologodskaya Oblast').

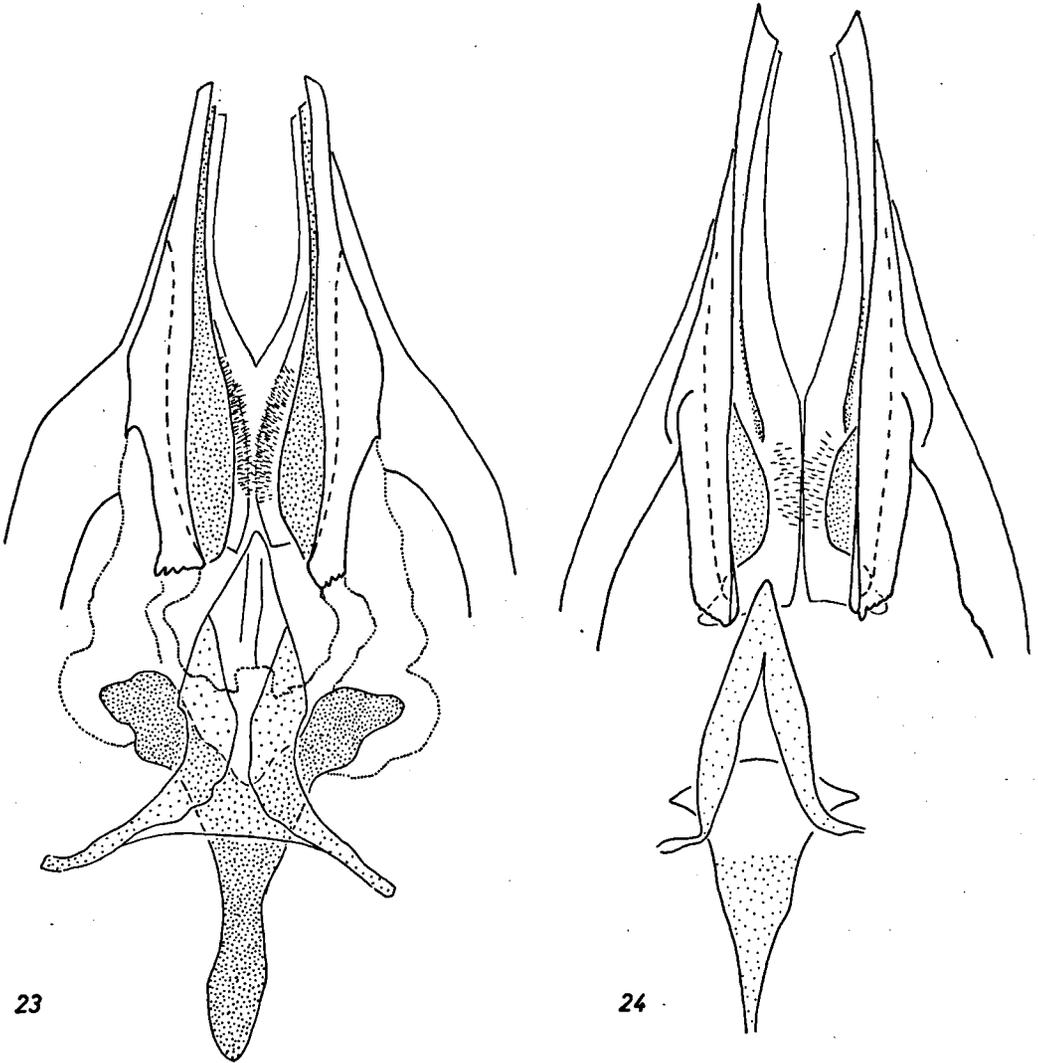
Distribution (map 3)

Norwegian localities are Tøjen (Lackschewitz, 1933), Ravand (Lackschewitz, 1935, not yet traced) and Lillehammer (v! 0 1977). In Great Britain, Stubbs (pers. comm., 1977) mentions two distinct areas: southern Wales-Herford-Gloucester-Somerset and York-Lancaster; Stewart (1975) lists *lunulicornis* from South-West Scotland. French localities are all north of the line Paris-Lyon or in the Pyrenees (Brolemann, 1923; Mannheims & Thomas, 1976; also known from Andorra, v! 0 1977). The only Italian specimen is a female from Novara, Maggiore (v! 0 1977); the other Italian specimens (Tarvisio, Mannheims & Theowald, 1959) belong to *austriaca* and the record by Zangheri (Forli, 1949) has not been confirmed since. The same applies for Morocco, Moyen Atlas (Pierre, 1921a, see distribution *subanalis*). Bulgarian specimens were examined from Yakoruda. The localities from which the nominate *lunulicornis* is known in central and eastern Asia are represented on map 3 by dots (near Krasnoyarsk, near Minusinsk, the Tomskaya obl., the Gorno-Altayskaya avt. obl., the Irkutskaya obl., the Buryatskaya ASSR and the Yakutskaya ASSR).

Nephrotoma lunulicornis angustistria Alexander, 1925

N. lunulicornis is considered to comprise two subspecies, the nominate one and *l. angustistria*, interpreted as a subspecies by Savchenko & Violovich (1967). The distribution area of *l. angustistria* is South Primorye, South Sakhalin and the Japanese Islands Honshu and Hokkaido. To this Savchenko & Violovich (1967) add the Tuva region (river Kemchik, Teli and Erzin). According to Savchenko (1973b) *l. angustistria* differs from *l. lunulicornis* in the following characters: the flagellar segments are distinctly bicolourous, brown with broadly yellow bands basally; the prescutal stripes are shining

dark brown, the inner stripe often with a lighter coloured median line; the hypopygium is conspicuously thickened, the posterior extension of tergite 9 has the lateral corners prolonged backwards and bluntly ending, the id has hardly indicated tubercles basally, the anterior beak of the id is more straight, the od is somewhat broader with the apical part longer and more slender. The specimens on which the Tuva records are based show the above mentioned differences (Savchenko, pers. comm., 1978).



Figs 23—24. Hypovalvae, furca and fused valvulae of: 23, *lunulicornis lunulicornis*, dorsal view; 24, *quadristriata*, dorsal view.

***Nephrotoma scurra* (Meigen, 1818)**

Figs 17, 26—28, diagram 4, map 4

- Tipula scurra* Meigen, 1818, Systematische Beschreibungen, 1: 198; Schummel, 1833: 112, figures; Zetterstedt, 1838: 845.
- Pachyrhina scurra*: Macquart, 1834: 90; Staeger, 1840: 26; Zetterstedt, 1851: 4000—2; 1852: 4361; van der Wulp & Snellen van Vollenhoven, 1853: 144; Walker, 1956: 332; Zetterstedt, 1860: 6544; Schiner, 1864: 506; van der Wulp, 1866: 17; Palm, 1869: 407; Grzegorzek, 1873: 27; van der Wulp, 1877: 380—1; Westhoff, 1880: 49, biology; Wallengren, 1882: 14; Westhoff, 1882: 48, figures; Verrall, 1886: 119; Bergroth, 1888: 656; Huguénin, 1888: 20; Kowarz, 1894: 7; Strobl, 1895: 85; van der Wulp & de Meijere, 1898: 29; Strobl, 1900c: 192; Thalhammer, 1900: 20; Jacobs, 1903: 352; Wahlgren, 1905: 133; Becker, 1907: 240 (= *alluaudi*?); Lundström, 1907: 25; Riedel, 1910: 422, 427, 434—6; Czižek, 1911: 62—4, 73, figures; Lundström, 1912: 47; Vimmer, 1913: 18; Nielsen, 1918: 10; Riedel, 1918/1919: 5; 1919b: 18; Goetghebuer & Tonnoir, 1921: 123; Stackelberg, 1922: 16; Brolemann, 1923: 495—8, figures; Alfken, 1924: 434; Pierre, 1924a: 29, figures, biology; Weigand, 1924: 46.
- Pales scurra*: Audcent, 1932: 9; Mannheims, 1951a: 17, 33—4, 42, 45—6, 50; 1951c: 228; Stackelberg, 1951: 741—2; Fischer, 1952: 120; Hemmingsen, 1952: 409; Mannheims, 1954b: 31, 40; Theowald & Mannheims, 1956: 249; Theowald, 1956: 159; 1957a: 229, figures, biology; 1957b: 10—1, biology; Mannheims & Theowald, 1959: 17; Simova, 1960: 58; Erhan & Theowald, 1961: 249; Erhan, 1962: 96—7, figures; Hemmingsen, 1962: 141; Höchstetter, 1962: 38, 48, 60, 80—1, 106, figures, biology; Zinovjev & Savchenko, 1962: 567—9, biology; Mannheims, 1963: 39; Mannheims & Pechlaner, 1963: 6, 14, 23, biology; Mannheims, 1964c: 107; 1965: 7; 1966a: 276; Savchenko, 1966a: 472—4, figures; 1966c: 94; 1966d: 120; 1973b: 84—6, figures, biology; Simova, 1974: 26; 1977: 26, 82—3, figures.
- Nephrotoma scurra*: Nielsen, 1925: 158—9, figures; Lackschewitz, 1933: 249; Nielsen, 1933: 245; Lackschewitz, 1935b: 17, 22; Edwards, 1939: 244; Nielsen, 1941b: 96; Grensted, 1944: 176; Coe, 1950: 9; Tjeder, 1955b: 246—7; Brindle, 1960: 86, 101, figures, biology; Tjeder 1965: 46; Mannheims, 1967a: 199; 1967b: 152; Mannheims & Savchenko, 1967: 149; Theowald, 1967: 19, 64, biology; Tjeder, 1967: 21; Freeman, 1968: 342, 346, biology; Theowald, 1971: 220, 228; Savchenko, Violovich & Narchuk, 1972, 77—8, 82—3, 93, biology; Stubbs, 1973: 104—7, figures, biology; Klopp, 1974: 143, 156, figures, biology.
- Tipula nodulosa* Brullé, 1832, Expédition scientifique de Morée, 3: 290—1; Riedel, 1910: 435—6.
- Pales nodulosa*: Mannheims, 1951a: 45—6; Savchenko, 1973b: 84.
- Nephrotoma microcera* Alexander, 1921, Annals of the Entomological Society of America, 14: 133—4; Masaki, 1933: 91.
- Pales microcera*: Savchenko, 1973b: 84.

In *scurra* the colouration of the body is extensively yellowish brown, presumably in relation to its nocturnal activity. The male antennae are relatively short. In both sexes the occipital marking is usually basally indicated only, the wing-stigma is faint (rarely brown), the pleural markings are less developed, and the abdominal dorsal stripe is very narrow.

N. scurra is widely distributed throughout the Palaearctic between 40° N.L. and 70° N.L. (map 4).

N. profunda, according to Savchenko (1973b) a subspecies of *scurra*, is given here species rank (see discussion).

Type-material & Synonymy

Tipula scurra Meigen, 1818: One male in the Meigen collection (MNHN; v! M 1950, v! 0 1976).

Tipula nodulosa Brullé, 1832: Types lost? According to Horn & Kahle (1937) the specimens from the Morea Expedition in 1830 are in the Paris Museum, but Brullé-types could not be traced there. The synonymy with *scurra* was proposed by Mannheims (1951a).

Nephrotoma microcera Alexander, 1921: Type-series (holotype male from Tokio, allotype and 3 male, 2 female paratopotypes, 2 male paratypes from Sapporo) in the Alexander collection, Amherst, Massachusetts). Savchenko (1973b) synonymized *microcera* with *scurra* (see discussion).

Other material: 305 males and 254 females from the following countries: Norway, Sweden, Finland, Great Britain, the Netherlands, Belgium, Luxemburg, West Germany, East Germany, Poland, France, Switzerland, Italy, Austria and the U.S.S.R. (Latviya, Livny-Sosna).

Description:

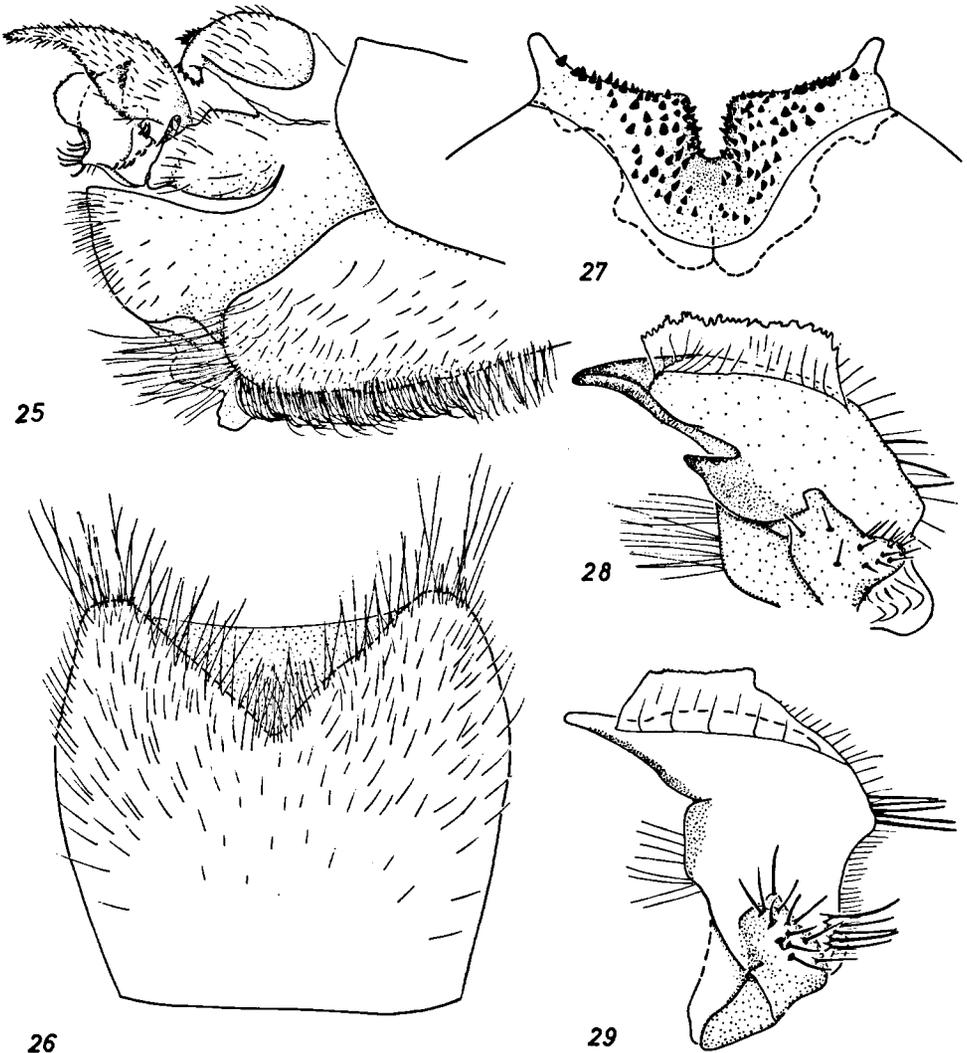
Body length male: 16—21 mm, female: 20—24 mm; wing length: 13—18 mm.

Head male: Antennae 13-segmented. Scape yellow, pedicel and first flagellar segment ranging from yellow to dark brown, following flagellar segments dark brown with the basal nodes sometimes lighter coloured; first flagellar segment 1.2—1.4 × length of second one; second and third flagellar segment reniform, following segments slightly reniform to nodulose basally only; verticils up to as long as flagellar segments. Palpi light to dark brown. Nasus brownish. Dorsal part of rostrum usually yellow, sometimes tinged with brown; lower lateral half of rostrum sometimes brownish to dark brown. Genae pale yellow. Vertex brownish yellow. Upper half of postgenae pale yellow to brownish, lower half pale yellow. Frontal tubercle small. Brown to dark brown occipital marking narrow, usually indicated posteriorly only, sometimes absent, rarely very conspicuous all over and ending on top of frontal tubercle. Hairs on vertex and postgenae variable, usually moderately long and densely set.

Thorax male: Pronotum yellowish brown, lateral posterior margin frequently dark brown. Median prescutal stripe ranging from brown to black, lateral margins generally lighter coloured. Straight lateral prescutal stripes and scutal stripes ranging from transparently brown to black, usually dark brown with broad, lighter coloured, lateral margins. Scutellum transparent, yellow to brown. Parascutellae yellow. Lateral parts of mediotergite broadly yellow; median region with a light brown or transparently brown, longitudinal stripe; posterior part of mediotergite transparently brown. Pleural markings less conspicuous, usually transparently brown, sometimes dark brown at lower half of sternopleuron and posterior half of katatergite. Anatergite yellow, frequently tinged with brown dorsally. Sternum 1 yellow. Coxae and trochanters yellow. Femora yellow, steadily growing darker towards brown apices, extreme tips dark brown. Tibiae light brown, tips slightly darkened. Tarsi brown to dark brown. Wings

light brown toned; wing-stigma hardly indicated, rarely brown, with macrotrichiae. Halteres light brown.

Abdomen male: Brown to dark brown dorsal stripe very narrow, more or less straight, usually confined to tergites 1—7, sometimes 1—8. Stripe broadly interrupted at anterior and posterior parts of tergites, especially at tergites 4—7. Lateral parts of tergites broadly yellowish brown with a brown to dark brown stripe at lateral margins of tergites 2—7, sometimes 2—8,



Figs 25—29. *N. profunda*, hypopygium after a male paratype from Ch'eng-tu, Szechwan, China. *N. scurra*. 26, sternite 8, ventral view; 27, posterior extension of tergite 9, dorsal view; 28, id, from outside. 29. *N. austriaca*, id, from outside.

these stripes interrupted in front of middle and at posterior corners of tergites. Sternites yellow with a narrow, brown to dark brown, more or less straight, median stripe on sternites 1—6 or 1—7, interrupted by lighter coloured hind margins of sternites. Segment 8 yellowish brown to reddish brown, sometimes anteriorly darkened.

Hypopygium: Tergite 9 laterally even more tumid than in *d. dorsalis*. Posterior extension of tergite 9 medially with a small incision and divided in two halves which underlie the posterior margin of tergite 9 and are densely set with small, black spines (fig. 27). Od twice as long as wide, apical part not as elongate as in *d. dorsalis*. (fig. 1). Id as in fig. 28. Posterior margin of sternite 8 with a widely V-shaped median incision of which at least the basal half is closed by a membrane; posterior margin with long golden hairs (fig. 26). Lateral appendages of adminiculum not bilobe, basally linked with sternite 9; ventral rods of adminiculum narrow, without bulbous appendages (fig. 17). Aedeagus as in *d. dorsalis*.

Female: Antennae 13-segmented, usually lighter coloured than in the male; first flagellar segment $1.6-1.7 \times$ length of second one; verticils up to $1.3 \times$ length of flagellar segments. Occipital marking frequently absent or hardly indicated, rarely conspicuous and prolonged on top of frontal tubercle. Lateral prescutal stripes and especially scutal stripes usually less darkened than medial prescutal stripe. Abdominal colouration as found in the male but dorsal stripe less interrupted at anterior parts of tergites. Tergite 8 usually coloured as preceding tergites, sometimes darkened. Tergites 9, 10, cerci, sternite 8 and hypovalvae light reddish brown; sternite 8 usually without darkened, oval spots laterally, but sometimes darkened anteriorly. Copulatory organs as in *quadristriata*, but cerci as long as in *l. lunulicornis* (fig. 31).

Biology (diagram 4)

N. scurra is a very abundant species, on the wing in Europe from June until the second half of September (diagram 7; early dates are 5.VI., Belgium and 6.VI., Great Britain; late dates are 26.IX. and 29.IX., the Netherlands). The period of flight in eastern Europe and Asia lasts until the second half of August, as is apparent from the data provided by Savchenko (1973b).

The habitat is circumscribed by Stubbs (1973) as "can occur on open sandy heaths, though it is also found in dry woods and hedgeròws" and the same opinion is reflected by Westhoff (1880), Höchstetter (1962), Theowald (1957b), and Savchenko (1973b), the latter adding "humid brush-wood" which is the refence made by Pierre (1924a) also. There is only few information about the developmental stages. According to Höchstetter (1962) the development of the eggs takes 9 days, and Savchenko (1973b) presumes that the first and second stage larvae hibernate. He also reports that full-grown larvae can damage, among others, lupine.

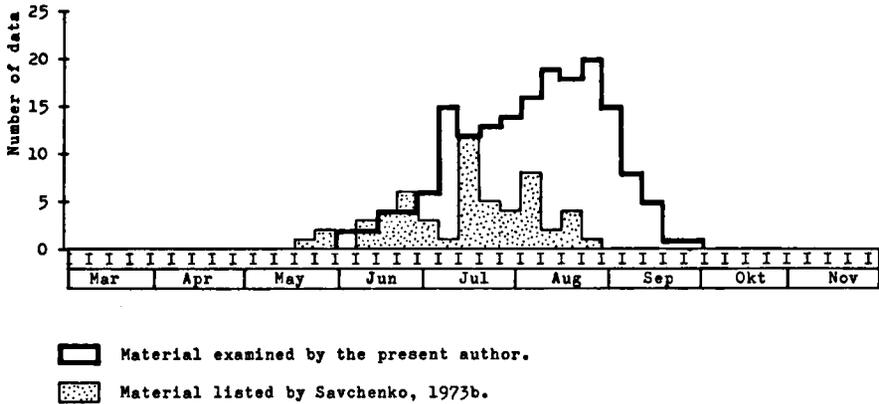


Diagram 4. Period of flight of *N. scurra*.

Females of *scurra* are attracted in large numbers on light during the night whereas males are captivated this way in a much lesser degree (Theowald, 1957b; i.l.). Two malaise traps (type Townes, 1972, situated in 1977 on the estate of Dr. R. T. Simon Thomas near Nunspeet, one placed at the edge of a small clearing in a coniferous forest, the other along meadows at the fringe of the same forest, both in position 24 hours a day but in fact not operational during dark) yielded 95 *scurra* specimens in the period 3 July until 29 September, of which 94 belonged to the male sex. From this and the above observations it is apparent that *scurra* males are active in the afternoon much earlier than females. The same difference in activity between the sexes of *Blacus* species (Hymenoptera, Ichneumonidae) is presumed by Van Achterberg (1977). Moreover it is noteworthy that nocturnal Ichneumonidae such as *Ophion*-, *Enicospilus*- and *Netelia*-species display the same brownish yellow colouration of the body as *scurra*.

Distribution (map 4)

N. scurra occupies a very wide range in the palaeartic and extends far up into the north. The distribution in the British Isles is based among others on data kindly provided by Mr. A. E. Stubbs (pers. comm., 1977, including the only Irish record in the southern part of the county Down). The record by Becker (1907) from Algiers presumably refers to *alluaudi*. All Italian localities (Prov. Valle d'Aosta, Alagna, Tarvisio) lie at the southern slopes of the Alps. The localities in the Pyrenees are French. Savchenko (1973b) synonymized *microcera* Alexander, 1921, with *scurra*, thereby extending the range of the latter with the Japanese islands Hokkaido and Honshu.

The type-locality of *nodulosa* Brullé, 1832 (Messene, Morea = Peloponnesos), lies outside the presently known range of the species.



Map 4. Distribution of *N. scurra*.

Discussion

Savchenko (1973b) synonymized *microcera*, known from the Japanese islands Hokkaido and Honshu, with *scurra*, writing: "Specimens from the Far East, described by Alexander as *microcera* show tendencies towards a different geographical race, which is not yet equipped with sufficient genetic material to be accepted as a different subspecies. The colouration of these specimens is brighter yellow, the antennae are short, merely reaching the bases of the wings and, in concordance, the first flagellar segment is shorter. The prescutal stripes are in general reddish cinnamon-brown, sometimes slightly indicated, in several specimens the central stripe has a faint, median line. The anatomy of the hypopygial structures is however identical with that of specimens from the western part of the distribution area".

Alexander (pers. comm., 1976) does not accept Savchenko's view-point, stating: „*microcera* Alex., 1921 This is not *scurra*, differing in the male antenna and in the hypopygium". The types of *microcera* (in the Alexander collection) were not examined by Savchenko, nor by the present author, hence a final judgement has to be postponed.

N. profunda Alexander, 1935, was tentatively interpreted by Savchenko (1973b) as a subspecies of *scurra*. Savchenko knew *profunda* from the original description only. Of *profunda* two male and two female paratypes (BMNH; labeled: Chengtu, 1933/Szechwan, China, D. C. Graham, V-10-14, 1700 ft/ Paratype *Nephrotoma profunda*, C. P. Alexander), were examined in the course of this study. This revealed that *profunda* is a distinct species, in hypopygial characters closer to *quadristriata* than to *scurra*. The colour-pattern is as described by Alexander (1935). The hypopygium of *profunda* is exemplified in fig. 25. The posterior extension of tergite 9 is moderately broad, centrally with a large, circular, incision, laterally with broad, ventrally directed projections. The od is slender. The id has a distinct, serrate crest and a narrow, sclerotized beak. The adminiculum is of a simple structure with a slender lateral appendage. The ventral, membranous connection of the two parts of sternite 9 has a bulbous protuberance just above sternite 8. Sternite 8 bears very long hairs on the posterior corners and is densely set along the medial line with shorter hairs which are distinctly incurved, meanwhile bent towards sternite 7, covering the broadly U-shaped incision of sternite 8. The posterior appendages of the aedeagus are close to each other.

Nephrotoma austriaca (Mannheims & Theowald, 1959)

Figs 13, 29, maps 5, 6

Pales austriaca Mannheims & Theowald, 1959, Memorie della Società Entomologica Italiana, 38: 17, 24 (key); Mannheims, 1959: 398; Mannheims & Pechlaner, 1963: 2, 6, 14, 23—24 (description), figures, biology; Savchenko, 1966a: 480—2, figures; 1966d: 120; Mannheims, 1967e: 317; Savchenko, 1973b: 100—1, figures, biology.

Pales lunulicornis: Mannheims & Theowald, 1959: 17.

The central European *austriaca* possesses fourteen antennal segments in the male and in the female. The second and following flagellar segments are reniform in the male. The wing-stigma and occipital marking are distinct, the latter basally about as broad as the neck. The verticils of the female antennae are relatively short, ranging up to $1.1 \times$ the length of the flagellar segments.

N. austriaca is known from eleven localities in central Europe (map 5).

Type-material

Holotype ♂: Styria, Ennsauen b. Schladming, 2000 m [changed in 740 m], 27.7.53, Mhs. leg./*Pales austriaca* n.sp. Mannheims det. 1955/Holotypus; (MAK; v! 0 1977).

Paratypes: Schladming, 740 m a.d. Enns. Steierm. 10.9.55, Wolf leg./*Pales austriaca* n.sp. Mannheims det. 1959/Paratypoid (MAK; v! 0 1977). 2♂, b. Alagna [Valsesia, Italy], 1000 m, 30.7.1959. Mannheims leg./*Pales austriaca* n.sp. Mannheims det. 1959/Paratypoid (MAK; v! 0 1977). 1♂, Volderwald, 28.5.55, Inn-Au/Umg. Innsbruck, Tj. Pechlaner/*Pales austriaca* n.sp. Mannheims det. 1955/Paratypoid (MAK; v! 0 1977; hypopygium in microvial). Mannheims and Pechlaner (1963) list another three paratypes (1♂, Volderwald, coll. Pechlaner, Innsbruck; 1♀, Dachau, Zool. Staats-slg. München, and 1♂, St. Johann in Pongau, Landesmuseum Joanneum Graz).

Other material: 2♂, Slovakia, 29.VII.1974, Tatr. Kotlina ú Belé, Martinovský leg., 1♂, idem, 31.VII, 2♀, idem 27.VII (kindly presented to the ZMA by Dr. Martinovský); 1♂, Italia-Udine, Tarvisio, 750 m, Torrento Bartolo, 14.VIII. 1958, Theowald-v.d. Goot leg. (ZMA), 1♀, idem, 10.VIII, 1♀, idem, 12.VIII; 1♀, Javorina, Czechoslovakia, 3-4.VIII.1959, Ujhelyi leg. (MAK); 1♀, Pfywald near Siders, Wallis, Switzerland, 27.VIII.1953, 550 m, Grosz leg. (ZMA).

Description

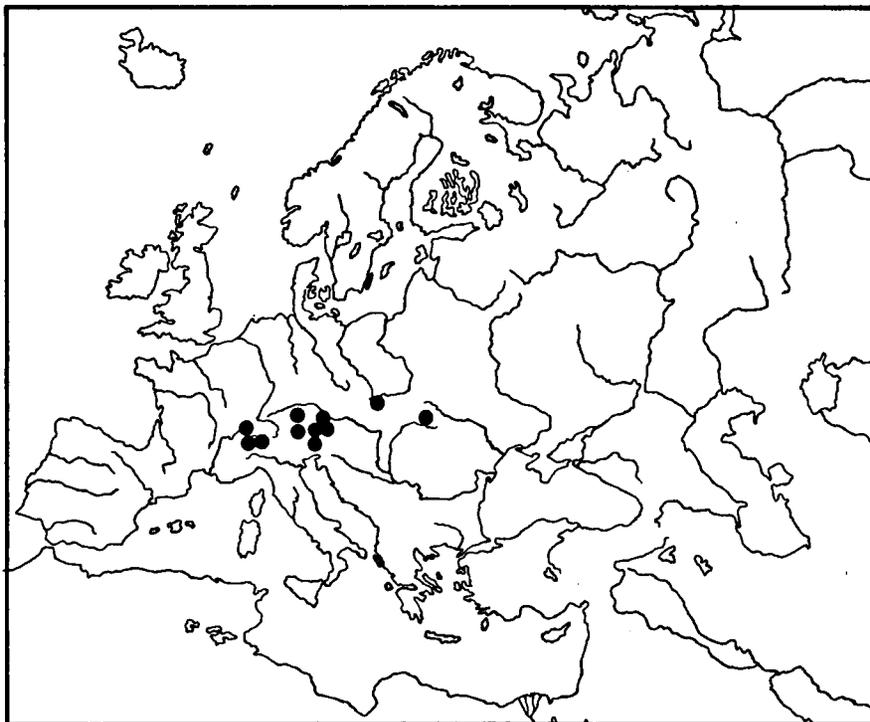
Body length male: 11—14 mm, female: 13—17 mm; wing length: 12—16 mm.

Head male: Antennae 14-segmented. Scape yellowish brown; pedicel brown; flagellar segments black, elongate; first flagellar segment $1.3 \times$ length of second one; second and following basal flagellar segments reniform; verticils up to $0.7 \times$ length of flagellar segments. Palpi brown to dark brown. Nasus, dorsal part and lower lateral half of rostrum usually brown to dark brown. Frontal tubercle small. Genae and postgenae pale yellow, vertex brownish yellow. Occipital marking distinct, dark brown to black, posteriorly about as broad as yellow colouration of pronotum, anteriorly triangular, bluntly ending on top of frontal tubercle. Hairs on vertex and postgenae sparsely set. Marks on inner part of postgenae distinct, small.

Thorax male: Pronotum dorsally yellow, laterally dark brown to black.

Prescutal and scutal stripes black, lateral prescutal stripes straight. Scutellum more or less transparent, yellow, median region with a narrow, longitudinal, brown stripe. Parascutellae yellowish brown. Lateral parts of mediotergite yellow, median region with a longitudinal brown stripe, distinctly widening towards mediotergite hind margin. Pleural markings, especially those on anepisternite, ranging from faint to dark brown. Anatergite yellowish brown. Sternum 1 ranging from yellow to dark brown. Coxae yellow, frequently basally darkened. Trochanters yellow. Femora basally light brown, steadily growing darker towards usually almost black tips. Tibiae and tarsi brown to black. Wings light brown to brown toned; wing-stigma distinct, brown to dark brown, without or with a few macrotrichiae; basal part of vein R4 + 5 and cross-vein R-M with a brown shade; wing-tip with a minor brown shade. Halteres yellowish, basal part of knob darkened.

Abdomen male: Tergite 1 laterally yellow, dorsally broadly brown to dark brown. Tergites 2—7 with a moderately broad, straight, dark brown, dorsal stripe; hind margins of the tergites lighter coloured. Lateral parts of tergites yellow with a dark brown lateral stripe, interrupted in front of middle of tergites. Sternite 1 yellow. Sternites 2—7 yellow with a narrow, straight, median stripe; hind margins of the sternites lighter coloured. Segment 8 dark brown to black, posterior corners of sternite 8 reddish brown.



Map 5. Distribution of *N. austriaca*.

Hypopygium: Posterior extension of tergite 9 more or less as in *I. lunulicornis*, the outer margin of the two parts slightly more concave. Apical part of od less elongate. Id as in fig. 29, laterally with a bulbous projection, set with bristles. Hind margin of sternite 8 (fig. 13) with a widely V-shaped median incision, about as deep as half the length of the sternite and with small tufts of long, golden hairs at lateral corners. Lateral appendage of adminiculum (fig. 13) basally linked with sternite 9; ventral appendage long and slender, membranously connected with the small, unilobe projection underneath. Aedeagus darkened; compressor apodeme distinctly bilobe, the two lobes not parallel-sided but in line with each other; posterior appendages very close to each other.

Female: Resembling the male. Antennae 14-segmented. First flagellar segments 1.3—1.5 × length of second one. Verticils up to 1.1 × as long as flagellar segments. Small triangle just behind ventral contact of fore coxae yellow, sometimes with darkened lateral margins. Tibiae and tarsi lighter coloured than in the male. Tergites 8 and 9 dark brown. Tergite 10 dark reddish brown. Cerci reddish brown. Sternite 8 anteriorly dark brown, posteriorly reddish brown with large, rounded, black dots laterally. Hypovalvae reddish brown. Cerci as slender as in *I. lunulicornis*. Sternite 8, hypovalvae and fused valvulae as in *quadristriata*. Furca slightly bifurcate.

Biology

The species is known to fly from 28 May until 10 September. The short period from 27 July until 27 August is covered however by eleven of the fourteen dates provided. The altitudes in the Alps lie between 550 and 1500 m. Pechlaner collected *austriaca* in Tirol at a scrubby mountainside with *Phragmites* and *Equisetum* (Mannheims & Pechlaner, 1963). In the Ukrainian Carpathians Savchenko (1966a, 1966d) mentioned an *Alnus viridis* vegetation and altitudes from 1100—1350 m.

Distribution (map 5 & 6)

N. austriaca is known from the localities mentioned with the type-material, the material examined, from Pozhizhev in the Ukrainian Carpathians (Savchenko, 1966a, 1966d), and from Solalex near Gryon in Vaud, Switzerland (1♂, 18.VIII.1977, 1466 m, Dufour, pers comm., 1978). The female from Pfynwald (Forêt de Finges), Siders, is discussed with the distributional notes under *helvetica*.

***Nephrotoma helvetica* (Mannheims & Theowald, 1959)**

Figs 18, 32—36, map 6

Pales helvetica Mannheims & Theowald, 1959, *Memorie della Società Entomologica Italiana*, 38: 17, 24 (key); Mannheims, 1959: 398; Mannheims & Pechlaner, 1963: 6, 23—5 (description), figures; Mannheims, 1967e: 317; Savchenko, 1973b: 93—4, figures.

N. helvetica is characterized by the very broad occipital marking, occupying the entire posterior vertex.

This species is recorded from the province of Wallis, Switzerland, only.

Type-material

Holotype: ♂, Pfywald, Wallis, Siders-Sierre, 550 m, 27.8.53, W. Grosz leg./*Pales helvetica* n.sp. Mannheims det. 1955/Holotypus (MAK; v! 0 1977).

Paratypes: 2♂, labeled as the holotype (MAK; v! 0 1977; 1♂ hypopygium in microvial), 1♂, b. Mövel [= Mörell, Wallis, 750 m, 6.8.53, Grosz leg./*Pales helvetica* n.sp. Mannheims det. 1955/Paratypoid (MAK; v! 0 1977). 1♀, Saltine Schlucht, Brig-Simplon, 1000 m, 13.7.53, Grosz/*Pales helvetica* n.sp. Mannheims det. 1955/Paratypoid (MAK; v! 0 1977; ovipositor in microvial).

Other material: one male, one female from Forêt de Finges [same locality as the holotype], F. Schmid, male 28.VI.1947, female 20.VII.1948 (Museum Lausanne, v! 0 1978).

Description

Body length male: 15—16 mm, female: 19 mm; wing length: 14—16 mm.

Head male: Antennae 13-segmented; scape yellow, sometimes apically darkened; pedicel light brown to dark brown, flagellar segments dark brown; first flagellar segment 1.2—1.3 × length of second one; verticils up to 0.8 × length of flagellar segments; second and following basal flagellar segments reniform. Nasus and dorsal part of rostrum brown to dark brown, lower lateral half of rostrum slightly infuscated. Genae, anterior half of vertex and lower half of postgenae yellow. Occipital marking very wide and lateral sides broadly in contact with eye margin; occipital marking shining all over and brown, central part dark brown. Small spots on inner parts of postgenae distinct, dark brown. Hairs on vertex and postgenae moderately long and sparsely set.

Thorax male: Pronotum dorsally yellow, laterally brown to dark brown. Prescutal and scutal stripes dark brown to black; lateral prescutal stripes straight. Scutellum transparently yellow. Parascutellae yellow. Anterior part of mediotergite laterally yellow, medially with a transparently yellow, longitudinal stripe, posterior part dark brown to black. Pleurae yellow with brown to dark brown markings. Anatergite transparently yellow to light brown. Sternum 1 yellow. Femora basally yellowish brown, at apical half steadily growing darker towards dark brown tips. Tibiae light brown, tips darkened. Tarsi brown to dark brown. Wings light brown toned; wing-stigma distinct, brown to dark brown, with a few macrotrichiae at the lower, anterior corner; apex of cell R4+5 with 10—30 macrotrichiae, apex of cell M1 with fewer macrotrichiae; basal part of vein R4+5, cross-vein R-M and wing-tip with a minor brown shade. Halteres yellow, basal half of knob dark brown, apical half lighter coloured.

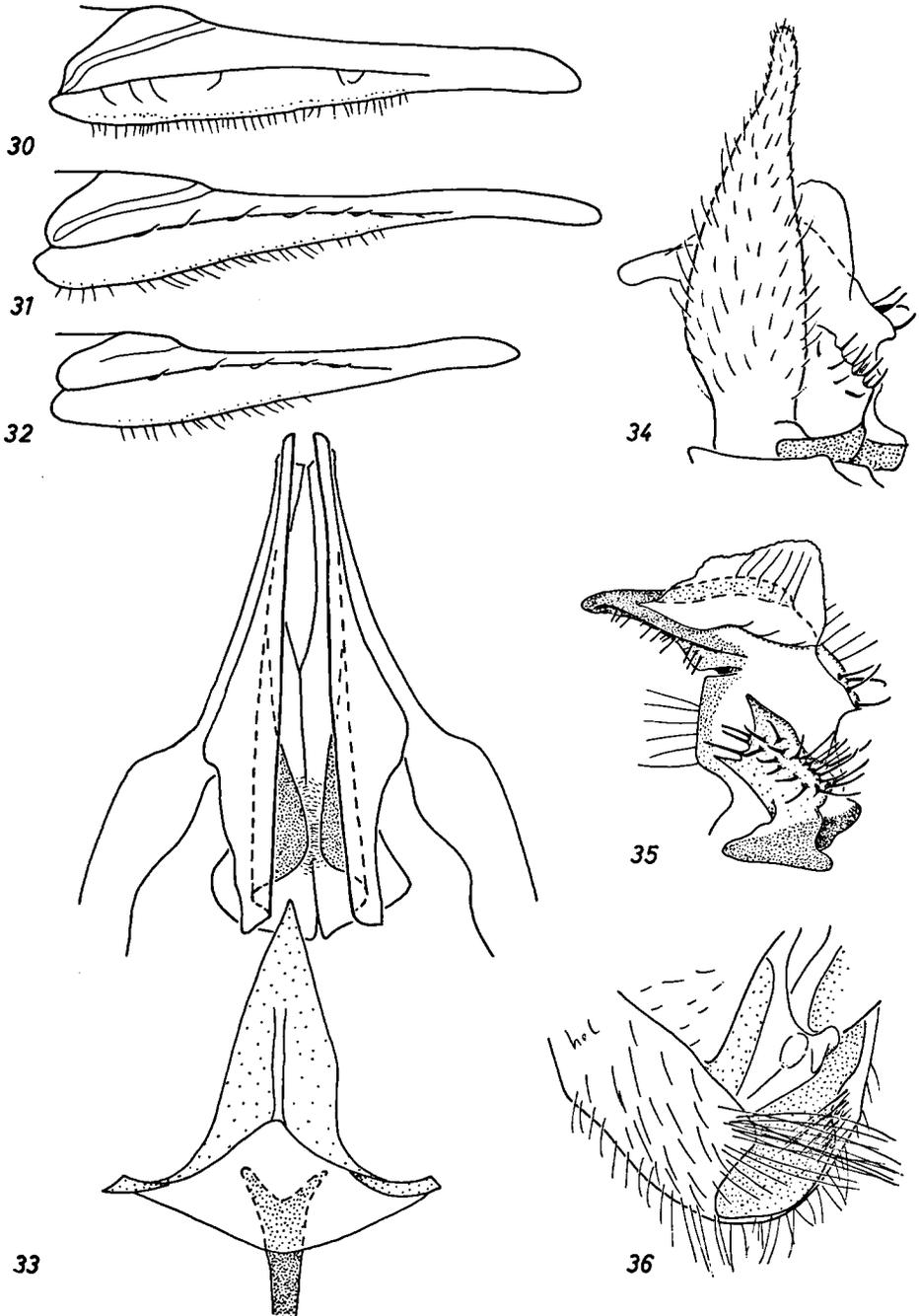


Fig. 30—36. 30. *N. dorsalis dorsalis*, cercus, lateral view; 31. *N. lunulicornis lunulicornis*, cercus, lateral view; 32—36. *N. helvetica*. 32, cercus, lateral view; 33, hypovalvae, furca and fused valvulae, dorsal view; 34, od, from outside; 35, id, from outside; 36, sternite 8 and midventral projection of sternite 9, lateroposterior view.

Abdomen male: Tergite 1 broadly dark brown dorsally. Tergites 2—6 with a moderately narrow, dark brown, dorsal stripe, which is interrupted by the lighter colouration of the tergites hind margins. Tergites 2—6 with isolated, elongate, dark brown spots at lateral margins. Sternites 1—6 yellow. Segments 7 and 8 dark brown, or colouration of segment 7 as preceding segment. Hind margin of sternite 8, especially laterally, broadly lighter coloured. Tergite 9 dark brown.

Hypopygium: Posterior extension of tergite 9 as in *I. lunulicornis* but median incision only about half as deep as extension and black spines smaller. Od as in fig. 34. Id (fig. 35) laterally with a bulbous projection, set with bristles. Tergite 8 widely U-shaped posteriorly (fig. 36), the hind margin with long golden hairs, especially near lateral corners. Adminiculum (fig. 18) ventrally membranously connected with the small, more or less bilobe, shortly pubescent projection (fig. 36); dorsal part of adminiculum with two distinctly bent horns. Aedeagus darkened; compressor apodeme distinctly bilobe, the lobes not parallel sided but in line with each other, posterior appendages close to each other.

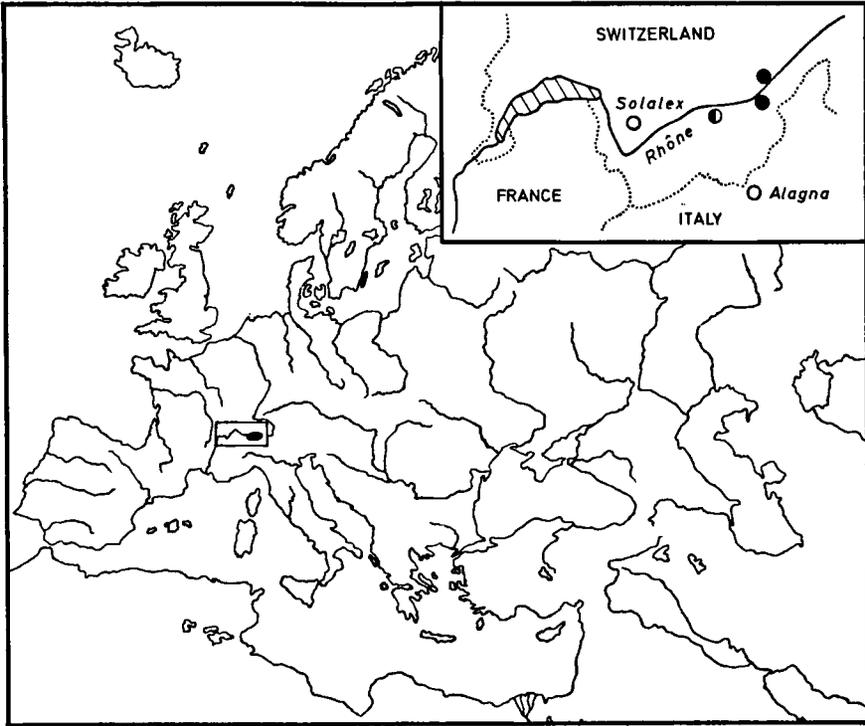
Female: Resembling the male. Antennae 13-segmented. First flagellar segment $1.7 \times$ length of second one; verticils up to $1.5 \times$ length of flagellar segments. Apex of wing without macrotrichiae. Abdominal dorsal strip broader than in the male and continuous, hind margins of tergites not lighter coloured dorsally. Stripe very broad at tergite 7. Tergites 2—7 with a lateral stripe, interrupted in front of middle of tergites. Sternites yellow with a median, narrow stripe, interrupted by the lighter coloured hind margins of the sternites. Tergite 8 and anterior part of sternite 8 dark brown. Tergite 9 dark brown, dorsally and along hind margin yellowish brown. Tergite 10, cerci, posterior part of sternite 8 and hypovalvae yellowish brown to brown. Cerci as slender as in *I. lunulicornis*, but shorter (fig. 32). Hypovalvae, furca and fused valvulae as in fig. 33; sternite 8 distally broad, the lateral margin posteriorly distinctly bent inside to meet the hypovalvae.

Biology

N. helvetica is recorded from 28 June until 27 August, at altitudes of 550 and 1000 m.

Distribution (map 6)

The three localities from which this species is known are indicated on map 6 (Mörel, Saltine-Schlucht, Pfywald near Sidens, all in Valais, Switzerland). The holotype and two male paratypes were collected by Grosz on August 27, 1953, in the Pfywald near Sidens (Forêt de Finges) from which also *dorsalis* is known. He then also collected 1 ♀ of *quadristriata* and 1 ♀ of *austriaca* (both bearing the same labels as the *helvetica* types). The female of *austriaca* has previously been identified as *helvetica* and as *lunulicornis*. It belongs to *austriaca* (by length and colour of the first flagellar-segment, shape and



Map 6. Distribution of *N. helvetica*, inset showing some localities of *austriaca* (○) and Pfywald (●), from which both species are recorded.

colouration of the occipital marking, structure of the hypovalvae and length of the cerci, etc.).

THE *BREVIPENNIS* GROUP

The *brevipennis* group contains the three *Nephrotoma* species from Madeira. As far as we know the genus is not represented on the Azores or Canary Islands. The Madeiran species share a number of unique characters, at least in respect to the western palaeartic species:

- 1) shape of the posterior extension of tergite nine in the male (fig. 39),
- 2) structure of the adminiculum, bearing small shells between the central part and the lateral appendages (figs 40, 41, 55),
- 3) the dorsal edge of the female sternite eight is bipartitious caudad (figs 45—47),
- 4) the furca closely underlies the fused valvulae (figs 47, 50, 51),
- 5) the mediotergite has a broad, almost rectangular dorsal spot anteriorly.

The recent literature on Madeira (pertinent review in Theowald, 1977), mentions two species only, *brevipennis* Wollaston, 1858, and *antithrix*

Mannheims, 1962. In order to trace the female of *antithrix*, a species known after the male holotype only, practically all material mentioned in literature and additional specimens were studied (not examined are 3♂, 1♀, *brevipennis* from Fte de Barro, 2—4.7.1957, Lindberg, and 1♂, *brevipennis* from Rabaçal, 6—7.V., Storå; see Mannheims, 1962b). From this it is revealed that *lucida* Schiner, 1868, which was synonymized with *brevipennis* since Mannheims (1951a), is a valid species. The female of *antithrix*, however, was not found.

***Nephrotoma brevipennis* (Wollaston, 1858)**

Figs 38, 41—43, 45, 49—50

(most references cited below refer to *lucida* also)

Pachyrhina brevipennis Wollaston, 1858, Annals and Magazine of Natural History, (3), 1: 115; Becker, 1908: 188; Riedel, 1910: 436.

Pales brevipennis: Mannheims, 1951a: 33—5, 46—7, figures; 1951b: 140; Nielsen, 1961: 3; Hemmingsen, 1962: 140; Mannheims, 1962b: 131—3, figures; Savchenko, 1973b: 87.

Nephrotoma brevipennis: Theowald, 1977: 154, 185.

Pachyrhina maderensis van der Wulp, 1885, Notes from the Leyden Museum, 7: 8; Riedel, 1910: 428, 435; Theowald, 1977: 154.

Pales maderensis: Mannheims, 1951a: 46—7; 1951b: 140; 1962b: 132; Savchenko, 1973b: 87.

Type-material

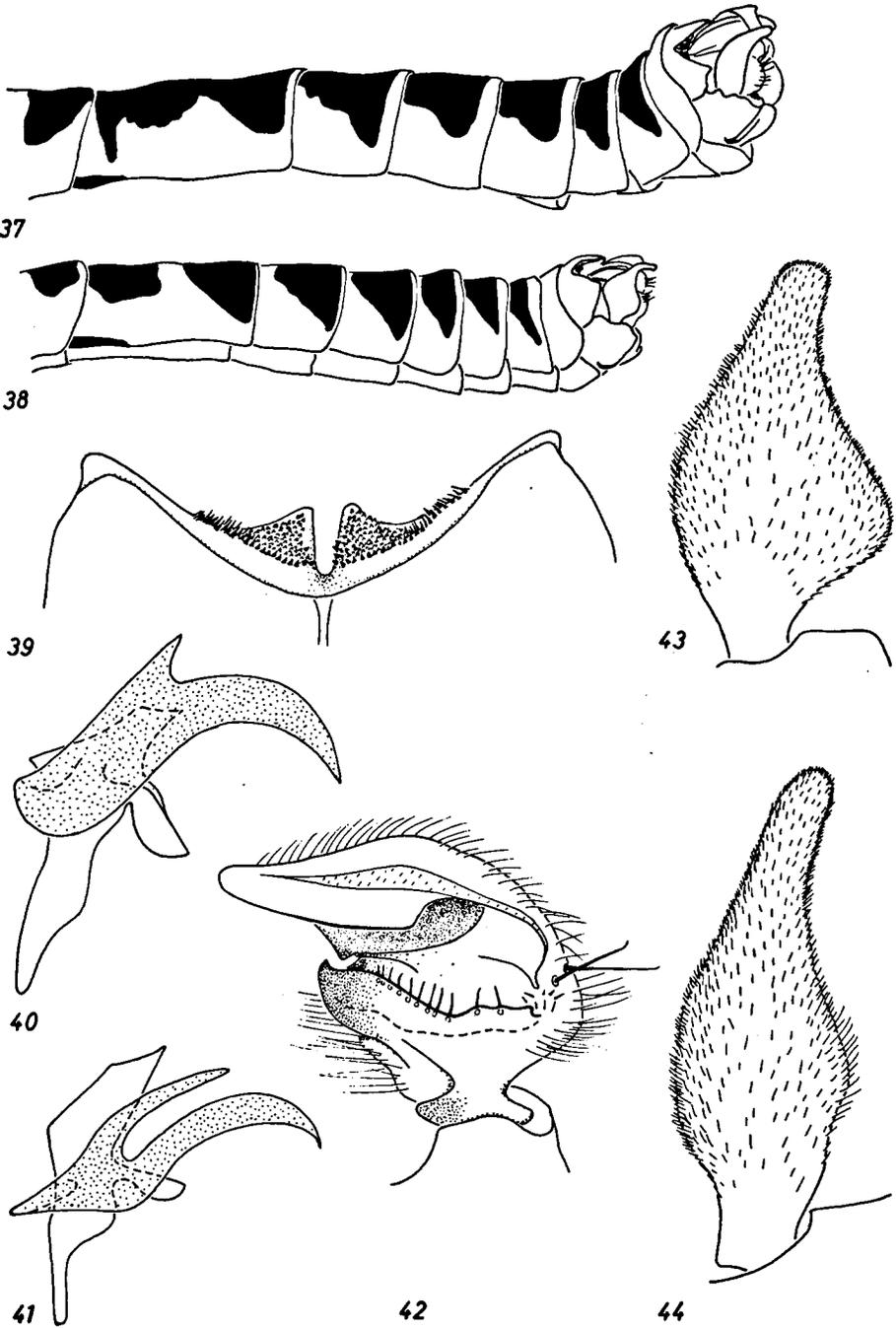
Pachyrhina brevipennis Wollaston, 1858: The type-series contains two males and six females, all labeled: Madeira, T.V. Wollaston, B.M. 1855—7; a male is designed here as lectotype (BMNH, v 0! 1978, abd. terminalia of male lectotype and of one female in microvials; although Mannheims (1962b) mentions a “Holotypus-♂ im British Museum”, there was no lectotype designated yet). One female out of the type-series belongs to *lucida*.

Pachyrhina maderensis van der Wulp, 1885: The holotype male bears the following labels: Kuhl, Madera/39/Type/Holotype/*Pachyrhina maderensis*, Type, vd Wulp/Type (RML, v! 0 1978, head and abdomen infuscated and in a bad condition, hypopygium in a microvial; see also Theowald, 1977).

Other material: 3♂, 1♀, Funchal, 23.VII.1928, S. R. Christophers, B.M. 1928—545 (BMNH; 1♂ and 1♀ in copula). 1♂ with two different labels: 1) Madeira, 1.000 m, Rabaçal, 17.7.35, Lundblad; 2) Caramujo, 14.8.35, Erica-Skogen (ZMH; hypopygium in microvial). 3♂, 2♀, Madeira, 1080 m, Rabaçal, 17.7—4.8.35, O. Lundblad (2♂ MAK 1♂ hypopygium in microvial; 1♂ 1♀ ZMA; 1♀ ZMH ovipositor in microvial). 1♂, Caramujo, 14.8.1935, Lundblad 1g (ZMH). 1♀, Madeira, 1250 m, Carajumo, 6—14.8.1935, O. Lundblad (NMW). 3♂, Mad., Paul da Serra, 3.7.1957, Lindberg (2♂ ZMH, 1♀ ZMA). 1♀, Mad., Serra d'Água, 2.7.1957, Lindberg (ZMH).

Description

Body length male: 9—11 mm, female: 15—20 mm; wing length male: 9—11 mm, female: 10—14 mm.



Figs 37—44. *N. lucida* and *N. brevipennis*. 37, *lucida*, abdomen male; 38, *brevipennis*, abdomen male; 39, *lucida*, posterior extension of tergite 9, dorsal view; 40, *lucida*, adminiculum, lateral view; 41, *brevipennis*, adminiculum, lateral view; 42, *brevipennis*, id, outside; 43, *brevipennis*, od, outside; 44, *lucida*, od, outside.

Head male: Antennae 13-segmented; scape and pedicel yellow to brownish yellow; flagellar segments brown to dark brown, first flagellar segment sometimes lighter coloured; second and following flagellar segments slightly nodulose basally; first flagellar segment 1.1—1.2 × length of second one; verticils up to as long as flagellar segments. Rostrum yellow, dorsally including the nasus sometimes coloured brown. Genae and postgenae pale yellow to yellow; vertex yellow to brownish yellow; sometimes entire head brownish. Occipital marking shining, brown, rarely dark brown, narrow triangular with tip reaching base of frontal tubercle, sometimes anteriorly with a narrow prolongation crossing the frontal tubercle. Small brown spot between eye and frontal tubercle usually present. Hairs on vertex and postgenae moderately densely set.

Thorax male: Dorsal yellow part of pronotum medially brownish; pronotum laterally yellow to brown, at upper corner dark brown. Prescutum with three brown to dark brown stripes, medial stripe divided in two longitudinally (especially at anterior part) by a moderately broad yellow to reddish brown stripe; lateral stripes straight. Scutal and lateral prescutal stripes sometimes in part lighter coloured also. Scutellum transparently yellow, medially with a longitudinal brown to dark brown stripe. Parascutellae yellow, upper part (usually upper half) always darkened. Mediotergite with a very broad, almost rectangular dorsal spot anteriorly, lateral parts of mediotergite yellow, posterior part transparently yellow, sometimes darkened along hind margin. Pleurae yellow, the pleural markings indicated by transparently yellow, sometimes coloured brown, especially between coxae, anatergite and posterior half of katatergite; anatergite usually with a narrow brown border. Sternum 1 yellow with dark brown lateral margins. Coxae and trochanters yellow. Femora yellow to light brown, tips broadly dark brown. Tibiae and tarsi brown to dark brown. Wings light brown toned; wing-stigma distinct, brown, rarely dark brown, with macrotrichiae ranging in number from 10—35, usually about 20. Wing-tip with about 10 macrotrichiae between vein R3 en R4 + 5, sometimes with a few macrotrichiae between R4 + 5 and M1 also.

Abdomen male (fig. 38): Tergites yellow, dorsally with a large, brown to dark brown spot on the anterior part of tergite 2 and triangular spots just in front or actually in contact with the hind margins of the tergites. Anteriorly, especially on tergites 2—4, these spots are abbreviated, not underlying the preceding segment. Sternites yellow to brownish yellow.

Hypopygium: Posterior extension of tergite 9 very widely V-shaped (as in *lucida*, fig. 39) Od a fleshy lobe, at basal half moderately broad (fig. 43). Lateral shell of id large, dorsal crest small (fig. 42). Ventral appendages of adminiculum abbreviated; lateral appendages distinctly divided in two, base of incision much lower than top of central part of adminiculum (fig. 41). Lateroventral parts of sternite 9 not connected by a membrane. Posterior margin of sternite 8 straight or with a small median incision from which a

small, triangular-shaped appendage protudes. Aedeagus small, compressor apodeme bilobe, the posterior appendages not close to each other.

Female: Colouration of head and thorax as described for the male. Antennal segments yellow to brownish yellow, the small basal nodes of the flagellar segments darker coloured; first flagellar segment 1.2—1.3 × length of second one; verticils up to 1.3 × length of flagellar segments. Number of macrotrichiae in the wing-stigma ranging up to 32 (usually about 20), at wing-tip as in the male. Abdominal tergites shining all over and yellow with broad, dark brown, transverse spots at posterior half. These spots are isolated and do not reach the tergite hind margins. Tergite 8 usually darkened. Tergites almost without fine white hairs where occupied by dark brown colouration. Sternites yellow. Tergites 9, 10, cerci, sternite 8 and hypovalvae yellow to brownish yellow. Cerci broad and ending blunt; cerci shorter than in *lucida* and otherwise connected with tergite 10 (fig. 49). Connection between fused valvulae and tergite 9 sclerotized (as in *lucida*, fig. 47). Furca closely underlying fused valvulae (as in *lucida*, fig. 47). Hypovalvae ending blunt (fig. 45) the lateral walls of the egg-slide moderately high and unmodified, with short hair-like bristles at ventral inner part.

Biology

N. brevipennis is known to be on the wing from 6 May until 14 August (only six precise collecting dates are provided). Altitudes are mentioned with specimens from Rabaçal (1000 and 1080 m) and Caramujo (1250 m). Specimens were collected in *Erica* scrubs (one male is labeled: Caramujo, 14.8.35, *Erica*-skogen, bears however an additional label: 1000 m, Rabaçal, 17.7.35, Lundblad). Wollaston (1858) refers to the type-locality as follows: „Madeira proper, occurring in moist spots of a lofty altitude. In July 1850 it was not uncommon at the Cruzinhas”. All localities from which *brevipennis* was examined by the present author lie, with the exception of Funchal, inland at altitudes above 1000 m.

Distribution

Madeira.

Discussion

See under *antithrix*.

***Nephrotoma lucida* (Schiner, 1868)**

Figs 37, 39—40, 44, 46—48, 51

Pachyrhina lucida Schiner, 1868, Reise der österreichischen Fregatte Novara, Zoologie, 2(1B): 34; Becker, 1908: 188; Riedel, 1910: 428, 435.

Pales lucida: Mannheims, 1951a: 46—7; 1951b: 140; 1962b: 132; Savchenko, 1973b: 87.

Pachyrhina maderensis: Becker, 1908: 188.

Pales brevipennis: Nielsen, 1963: 79—80.

Type-material

Holotype ♀: labeled: B/Novara/lucida Alte Sammlung/Pachyrhina lucida Schin/P ♀ lucida Schin. det. Riedel/Pales lucida Schin. Mannheims det. 1950/Holotypus Pales lucida Schin. det. Mannhs. 50/Pales (Pales) brevipennis Mannheims det. 1950 (NMW; v! 0 1978; abdomen glued on small card by the present author). The Australian frigate Novara payed a visit to Madeira from 8 until 17 June 1857. Amongst the insects collected, there was one female *Nephrotoma*, described by Schiner as *lucida*. From the splendid itinerary of the Novara voyage by Scherzer (1864) one can not deduce where this specimen was collected.

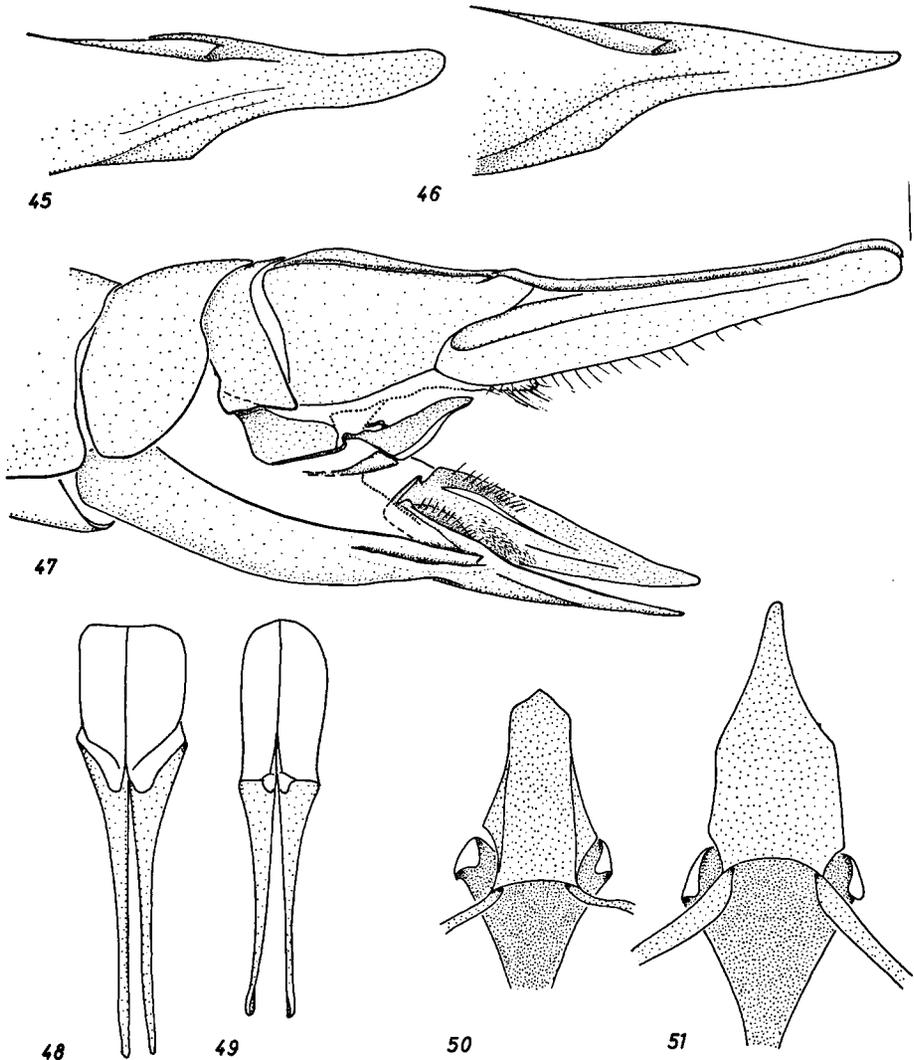
Other material: 1♂, Madeira, 12 km Sta. Cruz, coastal ravine, 22.II.1977, A. E. Stubbs (BMNH). 2♂, Madeira, 1080 m., Rabaçal, 17.7—4.8.1935, O. Lundblad (1♂ ZMH hypopygium in microvial; 1♂ ZMA). 14♀, Madeira, 1080 m., Rabaçal, 17.7—4.8.1935, O. Lundblad (8♀ ZMH; 3♀ MAK; 3♀ ZMA). 1♂, Madeira, 1250 m., Caramujo, 6—14.8.1935, O. Lundblad (ZMH, hypopygium in microvial). 1♂, Madeira, 51079 (MNB, hypopygium in microvial; specimen mentioned by Becker, 1908, and Riedel, 1910, under *maderensis*). 1♀, Madeira, 53471 (MNB; specimen mentioned by Becker, 1908, and Riedel, 1910, under *lucida*). 2♂, Madeira, Porto Novo., Rib. do Porto Novo., 22.IV.1957., Loc. 119., Brinck. Dahl./Ravine (ZIS in alcohol; specimens mentioned by Nielsen, 1963, under *brevipennis*). 1♀, Madeira, Canical, 27.IV.1972, N. L. Wolff (ZMA, ovipositor in microvial). 1♀ paralectotype of *brevipennis*.

Description

Very similar to *brevipennis*, differing in the following characters:

Male: *N. lucida* males are larger (body length 11—14 mm; wing length 11—15 mm). The abdominal dorsal spots are prolonged anteriorly thereby underlying the preceding tergites; the yellow colouration along the hind margins of the tergites is usually broader than in *brevipennis* (fig. 37). The od (fig. 44) is relatively slender, especially when compared with the od of *brevipennis* (fig. 43). In the latter species the lateral appendage of the adminiculum is deeply incised, in *lucida* the lateral appendage of the adminiculum only bears a small, more or less pointed outgrowth dorsally (fig. 39). The number of macrotrichiae in the wing-stigma ranges in *brevipennis* males from 10 till 35 with an average of 20, in *lucida* this number ranges from 32 till 50, with an average of 41. The macrotrichiae at the wing-tip are as in *brevipennis*.

Female: *N. lucida* females possess larger wings (body length 19—21 mm; wing length 14—18 mm) and the number of macrotrichiae in the wing-stigma ranges from 35 till about 70 with an average of 55. Abdominal tergites 2—7 yellow to brownish yellow with very broad, brown to dark brown, transverse spots dorsally, situated just in front of lighter coloured hind margins of



Figs 45—51. *N. lucida* and *N. brevipennis*. 45, *brevipennis*, hypovalvae, lateral view; 46, *lucida*, hypovalvae, lateral view; 47, *lucida*, ovipositor; 48, *lucida*, cerci, dorsal view; 49, *brevipennis*, cerci, dorsal view; 50, *brevipennis*, furca and fused valvulae, dorsal view; 51, *lucida*, furca and fused valvulae, dorsal view.

tergites; spots anteriorly sometimes underlying the preceding tergite. Tergites moderately densely set with fine white hairs where occupied by dorsal spots. Tergites 8, 9, cerci, sternites and hypovalvae yellow to brownish yellow, tergite 8 dorsally and sternite 8 latero-posteriorly sometimes with vague brown spots. Cerci broad and ending blunt; cerci longer than in *brevipennis* and otherwise connected with tergite 10 (fig. 48). Connection between fused valvulae and tergite 9 sclerotized (fig. 47). Furca closely

underlying fused valvulae (fig. 47). Hypovalvae as in *brevipennis* but tapered towards tip (figs 46, 47), and with more and longer hair-like bristles at ventral inner part.

Biology

N. lucida has been collected on the following dates: 22 February, coastal ravine; 22 April, coastal ravine; 27 April, coastal; April (Becker, 1908, without locality); June (female holotype); 17 July—4 August, inland (Rabaçal, 1080 m); 4—16 August, inland (Caramujo, 1250 m).

Distribution

Madeira.

Discussion

See under *antithrix*.

***Nephrotoma antithrix* (Mannheims, 1962)**

Figs 52—55

Pales antithrix Mannheims, 1962, Notulae Entomologicae, 42: 131—3, figures.

Nephrotoma antithrix: Theowald, 1977: 154, 185.

Type-material

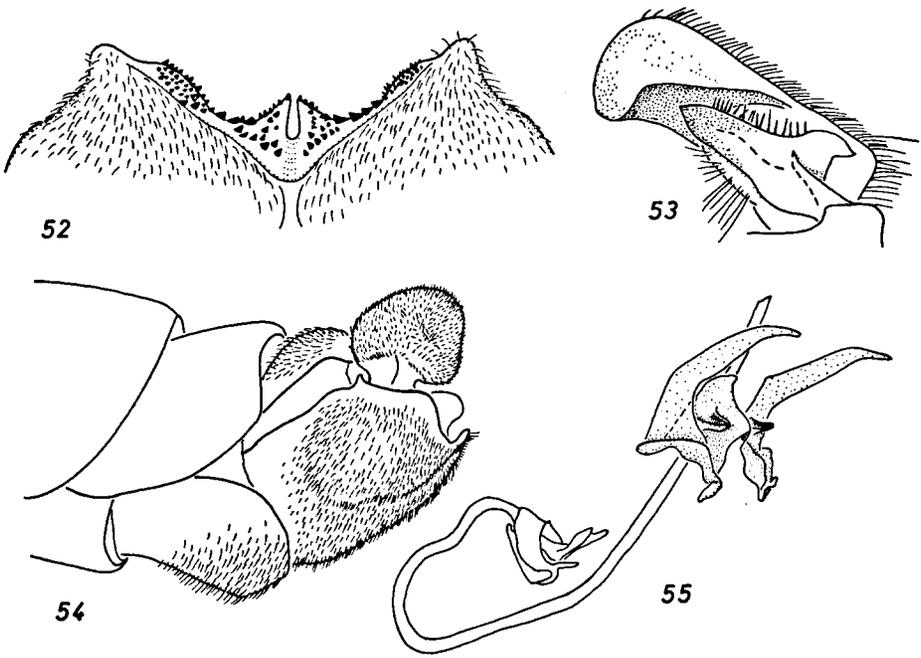
Holotype ♂: Madeira, Serre de Agua, 20—21.IV.59, Lindberg/n.sp., P.N./*Pales antithrix* sp.n., Mannheims det. 1962/Holotypus (ZMH; v! 0 1978).

Description

Body length holotype: 10 mm, wing length holotype: 12 mm.

Head and Thorax: Colouration in general as described for *brevipennis*. Scape, pedicel and first flagellar segment brownish yellow; the latter as long as second flagellar segment; second and third flagellar segment slightly reniform with the basal nodes dark brown, the apical two-third brownish yellow (remainder of both antennae missing); verticils of flagellar segments two and three up to as long as these segments. Occipital marking dark brown and shining with a narrow anterior prolongation ending on top of the frontal tubercle. Anterior half of median prescutal stripe divided in two by a broad, longitudinal, reddish brown stripe. Pleural markings dark brown; anatergite and anterior half of katatergite transparently brown, the latter with a fine, dark brown border. Sternum I brown with dark brown lateral margins. Wing-stigma distinct, brown, with 17—19 macrotrichiae; right wing-tip with 3 macrotrichiae, left wing-tip broken.

Abdomen: Dark brown to black dorsal stripe broad (as broad as



Figs 52—55. *N. antithrix*. 52, posterior extension of tergite 9, dorsal view; 53, hypopygium, lateral view; 54, id, from outside; 55, aedeagus, penis and adminiculum, lateral view.

mediotergite) and continuous; lateral parts of tergites 1—7 brownish yellow with a small dark brown spot at anterior corner of tergite 2. Sternites 1—7 brown. Tergites 1—7 and sternites 1—7 with a very short, dense pubescence, sternites in addition short hairy. Tergite 8 rectangular with dark brown spots laterally and a brightly yellow along posterior margin.

Hypopygium: Tergite 9, sternite 9 and posterior part of sternite 8 densely covered with adversely directed, short, black hairs: (fig. 53). Posterior extension of tergite 9 widely V-shaped, densely set with small black spines and with a small median incision (fig. 52). Od short and rectangular, covered with short black hairs (fig. 53). Inner side of id densely set with moderately long golden hairs; anterior beak of id very broad and with numerous small white spots; id without a crest (fig. 54). Shell at inner side of dorsal edge of sternite 9 between od and tergite 9 present. Adminiculum and aedeagus small, penis relatively short (fig. 55). Hind margin of sternite 8 with a broadly rounded median incision, about half as deep as broad. Two parts of sternite 9 ventrally not membranously connected but very close to each other.

Biology

Unknown.

Distribution

Madeira.

Discussion

Since Mannheims (1962b) two *Nephrotoma* species are known to occur on Madeira, *brevipennis* and *antithrix*. Examination of the relatively extensive *Nephrotoma* material collected on the island showed that the males belong to three species. Nevertheless only two different types of females could be recognized. They were associate to the male sex in respect to the following observations: 1) a copula pair of *brevipennis* (BMNH, ♂ & ♀ on one pin); 2) the number of macrotrichiae in the wing-stigma; 3) the colouration of the abdomen; 4) the size; 5) the period of flight (*brevipennis* May-August, *lucida* February-August); 6) the localities (*brevipennis* inland with one record from Funchal, *lucida* coastal and inland). The female of *antithrix* remained unknown.

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