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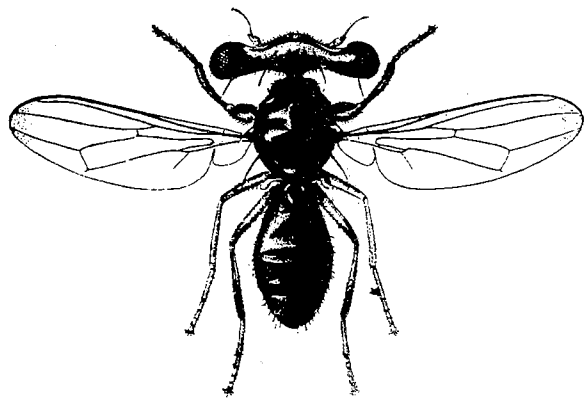

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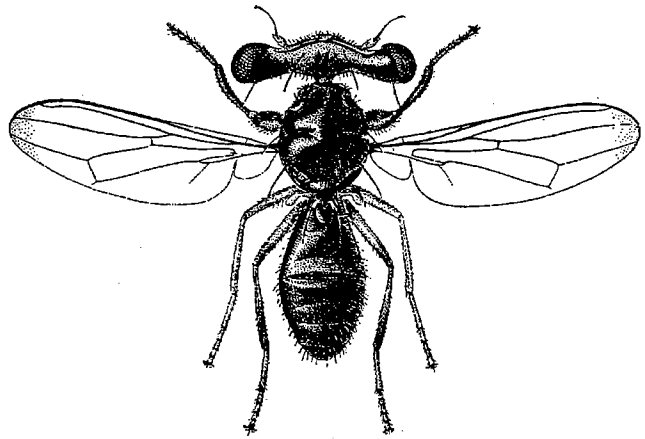

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Front cover picture: *Sphyracephala babadjanidesi* Zaitz. (Transcaucasus).

Description of *Dilophus borealis* sp. n. (Dipt.: Bibionidae) from Scandinavia.

JOHN SKARTVEIT

Skartveit, J. 1993. Description of *Dilophus borealis* sp. n. (Dipt.: Bibionidae) from Scandinavia. *Dipterological Research*, 4(1–2): 3—11.

The imago male and female of *Dilophus borealis* sp. n. is described and figured. The species is somewhat similar to *Dilophus femoratus* Meigen, 1803 and *D. neglectus* Haenni, 1982 but clearly distinct from these species. Its distribution in Norway is considered, some references to Swedish material are given.

John Skartveit. Museum of Zoology, Museplass 3 N-5007, Bergen, Norway.

Index words: Diptera, Bibionidae, *Dilophus*, taxonomy.

Introduction

When working on Norwegian Bibionidae I became aware of a small *Dilophus* species which was clearly distinct from *Dilophus femoratus* Meigen, 1803. I originally believed the species was *Dilophus neglectus* Haenni, 1982, but comparison with paratypes of this species revealed that the Norwegian specimens did not belong to this species. The new species keys out on *D. neglectus* in Haenni (1982) and on *D. antipedalis* Wiedemann in Meigen, 1818, in Duda (1930).

Material and methods

Altogether 205 specimens from Norwegian University collections and 16 specimens in the collection of the Museum of Zoology, Uppsala, Sweden have been examined. The material is deposited as follows:

Museum of Zoology, Bergen, Norway, 38 specimens (32 in alcohol, 4 in Canada Balsam, 2 pinned)
Vitenskapsmuseet, Trondheim, Norway 132 specimens (in alcohol).
Tromsø Museum, Tromsø, Norway 27 specimens (pinned).
Museum of Zoology, Oslo, Norway 8 specimens (pinned).
Museum of Zoology, Uppsala, Sweden 16 specimens (pinned).

Four paratypes (2 ♂, 2 ♀) of *Dilophus neglectus* Haenni were borrowed from Jean-Paul Haenni, Neuchatel, Switzerland. Three males and one female of the Bergen speci

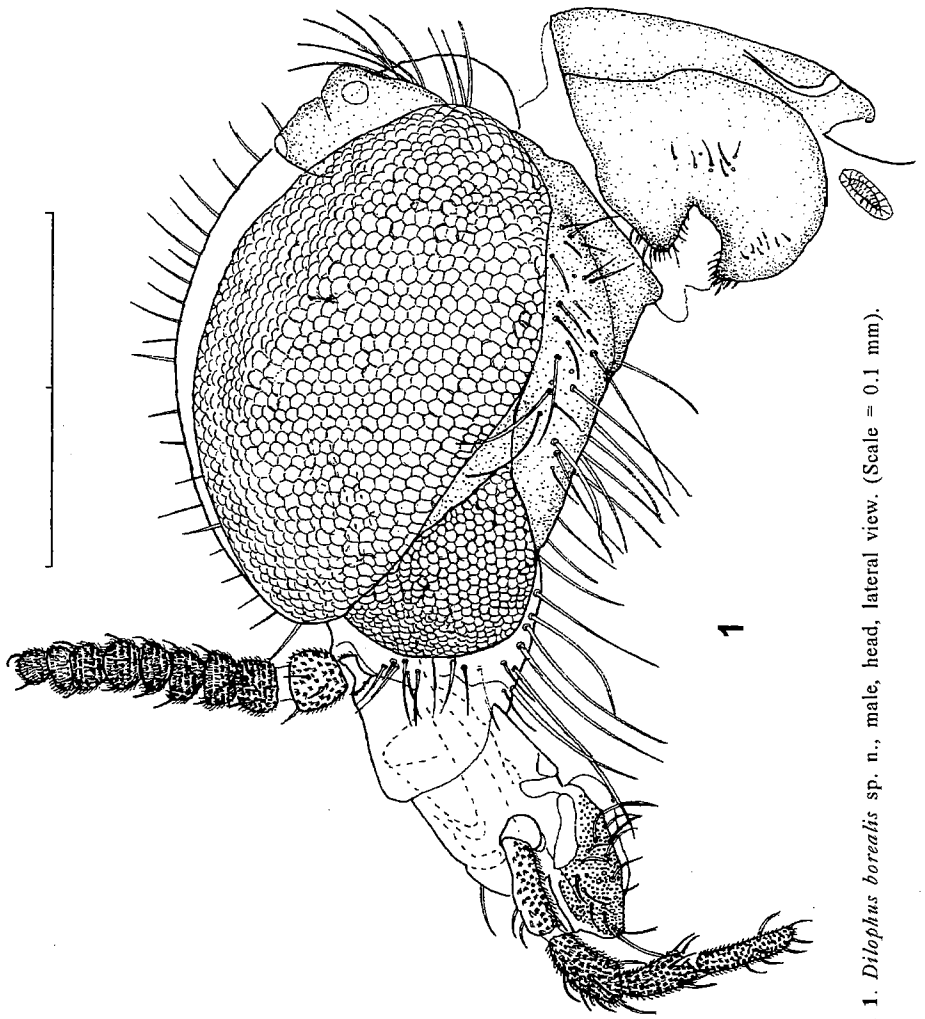


Fig. 1. *Dilophus borealis* sp. n., male, head, lateral view. (Scale = 0.1 mm).

mens were macerated and mounted in Canada Balsam for closer study and drawing.

RESULTS

Dilophus borealis sp. n.
(Figs 1—7)

Type locality. **Norway**, STI, Oppdal: at Kongsvoll (EIS 79). Altitude 900 m., birch (*Betula pubescens*) forest with many tall herbs, especially *Aconitum septentrionale*.

Holotype. Male , Malaise trap at type locality, 22.—28.7.1992, J. Skartveit leg. (ZMBN type no. 175).

Paratypes. **Norway**: STI, Oppdal: Kongsvoll Gåvålibk. Malaise trap, 2 ♂, 1 ♀, 21.9.1982, J. O. Solem (ZMBN) (in Canada Balsam). STI, Oppdal: Kongsvoll, near Sprænbekken, yellow-water trap 1300m, 1 ♂, 19.—22.8.1992, J. Skartveit (ZMBN). STI, Oppdal: Kongsvoll near Driva, on flower of *Tanacetum vulgare*, 1 ♂, 21.8.1992, J. Skartveit (ZMBN). STI, Oppdal: S. Knutshø 1080m Malaise trap, 1 ♀, 22.—28.7.1992, J. Skartveit (ZMBN). STI, Oppdal: near Kongsvoll, 110 ♂, 17 ♀, 1980—1983. Malaise traps. J. O. Solem (VMTR). STI, Oppdal: Drivstua, 17.8.1861, 1 ♂, H. Siebke leg (TM, label: „Drivstuen 17.8.—61. Siebke"). Same data, 2 ♂ (ZMO no. 11980—11981).

Diagnosis. The male can be recognized from *D. femoratus* by the V-shaped indentation of the hypopygium's ventral hind margin (Fig. 4), and by the shape of the gonostyli (Fig. 5). The genitalia look very much like those of *D. neglectus*. From this species it can be separated by its slender antennae (Figs 1, 6) and by the protibial spines of the apical circlet being almost parallell to the tibia, slender and widely separated (Fig. 2). The female can be recognized by its reddish-brown legs and slender antennae. The species is almost consistently smaller than the other Scandinavian *Dilophus* species, generally with a total length less than 5 mm.

Etymology. This species seems to occur in high-altitude and high-latitude localities in Scandinavia and is named accordingly. From Greek borealis, meaning northern.

Description

Male (Figs 1—5)

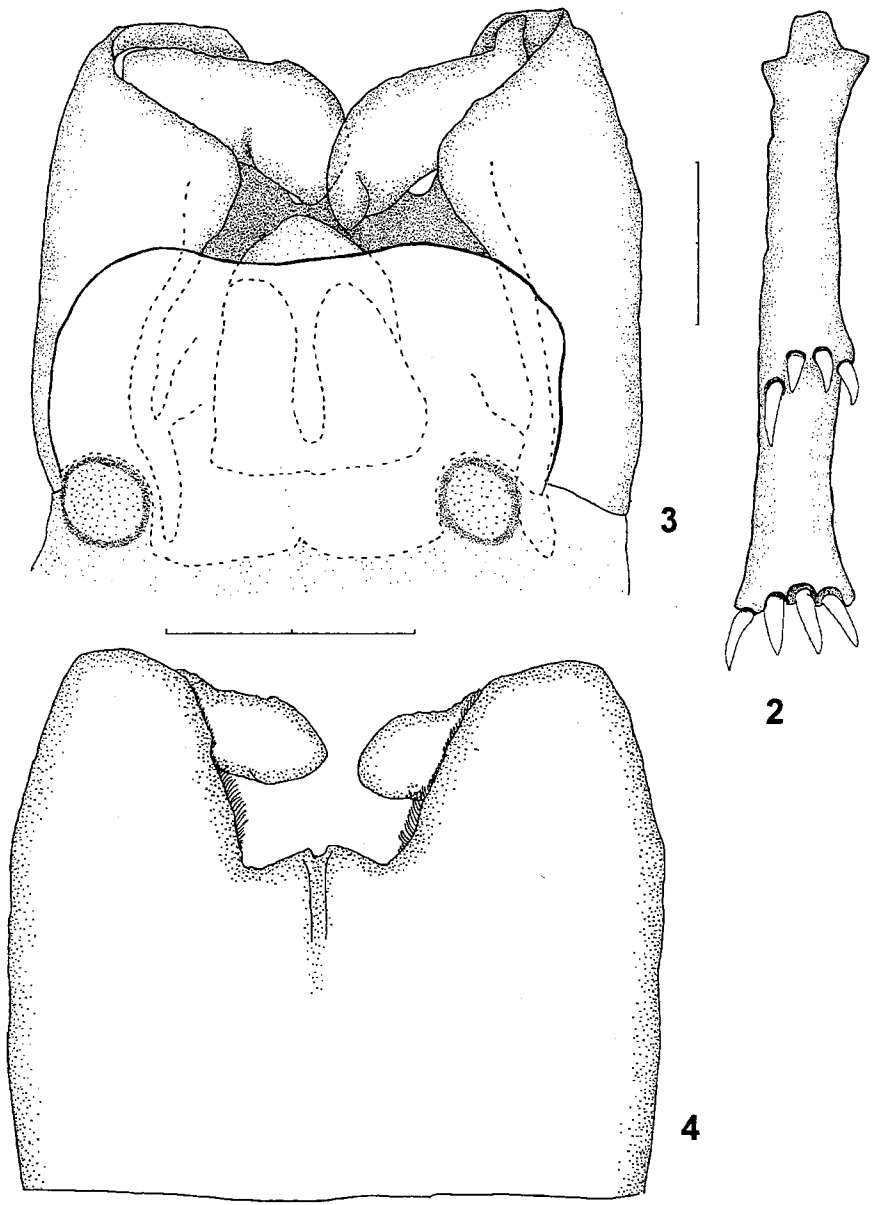
Total length 3.7—5.4 mm, mean 4.9 mm (n=25).

Head (Fig. 1). Black, setae on occiput black and coarse, intrafacetal pilosity short and brownish, length approximately one fourth of eye diameter in lateral view. Pilosity on ventral surface long and dark. Rostrum not produced, antennae inserted at eye fore margin. Antennae slender, flagellum approximately 5 times as long as wide and 8—9-segmented, the ultimate segment small.

Thorax. Length from fore margin of pronotum to hind margin of scutellum 1.0—1.6 mm, mean 1.22 mm (n=38). Entirely black, notum smooth and shining. Anterior pronotal row of spines consisting of 10 spines, posterior row of 10 short spines, the most lateral about two spine-lengths posterior to the remaining. Dorsocentral setae coarse and black, intraalar and pleural pilosity fine and light. Scutellar setae short and light. Halteres brown.

Wings. Clear, length 3.4—3.9 mm, mean 3.7 mm (n=11). Costal cell not darkened. Costa, R_1, R_{4+5} and crossvein R-M dark brown, M_1 light brown, more posterior veins colourless. Pterostigma light brown, not very distinct.

Legs. Dark brownish. Fore coxa with light



Figs 2—4. *Dilophus borealis* sp. n., ♂.
2, tibia, frontal view, , setae omitted; **3**, hypopygium, dorsal view setae omitted; **4**, hypopygium, ventral view, setae omitted. (Scale = 0.2 mm)

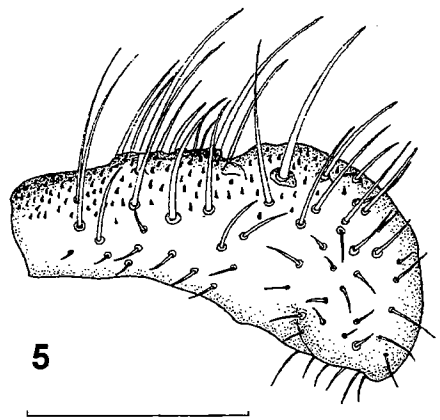


Fig. 5. *Dilophus borealis* sp. n., male right gonostylus, dorsolateral view. (Scale — 0.1 mm).

setae approximately as long as the coxa's width in lateral view. Fore tibia length 0.60—0.82 mm, mean 0.74 mm (n=35) including apical spines. Fore tibia (Fig. 2) 7—8 times as long as wide in lateral view, with four mesal spines in a slightly oblique transverse row. Apical circlet of 8 slender and widely separated spines, almost parallell to tibia. Mid tibia with approximately 70 sensillae on the dorsolateral surface (67—77, n=3). Hind tibia slender, about 12 times as long as wide in lateral view, bearing about 125 round sensillae (116—136, n=4), arranged in transverse rows of 2—3 sensillae on the dorsolateral surface. Proportional length of hind tarsomeres approximately 3:2:1.5:1:1 from the most proximate distad, measured along the ventral surface.

Abdomen. Black. Pilosity fine and light on entire surface.

Hypopygium. As in Figs 3 and 4. Gonostyli straight and rounded apically (Fig. 5). Tergite IX with hind margin slightly concave. Indentation on ventral side V-shaped.

Female (Figs 6—7)

Total length 4.2—5.4 mm, mean 4.7 mm (n=22).

Head. (Fig. 6). Black, setae on dorsal surface dark and coarse, intrafacetal setae short and brownish, length about one seventh of eye height in lateral view. Ventral surface devoid of pilosity. Length of head approximately equals 2.7 times eye diameter in lateral view. Antennae inserted approximately one third of eye diameter anterior to eye fore margin. Antennal habitus like male. Palpi short and stout.

Thorax. Black, proepimera yellowish brown. Length 1.2—1.5 mm, mean 1.33 mm (n=22). Smooth and shiny, with sparse setae. Anterior spine row consists of 14 blunt and short spines, posterior row of 14 spines. Dorsocentral setae dark and coarse, intraalar setae fine, pleura almost devoid of setae.

Wings. Length approximately 4.0 mm (n=2). Clear, costal cell not darkened. Vein coloration slightly lighter than in male, posterior veins of variable colour, brown to colourless. Pterostigma brown, more distinct than in male.

Legs. Reddish brown. Coxae, femora and tibiae approximately concolourous, tibia not black. Fore tibia approximately 5 times as long as wide in lateral view. A small, fifth protibial spine may be present. Sensillation as in male.

Abdomen. Dark brown, somewhat reddish. Pilosity short and light.

Terminalia. In ventral aspect as Fig. 7. Cerci rounded. Gonapophyses VIII relatively widely separated.

Ecology

The available material indicates a mainly northern/alpine distribution in Scandinavia.

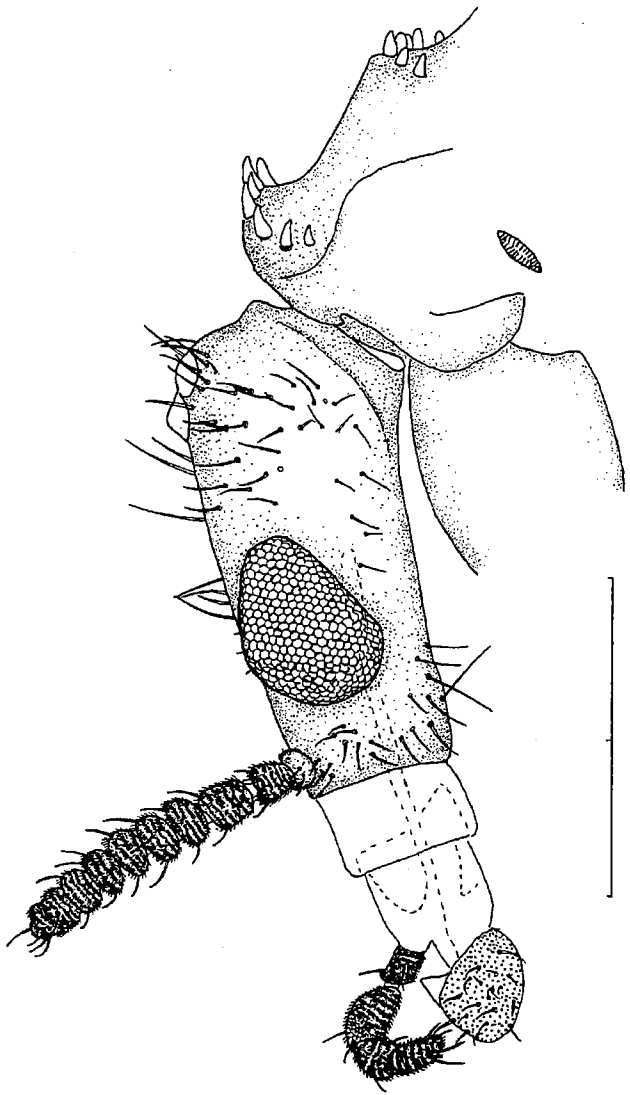


Fig. 6. *Dilophus borealis* sp. n., female head, lateral view. (Scale = 0.1 mm).

All records from Southern Norway (perhaps except from the rather diffuse locality name „Fron") are in the subalpine zone or above. Several of the localities in Northern Norway are lowland. The Swedish specimens were caught at lowland coniferous forest localities near Uppsala.

The species has been collected from birch forest and alpine localities, the maximum altitude from which it has been collected in Norway is 1300 m. near Kongsvoll. The numbers of this species found in trap catches are moderate, suggesting that mass-occurrences are not the species' normal pattern of appearance, or that its flight behaviour is such that Malaise traps are not ideally suited for its capture. The flight period will be considered in a paper in preparation.

Discussion

The species has previously been reported as *D. femoratus* (Siebke, 1864 and 1877, in part; Greve et al 1984) and as *D. vulqaris* Meigen (a synonym of *D. febrilis* (L., 1758) (Siebke, 1877). Some of Siebke's and all of Greve et al's specimens have been examined by the author.

The taxonomy of the European *Dilophus* species seems rather complex. Many characters vary considerably within currently recognized species. It is possible that some more species are present than are recognized at the moment. There may perhaps be a species complex, it is, however, also possible that the observed variation is just intraspecific variation.

Additional material

Norway: In Museum of Zoology, Bergen: BV, Gol: Engene, 1 ♂, 16.—30.8.1982, A. Bruserud (ZMBN A 22760). BV, Hol: Halnefjorden 1220 m, 9 ♂, 1 ♀, 29.8.1969, K. E. Jørstad et al (ZMBN A 22759). BV, Hol: Hovet, 1 ♂, 1.9.1969, A. Løken (ZMBN A 22876). BV, Uvdal: Geitsjøen, 9 ♂, 1 ♀, 24.8.1969, K. E. Jørstad et al (ZMBN A 22860 and 22861). NNV, Andøya: Bleik 1 ♂, 20.8.1983, L. Greve. TRI, Målselv: Kirkesdalen, 1 ♂, 25.8.1992, J. O. Solem. TRI, Målselv: Kirkesdalen Kjosvoll Malaisetrap, 3 ♂, 1 ♀, 10.—25.8.1992, J. O. Solem. TRY, Ibestad, Ibestad at church, 2 ♂, 19.8.1983, L. Greve (ZMBN A 22752). TRY, Ibestad: Sørrollnes on Rolla, 6 ♂, 1 ♀, 18.8.1983, L. Greve.

In Museum of Zoology, Oslo: Fron (OS, Sør-Fron or ON, Nord-Fron), 1 ♂, 27.7.1850, Siebke (ZMO 11982). Fron, 1 ♂, no date, Siebke (ZMO 11983). Dovre (ON, Dovre or STI, Oppdal), 4 ♂, no date, Siebke (ZMO 11979).

In Tromsø Museum: Fron (OS, Sør-Fron or ON, Nord-Fron), 1 ♂, 27.7.1850, Siebke. NSI, Rana: Krokstrand, Dunderlandsdalen, 4 ♂, 18.8.1926, Soot-Ryen. NSY, Sømna: Sømnes, 8 ♂, 22.8.1928, Soot-Ryen. NNØ, Sørfold: Røsvik, 1 ♂, 11.8.1923, Soot-Ryen. TRY, Tromsø: Ulsfjord, 2 ♂, 3.9.1922, Soot-Ryen. TRI, Storfjord: Vasdal, 3 ♂, 11.8.1922, Soot-Ryen. TRI, Balsfjord: Malangen, 2 ♂, 1926, Soot-Ryen. TRI, Balsfjord: Skjåvikør, 1 ♂, 10.9.1943, Soot-Ryen.

Sweden: In Museum of Zoology, Uppsala. From Upl: Uppsala, Nåsten S Håga: 1 ♂, 9.9.1966, 5 ♂, 2 ♀, 9.9.1969, 3 ♂, 25.8.1970, 1 ♂, 18.9.1972, 1 ♂, 9.9.1975, 1 ♂, 9.9.197?. Upl: Uppsala, Sunnersta, 1 ♂, 5.9.1975, 1 ♂, 7.9.1989. All these specimens collected during Zoology courses by Uppsala University.

Acknowledgements

Thanks to John O. Solem, Trondheim, Arne Nilssen, Tromsø, Karsten Sund, Oslo and Sten Jonsson, Uppsala, for giving me easy access to museum material. Thanks also to Jean-Paul Haenni, Neuchatel, Switzerland, for the loan of four paratypes of *D. neqlectus*. I also wish to thank Torstein Solhøy, Geir Søli and Endre Willassen,

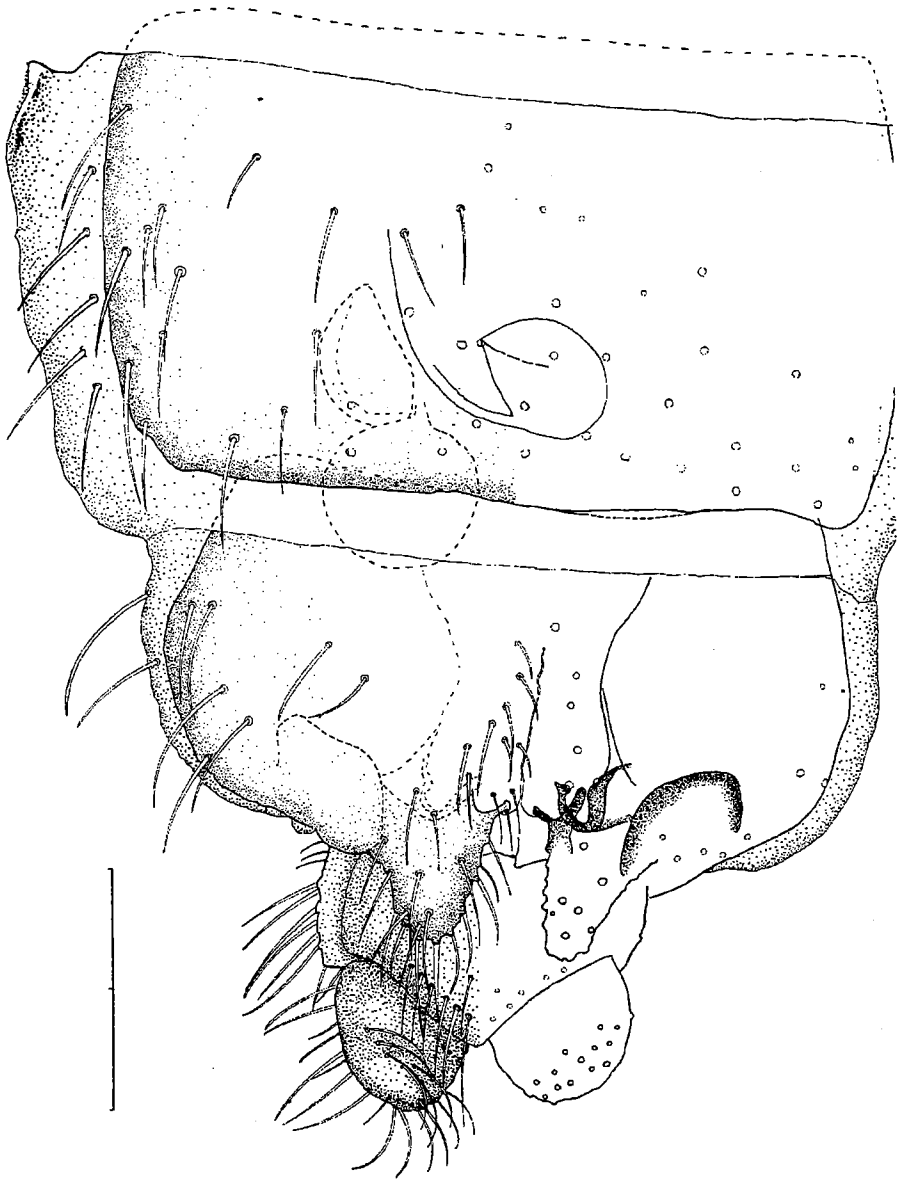


Fig. 7. *Dilophus borealis* sp. n., female terminalia, ventral view. (Scale = 0.2 mm).

Bergen, for critically reading through this manuscript. Finally, I wish to express my gratitude to Lita Greve, Bergen, for her assistance and advice during all phases of my work.

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Received 9 VI 1993

Descriptions of two new species of *Rhaphiomidas* (Diptera: Apioceridae)

RICK ROGERS

Rogers, R. 1993. Descriptions of two new species of *Rhaphiomidas* (Diptera: Apioceridae). *Dipterological Research*, 4(1–2): 13—19.

Descriptions of two new species of *Rhaphiomidas*: *Rh. hoguei* from Texas, and *Rh. scopaflexus* from Mexico are given.

Rogers, R. 4833 D Fulton Avenue Sherman Oaks, CA 91423, U.S.A.
Index words: Diptera, Apioceridae, *Rhaphiomidas*.

***Rhaphiomidas hoguei* new species**
(Fig. 1)

DIAGNOSIS. Large sized, with body extremely narrow for the genus, abdominal tergites primarily light orange-brown, bordered apically with a pale yellow vitta, compound eyes separated from lateral ocelli on vertex by more than the width of a lateral ocellus, proboscis of mouthparts short, slightly more than three times the width of the head, tarsal pulvilli broad, about two-thirds the length of the tarsal claws, terminalia rounded, with left hemitergite overlapping right hemitergite. Illustrated as Fig. 1.

DESCRIPTION OF HOLOTYPE

Male. **Head**: vertex, frons, face and posterior surface pale yellow-ochre pruinose, moderately densely clothed with short, light yellow pile, becoming longer on face and oral margin near proboscis, antennae with segments one and two light reddish-brown with whitish pruinosity, ventral side with long pale yellow macrochaetae, third segment missing (broken off) on both antennae, proboscis short, 8 mm.in length, palpi short, pale yellow-ochre pruinose, with pale yellow macrochaetae.

Thorax: humeral callosities deeply incised posteriorly, mesonotal surface light reddish-brown covered with pale yellow-ochre pruinosity, sparsely dothed with small reddish-brown hairs that appear golden when light is cast from certain directions, these hairs become larger around the postalar callosities, macrochaetae on lateral and posterior margins of mesonotum reddish-brown, markings on mesonotum are as follows: a pale orange median vitta divided in middle, also in middle is a very thin black vitta which is barely visible due covering with yellow-ochre pruinosity,

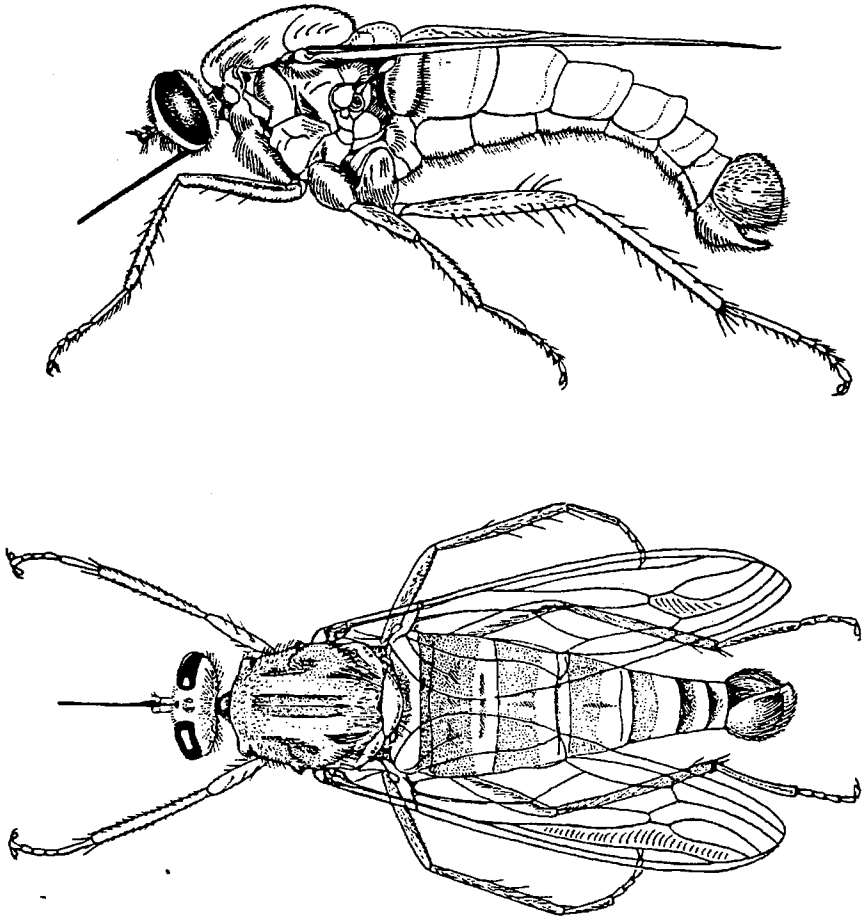

Fig. 1. *Rhaphiomidas hoguei*, Holotype, male.

two pale orange lateral vittae, one on each side, widely interrupted diagonally, scutellum deeply divided from posterior mesonotal margin, orange, with pale yellow-ochre pruinosity, sparsely clothed with small golden hairs, macrochaetae on posterior margin reddish-brown, wings with costal vein sparsely golden pilose in basal third, the remaining portion, plus the rest of the venation, light reddish-brown, lateral thoracic sclerites reddish-brown, covered with pale yellow-ochre pruinosity, darker reddish-brown areas at the dorsocaudal angle, and below metathoracic spiracle and halter, postnotal conical swellings with sides gradually constricting from base to near apex, apex narrowly constricted to a sharp point, the rather sparse pilosity of the lateral thoracic sclerites very light yellow, almost white, halteres with rather long stalk, pale orange in color.

Legs: middle and posterior pair longer than anterior pair, coxae light reddish-brown, covered with pale yellow-ochre pruinosity, rather densely clothed with very light yellow pile, and darker yellow macrochaetae, hind pair with dark brown macrochaetae, trochanters shining reddish-brown, with dark brown areas at point of attachment of the coxae and femora, sparsely clothed with pale yellow hairs, dark brown macrochaetae on hind pair, femora moderately thickened, orange, moderately densely clothed with short pale yellow pile, anterior pair with five dark brown macrochaetae on ventral surface, middle pair with a variable number of brown macrochaetae on ventral surface, and posterior pair with about 30 dark brown to black macrochaetae on outside lateral and ventral surfaces, apical end shining dark reddish-brown, tibiae as long as femora, orange, moderately densely clothed with short pale yellow pile, anterior pair with a variable number of reddish-brown macrochaetae, middle pair with a number of reddish-brown macrochaetae, mostly on ventral surface, posterior pair with a number of dark brown to black macrochaetae on all surfaces, tarsi with first segment on all legs as long as remaining segments, including daws, all segments with orange macrochaetae, tarsal pulvilli long, broadly expanded apically, about two-thirds as long as daws.

Abdomen: tergites mostly orange, tergite one, light reddish-brown with a covering of pale yellow-ochre pruinosity, tergites two through seven orange, with a slight whitish pruinosity, bordered apically with a pale yellow transverse vitta, sternites marked and colored same as tergites, tergites and sternites rather sparsely clothed with very light yellow pile.

Terminalia: (unopened) rounded, hemitergites sub-triangular. orange in color, left hemitergite overlapping right hemitergite, moderately densely dothed with small brown hairs basally, becoming longer and denser, changing to a bright orange color apically, ninth sternite convex, orange, surface wrinkled laterally, densely covered with bright orange pile, gonostyles extending posteriorly slightly beyond hemitergite apices, orange in color, covered with bright orange pile, interbasal folds triangular, deeply incised basally, apical tips dark brown, aedeagus projecting medially through membrane connecting gonostyles, base greatly enlarged, apex gradually narrowed, but tip cannot be seen due to the membranous anal tube which is covering it.

Length overall: 32 mm.

FEMALE. Unknown.

HOLOTYPE. Male, **U.S.A.**,*Texas*, Webb Co., Laredo, August 31, 1949, collected

by X. M. Fouts, deposited in the Los Angeles Co. Museum of Natural History. The male holotype is the only specimen known, my having found it while inspecting unsorted diptera in the museum's collection. The specimen was badly discolored by grease, but I thoroughly degreased it with acetone.

ETYMOLOGY. The species is named in honor of the late Charles Hogue, who, as curator of Entomology at Los Angeles Co. Museum of Natural History encouraged me to name this new species and placed the specimen at my disposal. Dr. Hogue made many contributions to Entomology and played a major role in developing the museum resources to their current high level.

ECOLOGY. Unknown, but most likely taken in a sandy area near the Rio Grande River.

RELATIONSHIPS. This species appears most closely related to *R. brevirostris* Cazier, 1954, a diagnosis I attribute to the following characters and character states: 1) the short proboscis and 2) the overlapping simple hemitergites. *R. hoguei* differs from *R. brevirostris* chiefly in coloration and pilosity, but particularly by the more elongated abdominal shape. From the collection date it appears to be a late summer flier, by contrast to *R. brevirostris*, which flies in early summer. It is closest to *R. painteri* in distribution, but morphologically differs by most diagnostic character states.

Rhaphiomidas scopaflexus Rogers, new species

(Fig. 2)

DIAGNOSIS. Small sized, moderately robust, hairy, clothed with long white sinuous hair, abdomen with tergites mostly black, with narrow apical borders of pale yellow, terminalia heart-shaped, produced and greatly compressed apically, proboscis long, about 10 mm., posterior pair of legs elongated, longer than anterior or middle pair, first segment of the hind tarsi extremely bowed, convex dorsally, with a very dense comb of long off-white pile over most of the ventral surface. Illustrated as Fig. 2.

DESCRIPTION OF HOLOTYPE.

Male. **Head**: vertex, frons, face and posterior surface moderately densely clothed with long off-white pile, surfaces of these areas gray pruinose, darker near ocelli, parafacial area shading from gray to reddish pruinose, antennae with segments one and two piceous, slightly gray pruinose with several white macrochaetae on dorsal side, ventral side with dense tufts of white macrochaetae, proboscis long, about 10 mm., 30 times the length of the antennae.

Thorax: humeral callosities not deeply incised posteriorly, surface gray pruinose, densely off-white pilose, sparsely white macrochaetose, mesonotum with shiny black median vitta, not divided in the middle, and two shiny black lateral vittae, not divided transversely, postalar callosities shiny gray with slight gray pruinosity, scutellum deeply acutely divided from posterior mesonotal margin, black, shining on basal half, slightly gray pruinose apically, moderately densely covered with long, white sinuous hair, wings with costal vein mostly golden pilose in basal third, the remaining portion short, black pilose, lateral thoracic sclerites gray pruinose, becoming brown pruinose near spiracles and basalare, dorsocaudal angle, basalare, supraepimeron and infraepimeron densely white pilose, postnotal conical swellings large and robust, halteres with rather long stalk, orange in color. Legs: coxae gray pruinose, densely white pilose, trochanters enlarged, shining black, sparsely white pilose, with four short black spines in single row along lower inside margins, femora black, shining, wrinkled laterally on outside surface, grooved along central portion of inside surface, front pair densely white pilose, no obvious macrochaetae, middle pair sparsely white pilose ventrally, densely white pilose dorsally, basal half with a few black macrochaetae, with four white macrochaetae along remaining portion, hind pair sparsely white pilose ventrally, densely white pilose laterally and dorsally, with a double row of brown macrochaetae along the basal half ventrally, tibiae with anterior pair testaceous, moderately densely white pilose, with scattered black and white macrochaetae from middle to apical portion, middle pair testaceous, shining black near apical portion, hind pair black, shiny, moderately densely white pilose from base to beyond middle of lateral and dorsal surfaces, densely long white pilose along entire ventral surface, moderately densely black pilose at apical third, a zig-zag formation of light brown macrochaetae along central portion of dorsal surface, tarsi of anterior legs slightly bowed, testaceous, moderately densely white pilose with a few large white macrochaetae, smaller scattered black macrochaetae, middle pair slightly bowed, shining black, with very short, stout black spines, large white macrochaetae, tarsal claws and pulvilli testaceous, first segment of hind pair extremely bowed, black, with light brown hairs covering light brown waxy pruinosity, small black hairs on dorsal and outer lateral surfaces, very dense comb of long, off-white pile on most of the ventral surface apical ends of tarsal segments with short black spines and light brown macrochaetae, pulvilli and claws testaceous.

Abdomen: all tergites mostly black, with narrow apical borders of pale yellow, slightly darker in the middle, moderately dense, white, semi-erect pilose, denser on sides, hair on first and second tergites rather sinuous, gradually straightening on remaining tergites, sternites the same as tergites in color and pilosity. Terminalia: (not opened) hemitergites heart-shaped, produced and greatly compressed apically, mostly shining black in color, wrinkled, rather densely clothed with white pile laterally and ventrally, narrowly bordered with reddish-brown along margins of sutural opening, color widening and continuing around apex, and along margins of ventral side of sutural opening, prominent subdorsal longitudinal carina are present on inside surfaces of hemitergites, margins of carina with very small jagged edges, membranous anal tube dark brown, protruding through space between carinal margins to about half the length of the hemitergites, aedeagus reddish-brown, rather narrow basally, strongly recurved anteriorly, gonostyles easily seen from dorsum because of hemitergite shape, shining piceous laterally outside, dense, long white pilose basally and laterally, shining reddish-brown inside, basal projections ear-shaped and half the length of the gonostyles.

Length overall. 21 mm. mesonotal width 6 mm.

FEMALE. Unknown.

HOLOTYPE. Male, **Mexico**, Baja California Sur, 5 miles south of Mulege, April 15, 1992, Andrew Calderwood, collector.

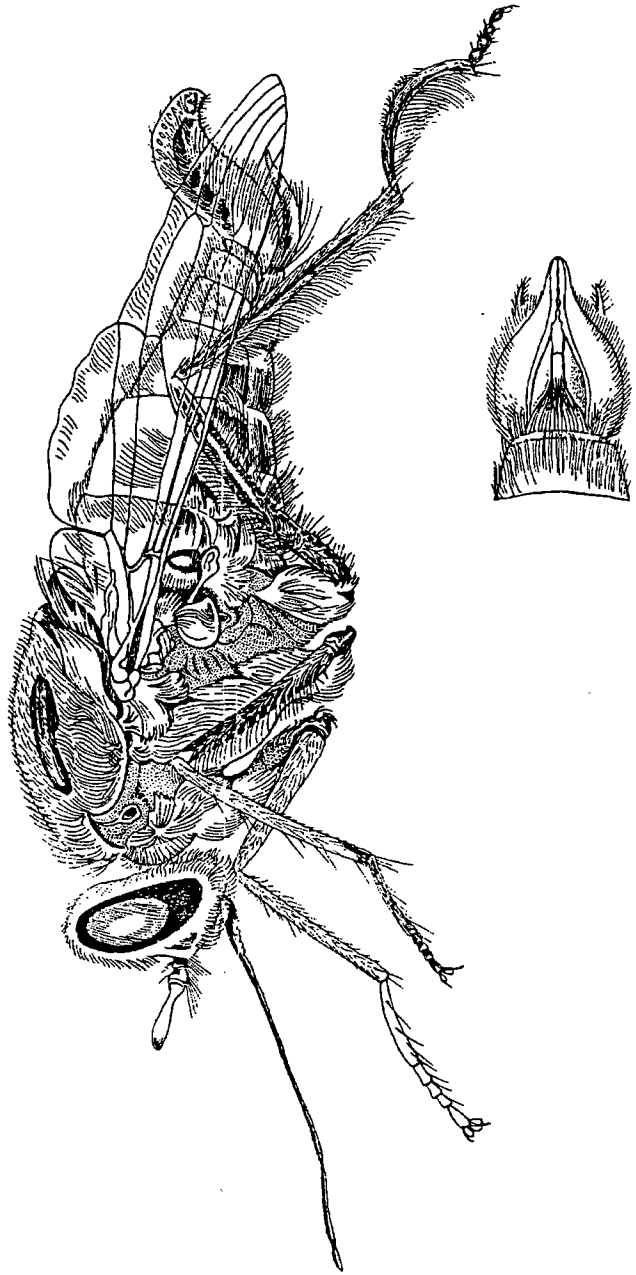

Fig. 2. *Rhaphiomidas scopaflexus*, holotype, male. Inset dorsal view of terminalia.

ETYMOLOGY. Latin, *scopa* (brush) *flexus* (bending), the name refers to the unique shape and pilosity of the first tarsal segment of the hind legs.

ECOLOGY. The single male holotype was taken on coastal sand dunes, nectaring at flowers of a 3 foot high purplish-blue composite.

RELATIONSHIPS. *Rhaphiomidas scopaflexus* can be separated from all other species in the genus by the extremely bowed first tarsal segment of the hind pair of legs. In color and size, it most closely resembles *R. parkeri* Cazier, 1941, but, in addition to the leg structure also differs in having heart-shaped terminalia. The terminalia shape and pilosity covering the body and legs, indicate a possible relationship with the recently described species *R. spinicaudus* Cazier, 1985.

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Observations on the Natural History and Conservation Biology of the Giant Flower Loving Flies, *Rhaphiomidas* (Diptera: Apioceridae)

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The genus *Rhaphiomidas* Cazier is comprosed of 19 species including two new species described previously (Rogers, 1993). The most recent findings on the natural history of these flies are presented with emphasis on their conservation biology. New information on the life history of several species is presented, although the complete life history of these animals remains undescribed. A brief review of the distribution of each species is given with known nectar sources and phenology.

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Index words: Diptera, Apioceridae, *Rhaphiomidas*.

Introduction

Flies of the genus *Rhaphiomidas* Cazier, in the family Apioceridae, along with some Mydidae and Asilidae, are the largest North American Diptera. They are rapid flyers and have the capability of hovering while taking nectar at flowers. In flight, the flies are usually heard before they are seen. They produce a high pitched whine that is loud, erratic, and quite definitive once recognized. At least one species is an important pollinator of a listed endangered plant (John Wheeler, unpub. data), and all well studied species are restricted to specialized habitats. They are so fast and wary that a long net handle is a necessity for collecting them. In spite of the size and beauty of these animals they are seldom collected, a combined result of their short flight periods, specialized habitat requirements, and extreme difficulty of observation and collection. In his recent revision of the genus, Cazier (1985) listed 17 species and five subspecies, most of which he authored, in addition to an

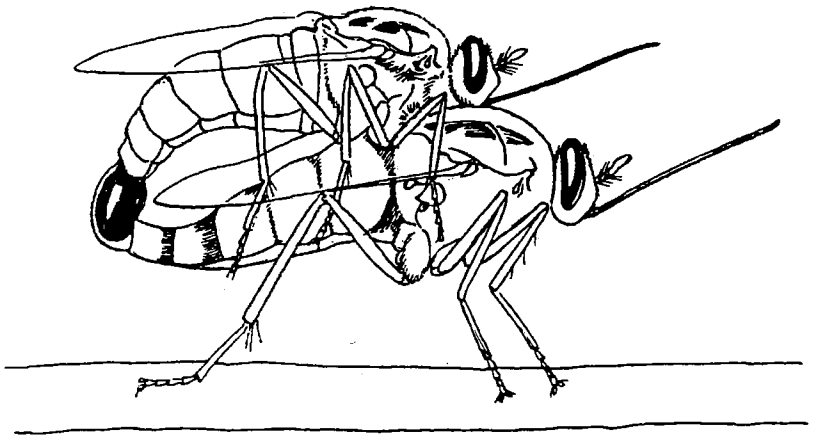

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Fig. 1 *Rhaphiomidas nigricaudus* in copulation drawn from a sketch made in the field by R. Rogers.

exhaustive review of all information available to that date. The purpose of this paper is to provide observations of the most recent findings on the natural history of these flies, emphasizing points concerning the extinction or threats to extinction of three taxa, and present a brief review of their distribution.

Distribution and Phenology

These remarkable flies are restricted to desert and semidesert regions of California, southern Nevada, Arizona, New Mexico, western Texas, Baja California, and northwestern Mexico, but can be expected into the Mexican states of Sonora, Sinaloa, Nayarit, Jalisco, and Colima when they are more thoroughly collected. A new species (Rogers, in press) extends the previously recorded range to western Texas. It is likely the genus extends yet further east, north and south wherever appropriate habitat is found. Appropriate habitat is on or near sand dunes, dry rocky washes with sandy areas nearby, or coastal dunes near the ocean. All known species appears to be obligately associated with sand. Collection data indicate that the appearance of adults within any specific population falls into one of three modal periods of seasonal occurrence: spring species (March-May), a summer group (May-Sept.), and fall species (Sept.-Oct.). All species are univoltine with the flight period of each species at a locality appears to be short, in the order of two to three weeks. Comprehensive phenology data are unfortunately limited.

Mating

Mating behavior has not been reported previously because mating is rarely seen among these flies. In the only two cases where close observation was possible, males were seen to mount the females above, with both sexes facing the same direction, as illustrated in Fig. 1 for *R. nigricaudus* Cazier. This observation (Bogert Trail Road, Palm Springs, Riverside Co. CA., 1400 hours, 2 May 1986, Rogers) began with the sighting of an unusual flying mass that landed on the stem of a desert willow (*Chilopsis linearis*) within 30 seconds of sighting., In flight the pair flew in a gently undulating fashion at about eye level. Both sexes appeared to be actively flying. After landing, the pair remained coupled for 1—2 minutes, then abruptly separated and flew away independently.

The second observation involved *R. sp. nr. undulatus* Cazier (Hwy. 62, 18 miles east of 29 Palms, Riverside Co. CA., 8 May 1992, 1400 hours, Rick Rogers) on a cool breezy, cloudy day. In this instance the male was first noted actively pursuing the female. Each time the female landed the male attempted copulation by jumping upon her back. On the fifth attempt he finally landed and locked on the upturned female abdomen. The act took place on a creosote bush stem. The pair remained locked in position for 3—4 minutes. The male then dismounted and both sexes flew away independently, the male not following.

The period of copulation in both cases lasted just a few minutes, which could account for the rarity of mating observations. We have spent over 200 hours in the field concentrating on *Rhaphiomidas* resulting in only two sightings. For such large insects that dearly depend on rapid flight to escape predators, any unnecessary time allowing vulnerability to predators would be disadvantageous. The mating position is opposite to that noted for the „sister" genus *Apiocera*, wherein the coupling is tail to tail with the two sexes facing opposite direction both at rest and in flight.

Oviposition

Prior to this report, the only observed oviposition of any species was that by F. Parker with *R. parkeri* Cazier in April at Blythe, California. Parker's notes are given in Cazier (1985) and have been confirmed by us for several species. What Parker assumed was oviposition behavior (he was unable to find the eggs, but hypothesized oviposition had taken place) was correct.

The first attempt to obtain eggs in the laboratory was made in August, 1986 with freshly collected adults of *R. terminatus abdominalis* taken at Colton, California. A set of 2 males and 2 females was confined in a 10-gallon aquarium filled with one inch of clean sand. The animals were introduced into the cage shortly after collection.

The males lived for three days in captivity and were not fed. The females lived longer in captivity, 5 and 8 days respectively. The females became active at 1000 every day, regardless of light conditions and settled down for the night about 1700 except when ovipositing. After five days in the aquarium, the surviving female stopped flying and appeared moribund. She was offered a mix of sugar water and mashed Banana. The fly showed immediate interest, imbibed for about ten

seconds, paused, and sipped for ten more seconds. Immediately after, she flew straight up and out of the aquarium to a window. After capture she remained hyperactive and proceeded to oviposit.

Observations of the oviposition behavior were made August 8, 1986 at 1930 hours, indoors with artificial light. The female's abdomen was extended about twice the normal length, then the acanthophorites near the genital opening spun around in a half circle, drilling a shallow depression in the sand. She then backed into the sand until the entire abdomen was buried. At the same time, the wings moved in a slow scissors-like motion and the sides of the abdomen expanded and contracted. Oviposition took about one minute with single eggs deposited. Each time the act was completed the female would hop several inches away and repeat the behavior. A total of 40 eggs were later sieved from the sand. Eggs are about 1.5 x 3 mm, almost kidney-shaped, pure white with a slight pink iridescence.

Later trials were successful with the following species:

R. sp. nr. undulatus, (18 miles east of 29 Palms, May 8, 1988.), 20 eggs recovered from one female placed as soon as collected in a quart plastic cottage cheese container with two cm sand on the bottom and a gauze top. The female was not fed and laid most eggs on the return trip in the car. Did not lay any further eggs, 18 eggs hatched June 3.

R. hirsuticaudis Cazier (Yuma airport loop road, Yuma Co. AZ, 2 Oct. 1989), 12 eggs were laid during the car trip home in a cottage cheese container, all hatched viable larvae, 26 Oct.

R. parkeri, 18 April, 1992, hatched May 9, 3 larvae.

R. acton Coquillett, (Cronise dry lake, San Bernardino Co. CA. May 23, 1992) laid 12 eggs, all hatched 9 June.

During 1990—1991 several attempts were made to obtain eggs in order to investigate and describe a complete life history. All involved the plastic container system and all were unsuccessful. Species attempted were *R. acton*, *R. terminatus abdominalis*, and *R. hasbroucki*. The latter laid two eggs, both were infertile. Six females of *R. nigricaudis* were confined as usual, but all flew so violently within their containers that they beat themselves to death before the end of the collecting day. This extreme behavior was not noted for any other species.

Oviposition behavior, as described above, has been observed repeatedly in the field for three species, *R. undulatus* at 29 Palms (loc. cit.), *R. nigricaudis* (Palms Springs, loc. cit.) and *R. hirsuticaudis* at Yuma (loc. cit.). At the three sites oviposition was restricted to shaded areas within one to several feet from the shrub trunk or within the plant cover, depending on plant species. The plants included creosote bush (*Larrea*), sand verbena (*Abronia*), silk-tassel bush (*Gerrya*), burr-bush (*Ambrosia*), and dunes primrose (*Oenothera*). The most productive females for captive oviposition were those observed performing this act in the field. Ovipositing was only observed after 1300 hours.

Rhaphiomidas painteri Cazier (sand dune 2.3 mi. N. of Mesquite exit, I—10), Sept. 23,1982,1420 hours, a female was observed flying slowly over flat compact sand with considerable gravel content (G. Forbes, pers. comm.). Upon landing and performing oviposition behavior, she left behind a small round crater with elevated sides, about 3 mm deep and 4 mm in diameter. The female was observed to oviposit (or attempt oviposition) three more times at locations from 2—3 cm apart, and about 10 cm from the base of a snakeweed (*Xanthocephalum sarothrae*).

A second female was observed making the same motions, with a pumping action of the abdomen, in the same area as the first. Duration of the atempt was about 90 seconds. A third female was observed at the same time and place on the north slope of the dune preparing to oviposit beneath an indigo bush (*Dalea*). No eggs were recovered from any of these instances.

The only exception to these oviposition sites was a female of *R. hirsuticaudis* Cazier noted laying in tire tracks on the road shoulder over 10 feet from the nearest plants (1630 hours, loc cited).

It has proven virtually impossible to recover eggs from natural sites.

Fecundity and reproductive strategy

One female of *R. acton* was dissected after a one day holding period without feeding. No eggs were laid. Almost the entire abdominal cavity was filled by an air sac with the only identifiable tissue the ovarioles and a slender alimentary tract. The ovarioles contained only 8 mature eggs with a maximum of about 60 eggs identifiable under the dissecting scope. For this instance, it would appear continuous nectar feeding is necessary to support egg maturation, similar to the case for butterflies shown by Murphy et al. (1983).

These observations indicate at least some species of *Rhaphiomidas* produce relatively few, but large eggs. Furthermore, since energy stores as fat bodies are virtually non-existent, maintenance of fecundity must depend on frequent feeding. Dissection of one male of the same species likewise revealed an abdominal cavity essentially occupied by an air sac with only minute testes and follicles. Unlike the case with butterflies, wherein males may make a substantial investment to egg nutrition (Boggs, 1982), fertilization by a male fly would appear strictly for sexual purposes.

Development and early stages

The following observations were made with *R. terminatus abdominalis* noted above. When first laid, eggs are opaque pearly white. Infertile eggs remain opaque, while fertile eggs become translucent pale yellow after several days and after a 6—8 days the outline of the developing larva is visible beneath the chorion. The egg retains its kidney-shape and the posterior segments of the larva start to turn into a „J" shape, as seen in Fig. 2.

A dramatic change takes place at 11 to 12 days. The larva rapidly develops,

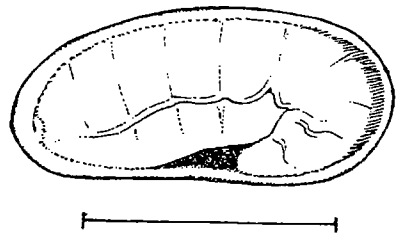

Fig. 2. *Rhaphiomidas terminatus abdominalis*, egg at 7 days showing larva position, egg still reniform, but transparent. Scale bar, 1 mm.

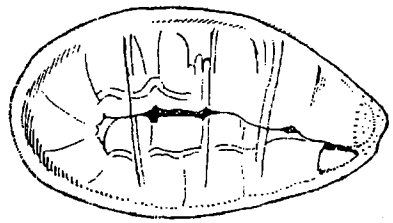

Fig. 3. Egg at 11 days, a few hours before hatching showing larval growth, note change in egg shape

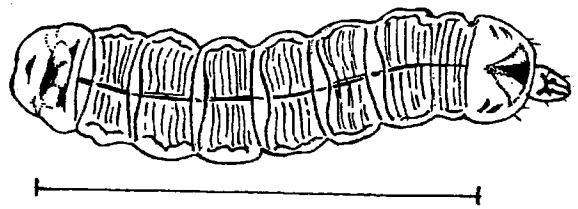

Fig. 4 Fig. 4. Larva shortly after hatching from egg, above. Scale bar 5 mm.

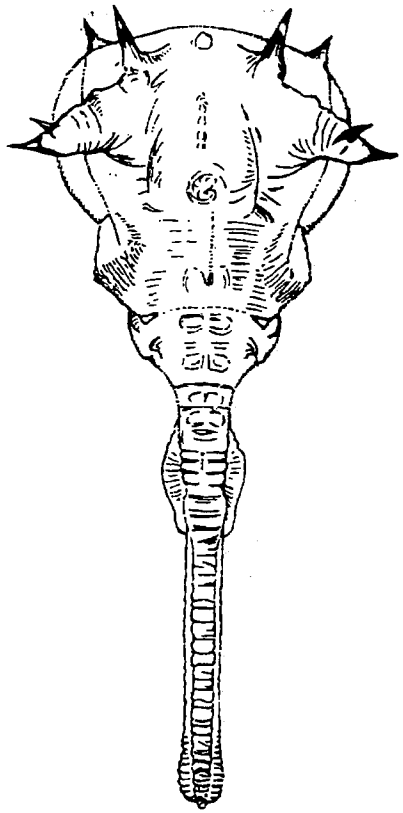

Fig. 5. Head capsule of pupa case recovered in the field, *Rhaphiomidas undulatus*, 29 Palms, CA

first by stretching in a undulating motion from head to tail, until the posterior segment touches the head. At this moment a molt takes place. The skin is cast off and pushed into the small empty space in the middle of the loop formed by the larva. Prior to hatching the egg changes shape from kidney to oval (Fig. 3). The skin is usually left behind in the egg after the larva hatches, but it is sometimes eaten. The neonate larva thus hatches as a second instar, illustrated in Fig. 4. The larvae began breaking out of their egg cases between 0100 and 0200 and had all emerged by 0500—0700.

Immediately upon hatching, the larvae started rooting through the sand substrate with their mouth hooks, apparently searching for food. A number of items were offered to the 13 larvae that hatched, including: small beetle larvae from sand dunes, *Drosophila* larvae, and immature sand roaches, *Arenivega* sp. Nothing was eaten, and all fly larvae died within 15 days, most dying within a week. A few larvae molted a second time just prior to death, but had not grown and were unable to become free from the earlier skin. Three *Rhaphiomidas* larvae kept together in a small container did not become cannibalistic even though starving.

The larvae did not bury themselves in the sand as do the therevids and mydids, but crawled on top of the sand in a undulating "inchworm" type of motion. They seem well adapted for moving over the sand using welt-like swellings on the underside of most segments as false legs.

Larvae of three other species, cited above, were obtained from eggs laid by captive females. All items of food, including synthetic diets, offered to all species were rejected. It remains unclear as to whether these flies are herbivores or carnivores like larvae of the closely related genus *Apiocera* Westwood that were successfully raised on earthworms in the laboratory (Cazier, 1982).

Eclosion

Hogue (1967) was the first to describe the eclosion of a *Rhaphiomidas*, *R. terminatus terminatus* Cazier from a sighting by a curious homeowner in mid-August 1965. From this and our later observations, it appears that pupae are always located underground, moving to the surface just prior to eclosion. The first eclosion observed in our studies was *R. undulatus* (8 May, 1988, 29 Palms, loc. cit., Rogers). The fly was seen emerging at 1805 hours from a pupa that appeared to have just surfaced. The teneral adult remained soft, not hardening completely until the following morning. The second observation was of an emerging *R. terminatis abdominalis*, found in the late afternoon at the now destroyed San Bernardino Avenue and Wildrose locality at Colton (San Bernardino Co., CA, 12 Aug. 1988, Rogers) which was attacked and killed by ants.

A number of pupal exuviae have been recovered from the field, including *R. undulatus* at 29 Palms, *R. nigricaudis* at Bogert Trail, *R. acton* at Ridgecrest, and *R. parkeri* at Glamis (Imperial Co. CA), in addition to those cited above. Curiously the pupal cases of both *R. nigricaudis* and *R. undulatus* were found dumped each in groups of 6—10 within areas no more than three square feet in open space, 3—5 feet from the nearest plant.

In all instances observed pupal cases were found in microhabitats of hardened sand surface with the emergence holes quite distinct and clearly not adventitious

burrows of other animals. Only the anterior half of the pupal actually emerges from the soil substrate. All pupa cases found were in the open, a minimum of 5 feet from perennial plants, quite in contrast to oviposition sites. The head of *R. undulatus*, Fig. 5, shows the spine pattern that may be useful in tunnelling through the substrate for emergence.

Some adult behavioral characteristics related to capture

Females of the three species *R. acton*, *R. undulatus* and *R. hirsuticaudus* have shown the odd habit of flying straight up into the air when released from an insect net Their flight continues until they are completely out of sight at about one hundred feet altitude. We have never observed a return. Released males on the other hand fly in a horizontal direction, continuing at a normal but higher speed. When removed from the net by hand, lightly pinching them, males try to pinch with their hemitergites. The abdomen is curled back with the hemitergites opening and closing, simulating a pinching or stinging organ.

While adults are knocked out quickly in a killing jar, specimens often revive, even after one hour in a freshly charged ethyl acetate jar. This is particularly true of females of larger species. One *R. undulatus* female, pinned in a cigar box, worked the pin out of the bottom and flew off, with the pin, when the lid was opened.

Interactions with other insects

Large asilids such as *Proctacanthus* Macquart are known to prey on *Rhaphiomidas*. Cazier (1985) cites *R. hasbroucki* being attacked by *Proctocanthus nearno* Martin. One of us (Rogers) has seen *R. parkeri* taken as prey by *P. coquilletti* Hine at Glamis (loc. cit.). Forbes (pers. comm.) reports *Promachus nigrialbus* Martin taking a male *R. painteri* as prey at the sand dunes near I—10 in New Mexico (loc. and time cit.). Forbes believes the asilid is a major predator as it is abundant where and when *R. painteri* flies.

By far the strangest interaction with another insect was an observation involving two bombyliid flies of the genus *Villa*. nr. *molitor*. These small and delicate flies were strongly attracted to the much larger *R. undulatus* (28 May, 1991, Hwy. S22, Culp Canyon, 11 miles east of S2, San Diego Co. CA, Rogers). These observations were made between 1000 to 1230. The two bombyliids flew behind the *R. undulatus* as if tied to it by a string. Then they took turns alternately hovering and actually landing on the thorax of the *undulatus*, while it was feeding on the common buckwheat (*Eriogonium fasciculatum*). These joint flights were seen several times, the piggy-back landings only once. This behavior was not seen at other localities and its meaning is unclear.

Population densities and colony sizes, isolation and sensitivity to extinction.

The primary habitat requirement of these flies is sandy substrate with a sparse cover of perennial shrubs. Adults are restricted to selected sandy areas with just the proper vegetation cover that they do not leave. On the Kelso sand dunes, for example, *R. tarsalis* Cazier are concentrated around the dune border with its sandpaper plant,

Petalonyx thurberi, shrubs reaching only 20% cover. Adults do not wander onto the dunes or the surrounding less sandy areas.

In their habitat niches, populations can be dense and abundant. All species we have dealt with in the field, excepting the endangered or extinct *R. terminatus-trochilus*-group taxa, seem capable of producing very large populations. The most abundant species encountered to date was *R. aitkeni* Cazier on the east slope of the Sierra Nevada Mountains (Gerkin road, just off hwy. 395, south of Bishop, Inyo, Co. CA 29 June 1991, Rogers). An average of 20 adults were observed simultaneously on each mature shrub of the common buckwheat, *Eriogonum fasciculatum*, along the wash. With this plant community extending about 100 miles north-south in a belt 5—10 miles wide, the *R. aitkeni* population must have ranged into the millions with a density of over one thousand per acre. This is the densest and most extensive population we have seen to date.

Other high density populations are as follows. The *R. acton maehleri* Cazier population near Phelan, (San Bernardino Co. CA 22 June 1991, Rogers) had an average of 10 adults on each *E. fasciculatum* and *Salvia mohavensis* shrub for about 4 miles along Hwy 138. *R. nigricaudis* at Bogert Trail Road (loc. cit.) was visually sighted in flight and nectaring by the hundreds across an isolated 600 acres sand area, an area imminently threatened with development. At the Kelso Dunes, (San Bernardino Co, 20 June 1988 Rogers) there were 15—20 *R. tarsalis* on each *Petalonyx thurberi* bush. With several thousand bushes at the site the minimum adult population here approached 50,000 on about 500 acres. Other records of high density populations, in the order of 1000 per acre, include *R. undulatus* on *E. fasciculatum* at Culp Valley (loc. cit.) 28 May 1991 and 18 miles east of 29 Palms (loc. cit.) on sand verbena; *R. nigricaudis* and *R. undulatus* sympatrically and synchronically at Palm Canyon, Borrego Park, San Diego Co., CA 25 May 1991 on *Salvia apiana*;; and *R. parkeri* at Glamis sand dunes, Imperial Co. CA 8 April 1988 with hundreds seen on sand verbena and Spanish needles (*Palafoxia linearus*).

Across all these sites, as is characteristic for virtually every habitat in which *Rhaphiomidas* fly, vegetation is sparse, always less than 50% cover, and usually in the range of 10—20%. Either low shrubs (c. 1—1.5 m high) form the plant community, or there is a denser cover of sand verbena. The only exception we know is a population of *R. acton maculatus* Cazier in Cottonwood Canyon, Borrego Park, San Diego Co., CA that is associated with an open stand of desert willow and mesquite, trees reaching 3—5 m.

Most known populations appear to be confined to habitats that are naturally very patchy and fragmented. From our observations, it may be inferred that any species can potentially produce high density populations of adults under natural conditions. By contrast, at all localities and during poor climatic seasons, adult populations can be reduced substantially or not appear at all. This is, indeed, a characteristic of all insects inhabiting harsh environments.

With urbanization and natural habitat destruction, some species have become vulnerable to extinction because of their dependence on specialized conditions. The great majority of *Rhaphiomidas* occur in regions not favorable for human exploi-

tation or massive resource development and need not be causes of concern. All members of the *R. terminatus* group, including the taxa *terminatus*, *abdominalis*, and *trochilus* are, however, are either extinct or nearly so. *R. terminatus terminatus* is unquestionably extinct. The last sample was the pupal eclosion recorded in 1965 (Hogue, 1967), and the last habitat fragment sufficient to support any population of more than a few dozen individuals was the some 600 acre prairie fragment at Los Angeles International Airport effectively destroyed as habitat in 1968. Earlier, the species ranged at minimum across the 36 sq. mile coastal prairie and along the Los Angeles River bank alluvium into nearly downtown Los Angeles.

R. terminatus abdominalis is restricted to the Delphi sand formation of extreme western Riverside and San Bernardino counties. Populations formerly likely occurred across the 25,000 acre range of this soil substrate type (Ballmer, 1989), but are now reduced to a few hundred acres, mostly fragmented. Our 1985 survey indicated the populations only in the hundreds, and more recent observations suggest the species has declined from that level. Our last transect count in 1989 produced 13 sightings in the best, yet already highly disturbed, remaining habitat. By crude extrapolation, the 1989 adult standing population was on the order of a few hundred at maximum. Because of imminent extinction Ballmer (1992) requested an emergency listing of this species from the U. S. Fish and Wildlife service as provided by the Endangered Species Act. The matter is pending.

R. trochilus, which is related to if not a subspecies of *terminatus*, and has been believed extinct since the last collection at the Antioch sand dunes in 1974, may still exist in suitable habitat along the San Joaquin river. A specimen was presumably taken at Oakley, east of Antioch, in August, 1986, and other populations have been recorded earlier as far south as Lindsay in Tulare county. The species should be considered a candidate species for listing under the Endangered Species Act.

Coastal populations of *R. acton maculatus* in San Diego county and in northern Baja California have been seriously impacted by habitat destruction for development and this subspecies is extirpated in most areas. Across portions of the desert off-road vehicle destruction probably has serious negative effects in many regions.

Annotated Checklist of *Rhaphiomidas* species

The following list is presented for purposes of briefly summarizing the current taxonomy, observed flower visitations, distribution, time of adult flight, and conservation highlights of each taxon. We are in process of a systematic study of the genus applying cladistic principles and will present a character matrix when that work is complete. Until that time we retain the taxa recognized by Cazier (1985).

R. acton Coquillett, 1891

The most widespread, abundant, and variable species of the genus. There are three named subspecies which are differentiated by maculation patterns which broadly overlap: *acton, maculatus*, and *maehleri*.

Nectar sources. The widest observed range of nectar sources, in part dependent on

specific population site: *Salvia mohavensis* (Phelan), *Eriogonum fasciculatum* (all localities), *Eriastrum spp., Chilopsis linearis*, (Cronise dry lake) *Gerrya canescens*, (Hopkin's well), *Baileya multiradiata* (Kelso Dunes). At the Kelso dunes *R. acton* is sympatric and synchronic with *R. tarsalis*, yet completely segregated by microhabitat, defined in this case by nectar source preference. *R. acton* is confined to the area of harder surface sand lying upslope from the free dunes margin sand, and these sites respectively are substrate for *Baileya* for *R. acton* and *Petalonyx thurberi* for *R. tarsalis*.

Distribution. R. acton acton: CA: Mono Co., Inyo Co., Kern Co., Los Angeles Co. (Mohave Desert areas), San Bernardino Co., Riverside Co., San Diego Co., Most captures late May and June.

R. acton maculatus Cazier, 1941: CA: San Diego Co., MEXICO: Baja Calif. Norte. Mid May to mid July 20.

R. acton maehleri Cazier, 1941. CA.: E. San Bernardino Co., E. Imperial Co., E. Riverside Co., AZ: Yuma Co., Mohave Co. April — May.

R. aitkeni Cazier, 1941

Nectar source. Only observed on *Eriogonum fasciculatum.*

Distribution. CA: Inyo Co. NE: Nye Co. Late May — mid July.

R. auratus Cazier, 1985

Nectar source. Eriastrum sp. (Clark Co. NV, Rogers).

Distribution. CA: Inyo Co. NE: Clark Co. AZ.: Mohave Co. Late April — mid July.

R brevirostris Cazier, 1954

Nectar source. No flower visits observed, most resting on sand.

Distribution. AZ: Yuma Co.: Mexico: Sonora May — mid-June.

R. episcopus episcopus Osten Sacken, 1877

Nectar source. Antigonon leptopus, Melochia tomentosa.

Distribution. R. episcopus episcopus. Mexico: Baja Calif. Sur: San Jose de Cabo. Sept.

R. episcopus michelbacheri Cazier, 1985

Mexico: Baja Calif. Sur: Todos Santos area. Late Aug. — mid Oct.

R. forficatus Cazier, 1985

Nectar source. No flower visits observed, most resting on stones in washes.

Distribution. Mexico: Baja Calif. Sur: San Ignacio. mid April 14—15.

R. hasbroucki Cazier, 1985

Nectar sources. No data.

Distribution. CA: Riverside Co. AZ: Yuma Co. May — June.

R. hirsuticaudus Cazier, 1985

Nectar sources. Never observed nectaring, even around abundant flowers most resting on sand.

Distribution. CA: Imperial Co. AZ: Yuma Co., Sept. — Feb.

***R. hoguei* Rogers, 1993**

Nectar sources. No data.
Distribution. TX: Webb Co. Aug. 31. (Holotype only, Rogers, 1993: 13).

***R. nigricaudis* Cazier, 1985**

Nectar sources. Salvia apiana, S. carduacea, Eriastrum eremica.
Distribution. CA.: San Diego Co., Imperial Co., Riverside Co., AR: Yuma Co. April — May.

***R. painteri* Cazier, 1941**

Nectar sources. Medicago sativa, Lepidium montanum, Dithyrea wislizenii, Ipomopsis (=GiliaJ longiflora, Funastrum =(Funastemma) heterophyllum.
Distribution. NM.: Dona Ana Co. TX: El Paso Co. Late Aug. — Sept.

***R. parkeri* Cazier, 1941**

Nectar sources. Abronia villosa, Palafoxia arida.
Distribution. CA.: Riverside Co., Imperial Co., San Bernardino Co., AZ.: Yuma Co. Apr. — early May.

***R. scopaflexus* Rogers, 1993**

Nectar sources. Spanish needles *Palafoxia arida.*
Distribution. Mexico: Baja California Norte. April 15 (only holotype known, Rogers, 1993: 16).

***R. socorroae* Cazier, 1985**

Nectar sources. Abronia umbellatum.
Distribution. Mexico: Baja Calif. Norte, May.

***R. spinicaudus* Cazier, 1985**

Nectar sources. No data.
Distribution. Mexico: Baja Calif. Norte, Apr.

***R tarsalis* Cazier, 1985**

Nectar sources. Petalonyx thurberi.
Distribution. CA.: San Bernardino Co. Late May 24 — June 30.

***R. terminatus terminatus* Cazier, 1941**

Nectar sources. Flower visitations not observed, usually rests on sand, but one old report on *Eriastrum* near Los Angeles (Cazier, 1985).
Distribution. R. terminatus terminatus CA: Los Angeles Co. Mid July 15 — early Aug. 6 extinct: Last collected: 1966.

***R. terminatus abdominalis* Cazier, 1941**

Distribution. CA: San Bernardino Co. Early Aug. 10 — Sept. Highly endangered.

***R. trochilus* Coquillett, 1892**

Nectar sources. Never seen in association with flowers, rests on sand.
Distribution. CA: Contra Cost Co., Merced Co., Stanislaus Co., Tulare Co., San Joaquin Co. July — early Sept. Presumed extinct. Office of Endanagered Species, U. S. Fish and Wildlife Dept. (1984) Listing 3A (As Extinct), but one record 1986.

***R. undulatus* Cazier, 1985**

Nectar sources. Eriogonum fasciculatum, Salvia apiana.
Distribution. CA: Riverside Co., San Diego Co. May — mid June.

***R. xanthos xanthos* Townsend, 1895**

Nectar sources: Antigonon leptopus.
Distribution. R. xanthos xanthos Mexico: Baja Calif. Aug. — Sept.

***R. xanthos vittatus* Cazier, 1985**

Distribution. Mexico: Baja Calif. Sur: Oct. 8 (only the male holotype is known at this time).

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A checklist of Latvian, Lithuanian and Estonian hover flies (Diptera, Syrphidae)

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Kuznetzov, S. Yu. 1992. A checklist of Latvian, Lithuanian, and Estonian hover flies (Diptera, Syrphidae). *Dipterological Research*, **4**(1–2): 35—47.

A checklist of the Syrphidae found within the present borders of Latvia, Lithuania, and Estonia, which comprise 71 genera and 288 species, and the analysis of data published in the course of about 200 years (1778—1992) are given.

S. Yu. Kuznetzov, Zoological Institute, Russian Academy of sciences, 199034, St.Petersburg, Russia.

Introduction

Syrphidae are small to large-sized (4—25 mm) flies, commonly called flower or hover flies as adults and maggots as immatures. The adult syrphids frequently have a black and yellow coloration, many syrphids flies have a striking mimetic resemblance to bees and bumble-bees while others to wasps, and are easily recognized by the special venation of the wing: basal cells are long, apical cells are closed and spurious longitudinal vein (*vena spuria*) is present. The adults, as their name implies, are usually found at flowers or hovering in the bright sunlight. The larvae are found in a wide range of habitats: the terrestrial predacious leechlike larvae, which feed mainly on aphids, scales and thrips (subfamilies Syrphinae and Pipizinae); the sluglike *Microdon* larvae, which are exclusively scavengers in ants' nests (subfamily Microdontinae); the short-tailed maggots, which are mainly saprophagous and found in a wide range of decomposing plant materials (most of the subfamily Eristalinae s. l.); and the long-tailed or rat-tailed maggots, which are aquatic filter feeders (tribes Callicerini, Sericomyiini and Eristalini of the subfamily Eristalinae) (Thompson, 1982). Feeding-habits of the larvae of Syrphidae are varied. The phytophagous larvae of *Cheilosia* feed in the stems and roots of various plants, also in fungi; larvae of *Eumerus* and *Merodon* feed in the bulbs of Liliaceae, Amaryllidaceae, and Iridaceae. The larvae of *Brachyopa* are feeders on the sap oozing from injured trees. The larvae of the vast majority of species in the subfamily Eristalinae are generally saprophagous in many kinds of aquatic and semi-aquatic

situations: some living in damp or wet rot-holes of trees (e.g., *Xylota*, *Mallota* and *Pocota*), others in dung (e.g. *Rhingia*) or in foul water or liquid manure (e.g. *Eristalis*, *Helophilus*), others obtaining oxygen from the roots of submerged plants (*Chrysogaster*). The larvae of *Volucella* live as scavengers in nests of bees and wasps. None of the hover flies are pests except for a few species of *Eristalis* that occasionally cause human myiasis and a few species of *Eumerus* and *Merodon* that damage bulbs of cultivated plants.

Syrphids are classified into 4 subfamilies and 18 tribes, with the known aquatic forms restricted to the subfamily Eristalinae, tribes Brachyopini (=Chrysogasterini) (some aquatic), Callicerini (some aquatic), Sericomyiini (all aquatic) and Eristalini (all aquatic). This present classification is based on the eggs, 1–st instar larvae, and adults and is outlined in Vockeroth (1969, Syrphinae), Thompson (1969, Microdontinae; 1972, Eristalinae), and Kuznetzov (1987, 1988, 1992, Pipizinae).

About 5000 species have been known to world fauna (Vockeroth, 1969; Thompson, 1969; 1972,...) and approximately 1650 are recorded from the Palaearctic region (Peck, 1988; etc.).

For this study syrphids material from the private collections of the author was identified, as well as from the collection of the Latvian Museum of Nature in Riga, from the Gimmerthal's collection of the Museum of Zoology of the Latvian University in Riga, from the collection of the Zoological Institute of the Russian Academy of Sciences in St.Petersburg, from the collection of the Institute of Zoology and Botany of the Estonian Academy of Sciences in Tartu, from the collection of the Institute of Ecology of the Lithuanian Academy of Sciences in Vilnius, and from the collection of the Department of Zoology of the Vilnius University. These newly recorded species was published previously (Kuznetzov, 1989a, 1989b; Kuznetzov & Kuznetzova, 1992). In all, 288 species were recorded from the Latvia, Lithuania, and Estonia.

In the present paper a check list is given of 71 genera and 288 species hitherto known from the Latvia, Lithuania, and Estonia, and the analysis of data published in the course of about 200 years (1778—1989) are given.

One species: *Cheilosia rotundicornis* Hellén, are excluded as misidentification. In general, the system presented by Thompson and Vockeroth (1989). There are, however, the following exceptions: the Pipizini have been placed after Syrphinae, in a subfamily of their own, Pipizinae and not included in Eristalinae (Kuznetzov, 1987, 1988a, 1988b, 1990, 1992). The genera are ordered phylogenetically; the species within a genus are ordered alphabetically.

The history of study of hover flies fauna of the Lithuania, Latvia, and Estonia

Historically the study of Latvian fauna was closely connected with the study of fauna of all Baltic States (Lithuania and Estonia). Therefore we consider the history of study of hover flies fauna of the Baltic Region. The history of study of hover flies fauna of the Baltic Region (restricted by the administrative borders of Lithuania, Latvia, and Estonia) began more than 200 years ago.

The first data on hover flies fauna of the Baltic Region appeared in the end of the 18th century in the works by Fischer (1778, 1784, 1791). He noted 7 species for Lifland.

Later in the first half of the 19th century we can find information on hover flies of the studied area in the works of the well known naturalist from Riga Benjamin August Gimmerthal. In his first work Gimmerthal (1832) published a catalogue of the Diptera of Livonia, containing a list of 77 species. But as some of the species names turned out to be synonyms, the list actually includes only 68 species. In his next work (Gimmerthal, 1834a) noted specifically for Latvia (Koknese) one more species of hover flies. At the same time Gimmerthal (1834b) published a supplement to the systematic catalogue of Diptera of Livonia, where he indicated 14 more species. In 1942 Gimmerthal summarized the data already published, supplemented them with new data and published a more complete catalogue of Lifland Diptera (Gimmerthal, 1842a), and comments to it (Gimmerthal, 1842b), including a list of 146 species, but only 113 should be regarded as actual species. Unfortunately, it is not possible to establish from that catalogue which of the species were found in Latvia and which in Estonia, because Lifland (or Vidzemskaya Government of Russia of the 18th and 19th century) included the northern part of Latvia and the southern part of Estonia. Location in Curland (Curland Government of Russia of the 18th and 19th century, western part of Latvia) was indicated for only 13 species. In 1847, i.e. less than a year before his death, Gimmerthal published one of his last works — the fourth contribution to the study of Russian Diptera and reported on 15 species found in Curland (Gimmerthal, 1847).

F. Lienig, I. Kawall, K. Büttner, and E. Lindemann studied fauna of Latvia at the same time, Gimmerthal (1842a, 1847) examined and published the material, which they had collected in Curland.

The works of Gimmerthal complete *the first period of study* of hover flies in the Baltic Region. A total of 128 species of hover flies were established for the Baltic Region at that time. However only 27 species were reported to belong to Latvian fauna; these were species noted for Curland.

Unfortunately, it is not possible to find out the precise number of species established for Estonia for reasons mentioned above. Data on hover flies of Lithuania for that period are lacking.

The second period in the study of hover flies fauna of the Baltic Region cover the end of the 19th century and the beginning of the 20th century. F. Sintenis was intensively studying Diptera fauna of that region at that period. However data on hover flies in his works are fragmentary and far from being complete, because he was not conducting a special study of them. Sintenis, in different years lived permanently in Dorpat (now Tartu, Estonia), published a number of entomological reports covering not only Diptera, but also other insect groups and indicated for Estonian fauna only 14 species of hover flies: 7 species — in 1896, 3 species — in 1899, and 5 species — in 1902; one of the latter 5 species was indicated by him earlier (Sintenis, 1896, 1899, 1902). The entomological report for 1905 only mentions the family Syrphidae, without indicating species (Sintenis, 1905).

The third period of study covers the 1920's and 1930's. Information, published during that period, only covers Estonian fauna, for which 21 more species was established. In 1920 Mühlen and Schneider published data on one species, Frey published in 1924 data on 12 species, and in 1933 Ahlqvist published data on 13 species, 8 of them were not published

for Estonia before (Mühlen, Schneider, 1920; Frey, 1924; Ahlqvist, 1933).

At the same time hover flies were collected in Latvia by O. Conde, O. Ion, and W. Grünwaldt, but their materials have not been examined to a large extent and are now deposited at the Zoological Museum of the Latvian State University in Riga. Material on hover flies collected by K. Hagen have been deposited in the same museum, they were partly published later by Z. Spuris (1956).

During the *fourth period* hover flies were studied by Estonian, Latvian and Lithuanian entomologists.

In Estonia these were H. Remm, E. Remm, V. Siitan, and K. Elberg; collections in southern Estonia were made also to A. A. Stackelberg, and later by S. Kuznetsov and N. Kuznetsova.

In Latvia — by Z. Spuris, E. Remm, K. Elberg, L. Danka, M. Stiprais, S. Kuznetsov and N. Kuznetsova. Collections in Lithuania during that period were made by E. Remm, K. Elberg, V. Valenta, R. Kazlauskas, G. Švitra, S. Podénas, S. Pakalniškis, S. Kuznetsov and N. Kuznetsova.

A total of 155 species that had not been noted in works of the earlier authors were reported for Estonian fauna for that period. Stackelberg (1958b) in his work on hover flies of the Leningrad Region gave information on 31 species for Estonia, 28 of which had not been reported for the fauna of the Republic before. Later Remm (1959) published one more species and then Elberg (1969) published data on 31 species, on 13 of them for the first time. Works by Remm and Elberg (1970) and Remm (1976) added one more species each. In 1979 Siitan published data on 36 species, on 35 of them — for the first time, and in 1983 — on 24 species (Siitan, 1979, 1983). A total of 111 species of hover flies have been published for Estonia. In 1987, S. Kuznetsov published data on 44 more species of hover flies. Therefore, 155 species were published and the entire fauna of Estonia was considered to include 224 species.

Data on 108 more species for Latvian fauna were added for that period. Spuris (1956) noted 123 species, 108 of them for the first time. That work included original data, and results of study of materials of other collectors (Spuris, 1956). At the same time hover flies fauna of Latvia was studied by L. Danka and M. Stiprais; however they did not publish the data obtained, but only mentioned 4 species in some of the works (Danka, Stiprais, 1970, 1972). Moreover, works dealing with agricultural entomology data on onion pest — *Eumerus strigatus* (Fll.) (Strazdinya, 1961a, 1961b, 1964a, 1964b; Augu ..., 1972).

A total of 143 species of hover flies have been published for Latvia in 1982—1989 by the author (Kuznetzov, 1982, 1983, 1984, 1985, 1986, 1987a, 1987b, 1987c, 1987d, 1988a, 1988b, 1989a, 1989b), and the entire fauna of Latvia was considered to include 282 species.

Information on hover flies of Lithuania for that period are restricted to data on 39 species published in 13 works (Kirvelite, 1958, 1959; Zaliene, 1960, 1962; Rakauskas, 1960; Lešinskas, Pileckis, 1967; Ionaitis, Zajantshkauskas, 1973; Pileckis, Žuklys, 1974; Dušek, Láska, 1976; Rakauskas, 1984, 1985; Valenta, Podenas, 1985; Pakalniškis, Podénas, 1992). Kuznetsov (1987) published data on 130 more species of lithuanian hover flies. A total of 169 species of hover flies have been published for Lithuania for that period, and the entire fauna of Lithuania was considered to include 216 species.

A checklist of Latvian, Lithuanian and Estonian hover flies is given in Table 1.

Table 1. A check list of Lithuanian, Latvian, and Estonian Syrphidae

1	Lithuania 2	Latvia 3	Estonia 4
SYRPHINAE			
PARAGINI			
***Paragus* Latr.**			
P. albipes Gimmerthal	●	●	
P. albifrons (Fll.)	●	●	●
P. bicolor (F.)		●	●
P. haemorrhous Mg.	●	●	●
P. quadrifasciatus Mg.		●	
P. tibialis (Fll.)	●	●	●
BACCHINI			
***Baccha* F.**			
B. elongata (F.)	●	●	●
B. obscuripennis Mg.		●	●
MELANOSTOMINI			
***Pyrophaena* Schin.**			
P. granditarsis (Forster)	●	●	●
P. rosarum (F.)	●	●	●
***Platycheirus* Lep. et Serv.**			
P. albimanus (F.)	●	●	●
P. ambiguus (F.)		●	
P. angustatus (Zett.)	●	●	●
P. clypeatus (Mg.)	●	●	●
P. fulviventris (Mcq.)	●	●	●
P. immarginatus (Zett.)	●	●	●
P. jaerensis Nielsen		●	●
P. manicatus (Mg.)		●	●
P. peltatus (Mg.)	●	●	●
P. perpallidus Verr.	●	●	●
P. podagratus (Zett.)		●	●
P. scambus (Staeger)	●	●	●
P. scutatus (Mg.)	●	●	●
P. sticticus (Mg.)		●	
P. tarsalis Schummel	●	●	
***Xanthandrus* Verr.**			
X. comtus (Harris)	●	●	●
***Melanostoma* Schiner**			
M. mellinum (L.)	●	●	●
M. scalare (F.)	●	●	●
SYRPHINI			
***Leucozona* Schiner**			
L. lucorum (L.)	●	●	●
***Eriozona* Schiner**			
E. syrphoides (Fll.)	●	●	●
***Ischyrosyrphus* Bigot**			
I. glaucius (L.)	●	●	●
I. laternarius (Muller)	●	●	●
***Scaeva* F.**			
S. albomaculata (Mcq.)		●	
S. pyrastri (L.)	●	●	●
S. selenitica (Mg.)	●	●	●
S. selenitica baltica S. Kuzn.		●	
S. selenitica rossica S. Kuzn.		●	●
***Didea* Mcq.**			
D. alneti (Fll.)	●	●	●
D. fasciata Mcq.	●	●	●
D. intermedia Loew	●	●	●
***Dasysyrphus* Enderlein**			
D. albostriatus (Fll.)	●	●	●
D. venustus (Mg.)	●	●	●
D. hilaris (Zett.)	●	●	●
D. friuliensis (v. d. Goot)		●	
D. lunulatus (Mg.)	●	●	●
D. obscuratus (Ringd.)		●	
D. postclaviger (St. et M.)	●	●	
D. tricinctus (Fll.)	●	●	●
***Megasyrphus* D. et L.**			
M. erraticus (L.)	●	●	●

Table 2 (Continued)

1	2	3	4
***Metasyrphus* Mats.**			
M. corollae (F.)	●	●	●
M. lapponicus (Zett.)	●	●	●
M. latifasciatus (Mcq.)	●	●	●
M. lundbecki (Soot-Ryen)	●	●	●
M. luniger (Mg.)	●	●	●
M. nielseni Dušek & Láska,?		●	
M. nitens (Zett.)	●	●	●
M. punctifer (Frey)	●	●	
***Parasyrphus* Mats.**			
P. annulatus (Zett.)	●	●	●
P. lineolus (Zett.)	●	●	●
P. macularis (Zett.)			●
P. malinelllus (Collin)	●	●	●
P. nigritarsis (Zett.)	●	●	●
P. punctulatus (Verr.)	●	●	●
P. vittiger (Zett.)	●	●	●
***Syrphus* Fabricius**			
S. attenuatus Hine		●	
S. ribesii (L.)	●	●	●
S. torvus O.-S.	●	●	●
S. vitripennis (Mg.)	●	●	●
***Melangyna* Verr.**			
M. arctica (Zett.)		●	●
M. barbifrons (Fll.)	●	●	●
M. cincta (Fll.)		●	
M. compositarum (Verr.)	●	●	●
M. guttata (Fll.)	●	●	●
M. lasiophthalma (Zett.)	●	●	●
M. quadrimaculatum Verr.		●	●
M. umbellatorum (F.)	●	●	●
***Epistrophe* Walker**			
E. annulitarsis (Stack.)		●	
E. diaphana (Zett.)	●	●	●
E. eligans (Harris)	●	●	●
E. euchroma (Kowarz)	●	●	●
E. grossulariae (Mg.)	●	●	●
E. melanostoma (Zett.)	●	●	●
E. melanostomoides (Strobl)		●	●
E. nitidicollis (Mg.)	●	●	●
E. ochrostoma (Zett.)		●	●

Table 2 (Continued)

1	2	3	4
***Meliscaeva* Frey**			
M. auricollis (Mg.)	●	●	●
M. cinctella (Zett.)	●	●	●
***Episyrphus* Mats. & A.**			
E. balteatus (Degeer)	●	●	●
***Sphaerophoria* Lep. et Serv.**			
S. abbreviata Zett.	●	●	●
S. batava Goeldlin de Tiefenau	●	●	●
S. indiana Bigot	●		
S. loewi Zett.	●	●	●
S. menthastri (L.)	●	●	●
S. philantus (Mg.)	●	●	●
S. potentillae Claussen	●	●	●
S. rueppelii (Wiedemann)	●	●	●
S. scripta (L.)	●	●	●
S. taeniata (Mg.)	●	●	●
S. virgata Goeldlin de Tiefenau	●	●	●
***Doros* Mg.**			
D. profuges (Harris)	●	●	●
***Xanthogramma* Schiner**			
X. citrofasciatum (Degeer)	●	●	●
X. pedissequum (Harris)	●	●	●
CHRYSOTOXINI			
***Chrysotoxum* Mg.**			
C. arcuatum (L.)	●	●	●
C. bicinctum (L.)	●	●	●
C. cautum (Harris)		●	
C. fasciolatum (Degeer)	●	●	●
C. festivum (L.)	●	●	●
C. octomaculatum Curtis	●	●	
C. vernale Loew	●	●	●
C. verralli Collin		●	
PIPIZINAE			
PIPIZINI			
***Triglyphus* Loew**			
T. primus Loew	●	●	●
***Trichopsomyia* Will.**			
T. flavitarse (Mg.)	●	●	●

Table 2 (Continued)

1	2	3	4
T. lucida (Mg.)		●	
***Heringia* Rondani**			
H. heringi (Zett.)	●		
***Pipizella* Rd.**			
P. maculipennis (Mg.)	●	●	●
P. viduata (L.)	●	●	●
P. virens (F.)	●	●	●
***Pipiza* Fll.**			
P. austriaca Mg.	●	●	●
P. bimaculata Mg.	●	●	●
P. fasciata Mg.	●	●	
P. fenestrata (Mg.)		●	
P. lugubris (F.)	●	●	●
P. luteitarsis (Zett.)	●	●	●
P. noctiluca (L.)	●	●	●
P. notata Mg.	●	●	●
P. quadrimaculata (Panzer)	●	●	●
P. signata Mg.	●	●	●
***Neocnemodon* Goffe**			
N. latitarsis (Egger)		●	
N. pubescens (D.et P.-W.)	●	●	●
N. verrucula (Collin)		●	
N. vitripennis (Mg.)	●	●	●
ERISTALINAE			
CHRYSOGASTERINI			
***Hammerschmidtia* Schumm.**			
H. ferruginea (Fll.)	●	●	●
***Brachyopa* Mg.**			
B. bicolor (Fll.)		●	
B. conica (Panzer)		●	●
B. dorsata Zett.		●	
B. testacea (Panzer)	●	●	●
***Neoascia* Williston**			
N. annexa Muller		●	●
N. geniculata (Mg.)	●	●	●
N. interrupta (Mg.)	●	●	●
N. meticulosa (Scopoli)	●	●	●
N. podagrica (F.)	●	●	●

Table 2 (Continued)

1	2	3	4
N. tenur (Harris)	●	●	●
N. unifasciata (Strobl)		●	
***Sphegina* Mg.**			
S. claviventris Stack.	●	●	
S. clunipes (Fll.)	●	●	
S. sibirica Stack.	●	●	●
S. kimakowiczi Strobl		●	●
***Lejogaster* Rd.**			
L. metallina (F.)	●	●	●
L. splendida (Mg.)	●	●	
***Orthonevra* Mcq.**			
O. elegans (Mg.)	●	●	●
O. erythrogona Malm		●	●
O. geniculata Mg.		●	
O. intermedia Lundbeck		●	●
O. nobilis (Fll.)	●	●	●
O. plumbago Loew	●	●	
O. stackelbergi Thmps. & Torp	●		●
O. splendens (Mg.)		●	●
***Chrysogaster* Mg.**			
C. coemeteriorum (L.)	●	●	●
C. hirtella Loew	●	●	●
C. lucida (Scopoli)	●	●	●
C. macquarti Loew	●	●	●
C. solstitialis (Fll.)	●	●	●
CHEILOSIINI			
***Rhingia* Scopoli**			
R. austriaca (Mg.)	●	●	
R. campestris (Mg.)	●	●	●
R. rostrata (L.)	●	●	
***Ferdinandea* Rd.**			
F. cuprea (Scopoli)	●	●	●
F. ruficornis (F.)		●	
***Cheilosia* Mg.**			
Ch. albipila Mg.	●	●	●
Ch. albitarsis Mg.	●	●	●
Ch. angustigenis Beck.	●	●	
Ch. antiqua Mg.		●	

Table 2 (Continued)

1	2	3	4
Ch. bergenstammi Beck.		●	
Ch. canicularis (Panzer)		●	
Ch. carbonaria Egg.	●	●	●
Ch. chloris (Mg.)	●	●	●
Ch. chrysocoma (Mg.)	●	●	●
Ch. cynocephala Lw.		●	●
Ch. flavipes Panz.	●	●	●
Ch. fraterna (Mg.)		●	
Ch. frontalis (Loew)	●	●	●
Ch. gigantea (Zett.)	●	●	●
Ch. grossa (Fll.)	●	●	●
Ch. honesta Rd.		●	
Ch. illustrata (Harris)	●	●	●
Ch. impressa Loew	●	●	●
Ch. ingrica Stack.		●	
Ch. intonsa Loew	●	●	●
Ch. langhofferi Beck.		●	
Ch. longula (Zett.)	●	●	●
Ch. mutabilis (Fll.)	●	●	●
Ch. morio (Zett.)		●	
Ch. nasutula Beck.	●	●	●
Ch. nigripes (Mg.)	●	●	●
Ch. pagana (Mg.)	●	●	●
Ch. pallipes Loew		●	
Ch. proxima (Zett.)	●	●	●
Ch. pubera (Zett.)	●	●	●
Ch. rotundiventris Beck.		●	●
Ch. ruralis (Mg.)	●	●	●
Ch. sahlbergi Beck.	●	●	
Ch. scutellata (Fll.)	●	●	●
Ch. sootryeni Nielsen		●	
Ch. variabilis (Panzer)	●	●	●
Ch. velutina Loew	●	●	●
Ch. vernalis (Fll.)	●	●	●
Chamaesyrphus Mik			
C. caledonicus Collin		●	
C. lusitanicus Mik	●	●	
C. scaevoides (Fll.)		●	
Pelecocera Mg.			
P. tricincta Mg.	●	●	●

Table 2 (Continued)

1	2	3	4
VOLUCELLINI			
Volucella Geoffroy			
V. bombylans (L.)	●	●	●
V. inanis (L.)			●
V. pellucens (L.)	●	●	●
SERICOMYIINI			
Arctophila Schiner			
A. superbiens (Müller)	●	●	●
Sericomyia Mg.			
S. lappona (L.)	●	●	●
S. silentis (Harris)	●	●	●
PSARINI			
Psarus Latr.			
P. abdominalis (F.)		●	
ERISTALINI			
Eristalinus Rd.			
E. sepulchralis (L.)	●	●	●
Lathyrophthalmus Mik			
L. aeneus (Scopoli)	●	●	●
Eristalis Latr.			
E. abusivus Collin	●	●	●
E. arbustorum (L.)	●	●	●
E. anthophorinus (Fll.)	●	●	●
E. cryptarum (F.)	●	●	●
E. horticola (De Geer)	●	●	●
E. intricarius (L.)	●	●	●
E. nemorum (L.)	●	●	●
E. oestraceus (L.)	●	●	●
E. pertinax (Scopoli)	●	●	●
E. pratorum Mg.	●	●	●
E. rossicus Stack.	●	●	●
E. rupium F.	●	●	●
E. tenax (L.)	●	●	●
E. vitripennis Strobl	●	●	●
Myiatropa Rd.			
M. florea (L.)	●	●	●

Table 2 (Continued)

1	2	3	4
Helophilus Mg.			
H. affinis Wahlberg	●	●	●
H. hybridus Loew	●	●	●
H. parallelus (Harris)	●	●	●
H. pendulus (L.)	●	●	●
Parhelophilus Girschner			
P. consimilis (Malm)	●	●	●
P. frutetorum (F.)	●	●	●
P. versicolor (F.)	●	●	●
Anasimyia Schiner			
A. contracta Claussen et Torp		●	●
A. interpuncta (Harris)	●	●	
A. lineata (F.)	●	●	●
A. lunulata (Mg.)	●	●	●
A. transfuga (L.)	●	●	●
Mallota (Fll.)			
M. cimbiciformis (Fll.)		●	
M. megilliformis (Fll.)	●	●	●
M. tricolor Loew	●	●	
MERODONTINI			
Merodon Mg.			
M. aeneus Mg.		●	
M. equestris (F.)		●	
M. spinipes (F.)		●	
Eumerus Mg.			
E. flavitarsis Zett.			●
E. ovatus Loew	●	●	
E. sabulonum (Fll.)		●	●
E. sogdianus Stack.	●	●	
E. strigatus (Fll.)	●	●	●
E. tuberculatus Rd.		●	
Psilota Mg.			
P. anthracina Mg.		●	
MILESIINI			
Blera Billberg			
B. fallax (L.)		●	●

Table 2 (Continued)

1	2	3	4
Criorhina Mg.			
C. asilica (Fll.)	●	●	●
C. ranunculi (Panzer)		●	
Tropidia Mg.			
T. fasciata			●
T. scita (Harris)		●	●
Syritta Lep. et Serv.			
S. pipiens (L.)	●	●	●
Xylota Mg.			
X. abiens Mg.	●	●	●
X. coeruleiventris Zett.	●	●	●
X. curvipes Loew		●	
X. florum (F.)	●	●	●
X. ignava (Panzer)	●	●	●
X. meigeniana Stack.	●	●	●
X. segnis (L.)	●	●	●
X. sylvarum (L.)	●	●	●
X. tarda Mg.	●	●	●
Chalcosyrphus Curran			
C. femoratus (L.)		●	●
C. nemorum (F.)	●	●	●
C. piger (F.)		●	●
Brachypalpoides Hippa			
B. lentus (Mg.)	●	●	●
Brachypalpus Mcq.			
B. laphriformis (Fll.)	●	●	●
Sphecomyia Latr.			
S. vespiformis Gorski	●	●	●
Spilomyia Mg.			
S. diophthalma (L.)	●	●	●
Temnostoma Lep. et Serv.			
T. apiforme (F.)	●	●	
T. bombylans (F.)	●	●	●
T. meridionale Kriv. & Mamaev		●	●
T. vespiforme (L.)	●	●	●

Table 2 (Continued)

1	2	3	4
Lejota Rd.			
L. ruficornis (Zett.)		●	
CERIOIDINI			
Ceriana Rafinesque			
C. conopsoides (L.)		●	●
MICRODONTINAE			
MICRODONTINI			
Microdon Mg.			
M. devius (L.)	●	●	●
M. eggeri Mik	●	●	●
M. latifrons Loew	●		●
M. mutabilis (L.)	●	●	●

Therefore, for the more than 200 years (1778—1989) of faunistic study on the basis on data, available in literature, (i.e. 45 published works, not to mention the author's works) a total of 194 species of syrphids were found in the Baltic Region prior to our studies (27 species were found in Lithuanian fauna, 143 in Latvian fauna, and 146 species in Estonian fauna). The entire fauna of the Syrphidae found within the present borders of Lithuania, Latvia, and Estonia was considered to include 288 species: 216 species were found in Lithuania, 282 — in Latvia, and 224 species — in Estonia.

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New species of *Dorylomorpha* (Diptera, Pipunculidae) from the West Siberia and the Far East

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Descriptions and figures of *Dorylomorpha (Dorylomyza) albrechti* sp. n. from West Siberia, *D. (Dorylomyza) ussuriana* sp. n., *D. (Dorylomyza) clavipes* sp. n., *D. (Dorylomyza) laticlavia* sp. n., *D. (Dorylomorpha) insulana* sp. n., *D. (Dorylomorpha) confracta* sp. n., *and D. (Dorylomorpha) spinosula* sp. n., from the Far East are given.

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Index words: Diptera, Pipunculidae, *Dorylomorpha*, new species, taxonomy.

Introduction

During expedition to the Far East in 1989 I catched few specimens of two new species, and during examination of the Zoological Institute of the Russian Academy of Sciences in St. Petersburg (ZIL) collections of Pipunculidae (Kuznetzov, 1990a, 1990b, 1991a, 1991b, 1992a, 1992b), I have found five more unknown Palaearctic species of *Dorylomorpha,* which easily distinguishable by the shape and structure of the male genitalia from other members of the genus (Albrecht, 1979a, 1979b, 1990; Kuznetzov, 1992a; Kuznetzova, 1992): *Dorylomorpha (Dorylomyza) albrechti* sp. n. from West Siberia, *D. (Dorylomyza) ussuriana* sp. n., *D. (Dorylomyza) clavipes* sp. n., *D. (Dorylomyza) laticlavia* sp. n., *D. (Dorylomorpha) insulana* sp. n., *D. (Dorylomorpha) confracta* sp. n., *and D. (Dorylomorpha) spinosula* sp. n., from the Far East, which are described below.

Holotype deposited in the Zoological Institute, St.Petersburg.

Dorylomorpha (Dorylomyza) albrechti sp. n.

(Figs 1—5)

Holotype. ♂, **Россия**, Новосибирская обл., Здвинский р-н, Чановский стан. (**Russia**, West Siberia, *Novosibirsk Prov.*, Zdvynskyy distr., Tshanovskyy station), 13 VI 1988 (Harinova).

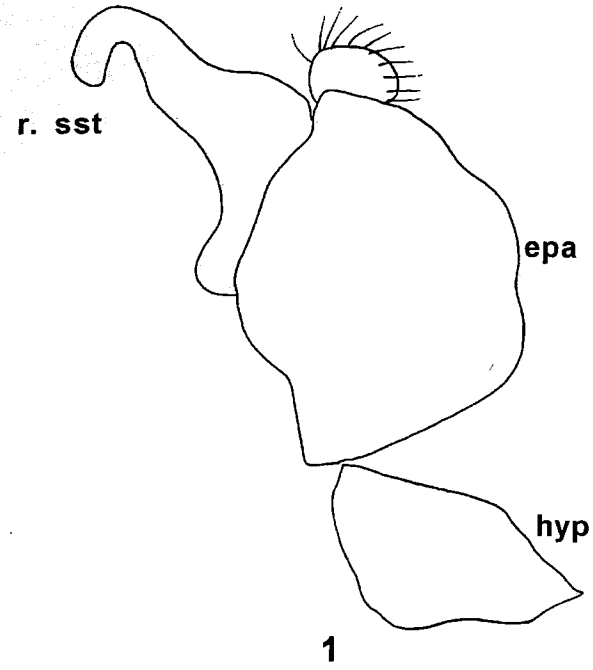


Fig. 1. *Dorylomorpha albrechti* sp. n, holotype, male, epandrium (*epa*) and right surstylus (*r. sst*), lateral view.

Diagnosis. Close to *Dorylomorpha* (*Dorylomyza*) *sachalinensis* Albrecht, 1990, from which it is easely separated by the shape and structure of the male genitalia, Figs 1—5.

Description

Body length 4.4 mm.

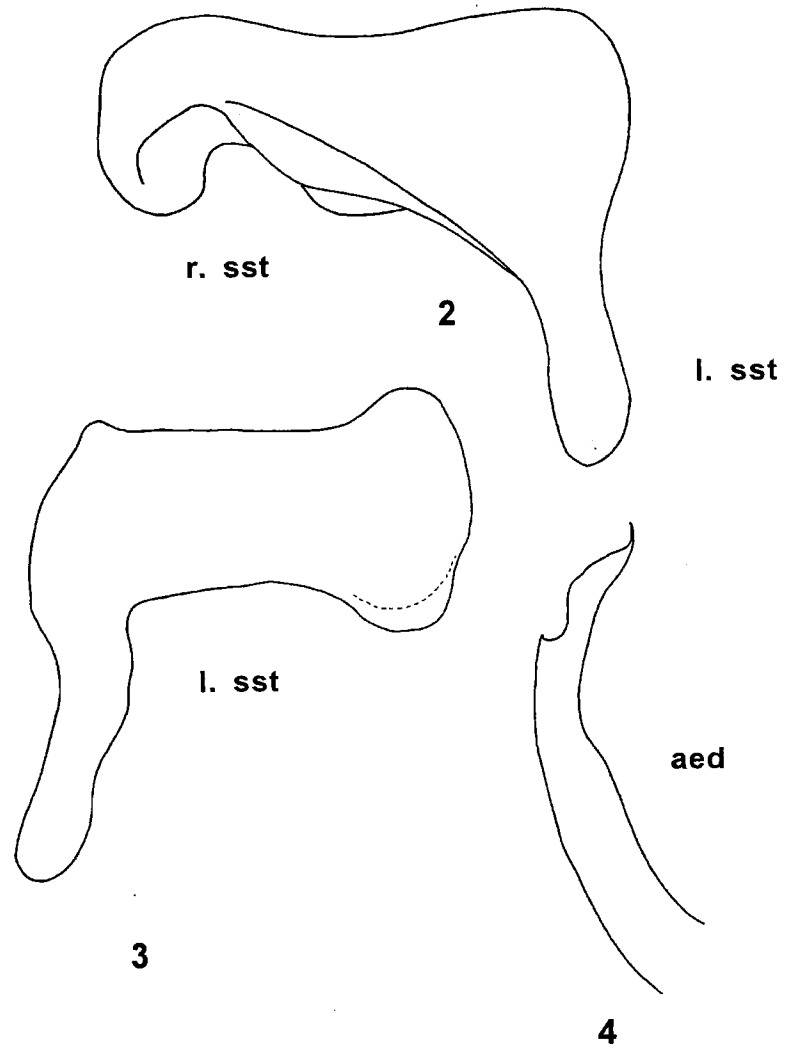
Head. Frons in male at narrowest point almost as wide as anterior ocellus. Antennal segment 3 moderately short, brown, short acuminate. Arista brown.

Thorax. Hairs moderately short, about 1/3 as long as height of humerus. Humeri black.

Wing 4.5 mm long, with a very faint trace of a coloured stigma at the extreme apex of cell *Sc*. Cross-vein *r-m* at 1/5 from the base of cell *M*.

Legs. Hind femur moderately thickened; all femora black, in apical 1/4 yellow. Hind tibia mid-anteriorly without pale bristly-hairs more or less distinctly outstanding from the general pubescence; fore and middle tibiae with apical ventral spur; all tibiae yellow with the small brown spot mid-ventrally. Tarsi yellow, last tarsal segment brown.

Abdomen black. Stemite 8 in male about half as long as tergite 5 in dorsal view,



Figs 2—4. *Dorylomorpha albrechti* sp. n, holotype, male genitalia.
2, right surstylus (*r. sst*), lateral view; 3, left surstylus (*l. sst*), lateral view; 4, aedeagus (*aed*).

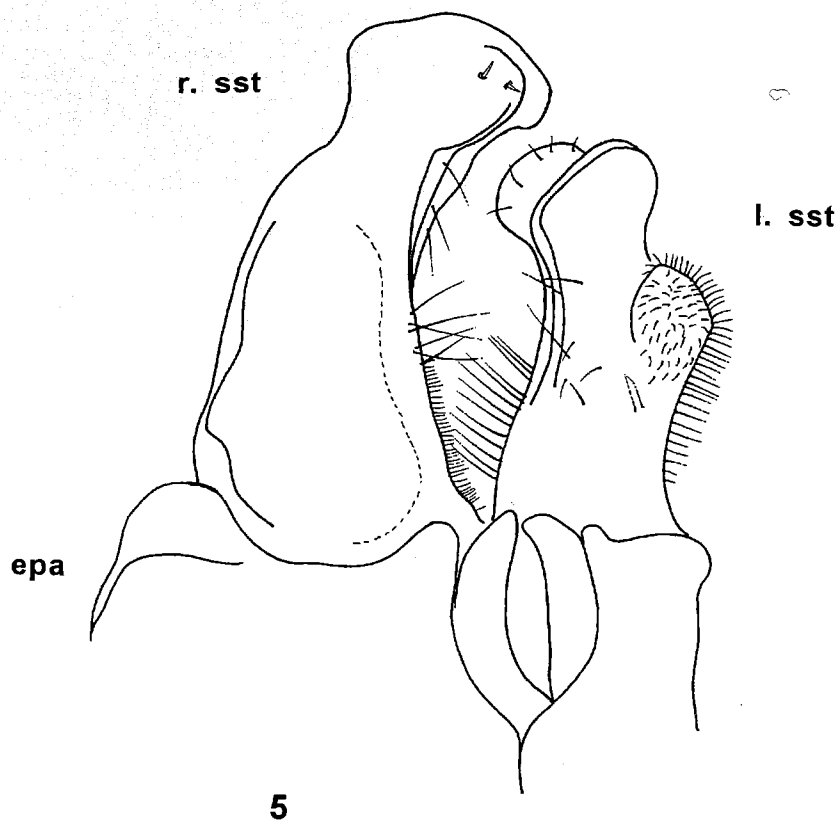


Fig. 5. *Dorylomorpha albrechti* sp. n, holotype, male genitalia. right (*r. sst*) and left surstyli (*l. sst*), lateral view.

its terminal membranous area in the right half of the sternite 8, medium sized, almost roundish.

Male genitalia. Sternite 6 brownish, thick-walled and strongly sclerotised, of moderate size; outer part rather broad with the posterior margin rolled under; inner part very broad, almost circular in outline, strongly convex, its inner margin broadly rolled under; the distal part of the ventral appendage very conspicuous, plate-like, strongly sclerotised and distinctly set-off from the rest of the appendage, distinctly separated from the tergite.

Sternite 7 brownish, strongly modified, thick-walled and strongly sclerotised, elongate, convex, with rolled-under posterior margin and a conspicuous ventral projection forming a ventrally directed pouch on the ventral margin; moderate in size. Epandrium as in Fig. 1.

Surstyli as in Figs 1—3, 5, strongly modified and dissimilar. Right surstylus strongly sclerotised, highly modified, especially in its apical part, of complex structure; apical setae few. Left surstylus extremely thick-walled and strongly sclerotised, highly modified; outer lobe distally fused with the inner lobe; apical setae few.

Hypandrium as in Fig. 1. Basal rim broad; lateral arms usually long and narrow in lateral view; ventral membranous area of moderate size; basal lobes of moderate size.

Aedeagus (Fig. 4) with proximal part rather long, more or less parallel-sided; distal part of moderate length, evenly tapering toward the apex which is elongate and hooded, with evenly rounded sides; tip roundedly acute, almost truncate with a constricted point. Setae: 1 small dorsal present; laterals absent. Membranes developed.

Ejaculatory duct with moderately long stiff tubules, almost subequal in length; longitudinal and terminal membranes and membranous teeth or folds weekly developed; sheath short, its basal end free.

Ejaculatory apodeme extremely flattened, broadly toadstool-shaped when seen from the flattened side.

Distribution. Russia (West Siberia).

D. (Dorylomyza) ussuriana sp. n.
(Figs 6—8)

Holotype. ♂, **Россия**, *Приморский Край*, Уссурийский заповедник, долина реки Комаровки (**Russia**, *Prymorskyy Terr.*, Ussuryyskyy reserv., Komarovka river valley), 5 VI 1989 (Sidorenko).

Diagnosis. Close to *Dorylomorpha (Dorylomyza) flavolateralis* Albrecht, 1990 from Nearctic Region, from which it is easely separated by the shape and structure of the male genitalia, Figs 6—8.

Description

Body length 3.7 mm.

Head. Frons in the male at narrowest point almost as wide as anterior ocellus. Antennal segment 3 moderately prolonged, brown, short acuminate.

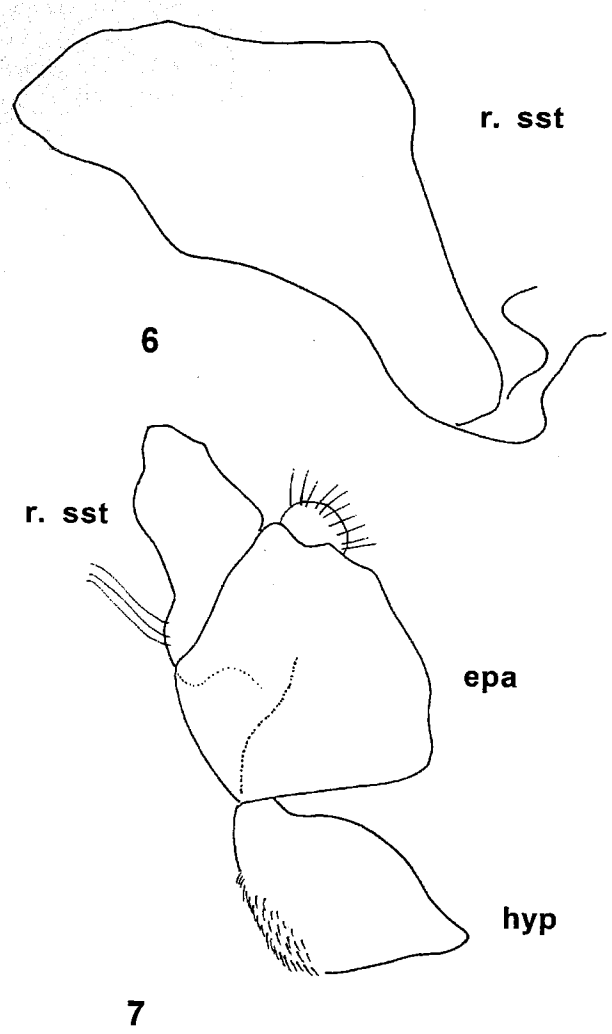
Thorax. Hairs moderately short, about1/3 as long as height of humerus.

Wing 3.8 mm long, with a very faint trace of a coloured stigma at the extreme apex of cell *Sc*. Cross-vein *r-m* at 1/6 from the base of cell *M*.

Legs. Hind femur moderately thickened; all femora black, in apical 1/4 yellow. Hind tibia mid-anteriorly without pale bristly-hairs more or less distinctly outstanding from the general pubescence; fore and middle tibiae with apical ventral spur; all tibiae yellow with the brown spot mid-ventrally. Tarsi yellow, last tarsal segment brown.

Abdomen black. Stemite 8 in male about half as long as tergite 5 in dorsal view, its terminal membranous area in the right half of the sternite 8, medium sized, almost roundish.

Male genitalia. Sternite 6 brownish, thick-walled and strongly sclerotised, of moderate size; outer part rather broad with the posterior margin rolled under; inner part very broad, almost circular in outline, strongly convex, its inner margin broadly rolled under; the distal part of the ventral appendage very conspicuous, plate-like, strongly sclerotised and distinctly set-off from the rest of the appendage, distinctly separated from the tergite.



Figs 6, 7. *Dorylomorpha ussuriana* sp. n., holotype, male
6, right surstylus (*r. sst*), lateral view; 7, epandrium (*epa*) and right surstylus (*r. sst*), lateral view.

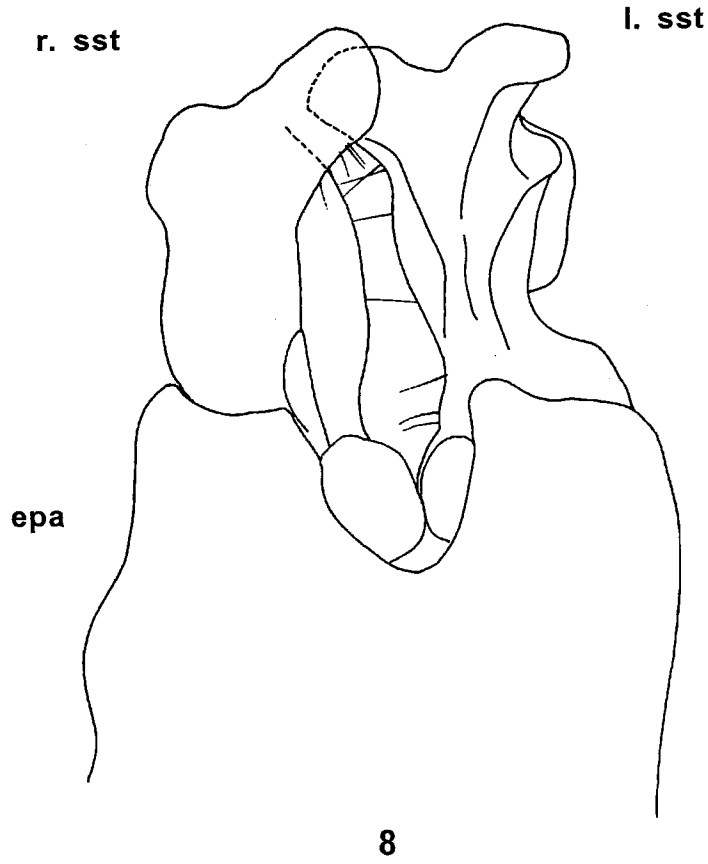


Fig. 8. *Dorylomorpha ussuriana* sp. n, holotype, male genitalia. right (*r. sst*) and left surstyli *(l. sst*), lateral view.

Sternite 7 brownish, strongly modified, thick-walled and strongly sclerotised, elongate, convex, with rolled-under posterior margin and a conspicuous ventral projection forming a ventrally directed pouch on the ventral margin; moderate in size.

Epandrium as in Fig. 7.

Surstyli as in Figs 6—8, strongly modified and dissimilar. Right surstylus strongly sclerotised, highly modified, especially in its apical part, of complex structure; apical setae few to numerous. Left surstylus extremely thick-walled and

strongly sclerotised, highly modified; outer lobe distally fused with the inner lobe; apical setae few to numerous.

Hypandrium as in Fig. 7. Basal rim broad; lateral arms usually long and narrow in lateral view; ventral membranous area of moderate size; basal lobes of moderate size.

Aedeagus with proximal part rather long, more or less parallel-sided; distal part of moderate length, more or less evenly tapering toward the apex which is elongate and hooded, with evenly rounded sides; tip roundedly acute, almost truncate with a constricted point. Setae: 1 small dorsal (or a trace of a dorsal) present; laterals absent. Membranes developed.

Ejaculatory duct with moderately long stiff tubules, almost subequal in length; longitudinal and terminal membranes and membranous teeth or folds weekly developed; sheath short, its basal end free.

Ejaculatory apodeme extremely flattened, broadly toadstool-shaped when seen from the flattened side.

Distribution. Far East of Russia.

D. (Dorylomyza) clavipes sp. n.
(Figs 9—12)

Holotype. ♂, **Россия**, *Приморье*, Анисимовка (**Russia**, Far East, S *Prymorskyy Terr.*, Anisimovka), 23 V 1986 (Makarkin).

Diagnosis. Close to *Dorylomorpha* (*Dorylomyza*) *clavata* Albrecht, 1979, from which it is easely separated by the shape and structure of the male genitalia, Figs 9—12.

Description

Body length 3.6 mm.

Head. Frons in male at narrowest point twice as wide as anterior ocellus. Antennal segment 3 moderately prolonged, brown, acuminate. Arista brown.

Thorax. Hairs moderately short, about1/3 as long as height of humerus.

Wing 3.75 mm long, with a very faint trace of a coloured stigma at the extreme apex of cell *Sc*. Cross-vein *r-m* at 1/4 from the base of cell *M*.

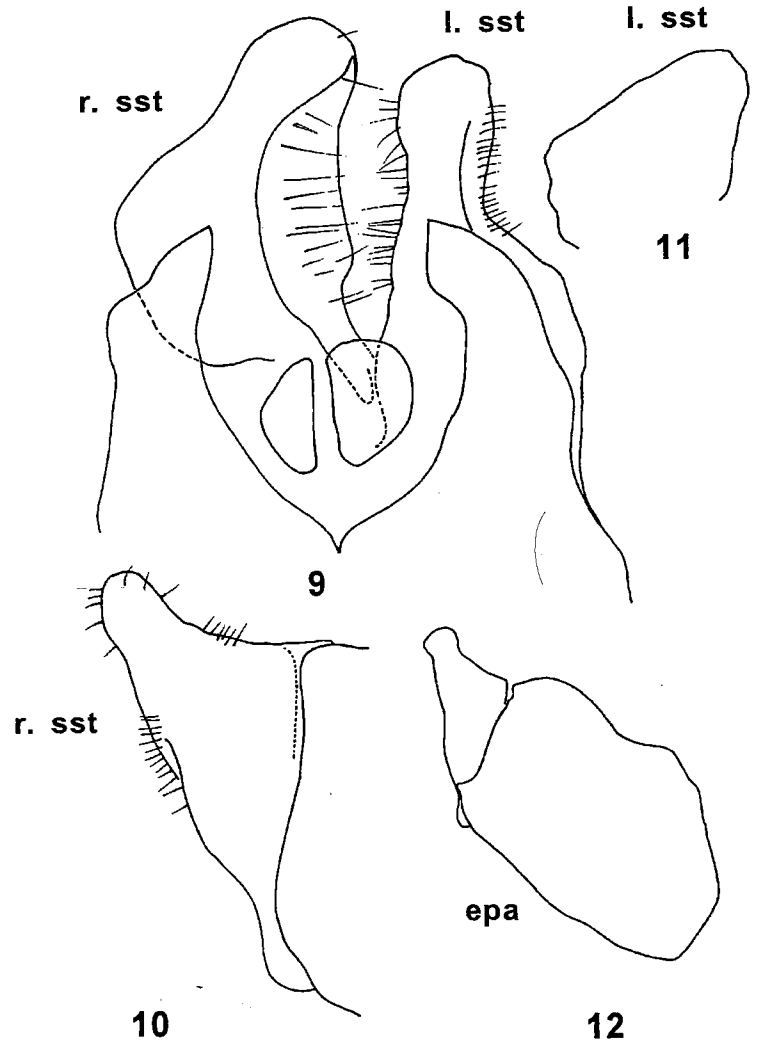
Legs. Hind femur moderately thickened; all femora black, in apical 1/4 yellow. Hind tibia mid-anteriorly without pale bristly-hairs more or less distinctly outstanding from the general pubescence; fore and middle tibiae with apical ventral spur; all tibiae yellow. Tarsi yellow, last tarsal segment brown.

Abdomen black. Sternite 8 in male about half as long as tergite 5 in dorsal view, its terminal membranous area in the right half of the sternite 8, medium sized, almost roundish.

Male genitalia. Sternite 6 brownish, thick-walled and strongly sclerotised, of moderate size; outer part rather broad with the posterior margin rolled under; inner part very broad, almost circular in outline, strongly convex, its inner margin broadly rolled under; the distal part of the ventral appendage very conspicuous, plate-like, strongly sclerotised and distinctly set-off from the rest of the appendage, distinctly separated from the tergite.

Sternite 7 brownish, strongly modified, thick-walled and strongly sclerotised, elongate, convex, with rolled-under posterior margin and a conspicuous ventral projection forming a ventrally directed pouch on the ventral margin; moderate in size. Epandrium as in Fig. 12.

Surstyli as in Figs 9—12, strongly modified and dissimilar. Right surstylus strongly sclerotised, modified, especially in its apical part, of complex structure; apical setae few. Left surstylus extremely thick-walled and strongly sclerotised, modified; outer lobe distally fused with the inner lobe; apical setae few.



Figs 9—12. *Dorylomorpha clavipes* sp. n., holotype, male
9, left (*l.sst*) and right (*r. sst*) surstyli, dorsal view; **10**, right surstylus (*r. sst*), lateral view; **11**, left surstylus (*l. sst*), lateral view; **12**, epandrium (*epa*) and right surstylus (*r. sst*), lateral view.

Hypandrium. Basal rim broad; lateral arms usually long and narrow in lateral view; ventral membranous area of moderate size; basal lobes of moderate size.

Aedeagus with proximal part rather long, more or less parallel-sided; distal part of moderate length, more or less evenly tapering toward the apex which is elongate and hooded, with evenly rounded sides; tip roundedly acute, almost truncate with a constricted point. Setae: 1 small dorsal present; laterals absent. Membranes developed.

Ejaculatory duct with moderately long stiff tubules, almost subequal in length; longitudinal and terminal membranes and membranous teeth or folds weekly developed; sheath short, its basal end free.

Ejaculatory apodeme extremely flattened, broadly toadstool-shaped when seen from the flattened side.

Distribution. Far East of Russia.

D. (Dorylomyza) laticlavia sp. n.
(Figs 13—16)

Holotype. ♂, **Россия**, *Приморье*, Лазовский зап., к. Звездочка (Russia, Far East, Prymorskyy Terr., Lazovskyy reserv., Zvezdotshka), 14 VI 1980 (V. Zlobin).

Paratype. ♂, **Россия**, *Приморский Край*, Уссурийский заповедник, долина реки Комаровки (**Russia**, *Prymorskyy Terr.*, Ussuryyskyy reserv., Komarovka river valley), 6 VI 1989 (Sidorenko).

Diagnosis. Close to *Dorylomorpha* (*Dorylomyza*) *platystylis* Albrecht, 1979, from which it is easely separated by the shape and structure of the male genitalia, Figs 13—16.

Description

Body length 4.4 mm.

Head. Frons in male at narrowest point narrower than anterior ocellus. Antennal segment 3 moderately prolonged, dark brown, acuminate. Arista dark brown.

Thorax. Hairs moderately long, about 1/2 as long as height of humerus.

Wing 4.62 mm long, with a very faint trace of a coloured stigma at the extreme apex of cell *Sc*. Cross-vein *r-m* at 1/6 from the base of cell *M*.

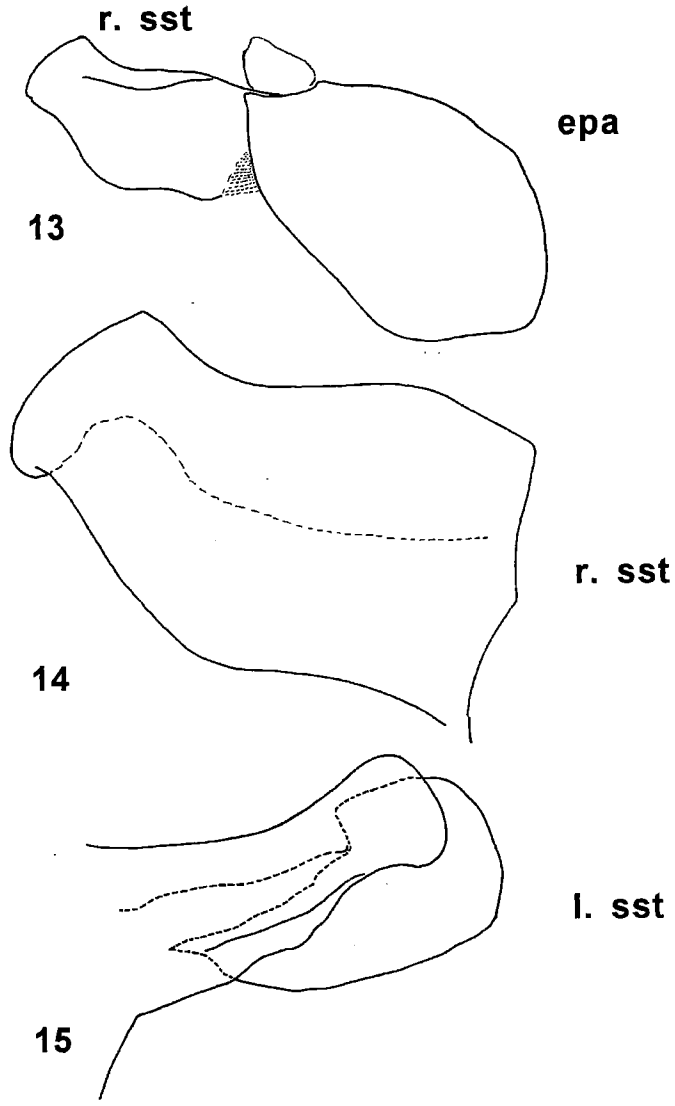
Legs. Hind femur moderately thickened; femora brown, at base and in apical 2/3 yellow. Hind tibia mid-anteriorly without pale bristly-hairs more or less distinctly outstanding from the general pubescence; fore and middle tibiae with apical ventral spur; all tibiae yellow. Tarsi yellow, last tarsal segment brown.

Abdomen black. Stemite 8 in male about half as long as tergite 5 in dorsal view, its terminal membranous area in the right half of the sternite 8, medium sized, almost roundish.

Male genitalia. Sternite 6 brownish, thick-walled and strongly sclerotised, of moderate size; outer part rather broad with the posterior margin rolled under; inner part very broad, almost circular in outline, strongly convex, its inner margin broadly rolled under; the distal part of the ventral appendage very conspicuous, plate-like, strongly sclerotised and distinctly set-off from the rest of the appendage, distinctly separated from the tergite.

Sternite 7 brownish, strongly modified, thick-walled and strongly sclerotised, elongate, convex, with rolled-under posterior margin and a conspicuous ventral projection forming a ventrally directed pouch on the ventral margin; moderate in size. Epandrium as in Fig. 13.

Surstyli as in Figs 13—16, strongly modified and dissimilar. Right surstylus strongly sclerotised, highly modified, especially in its apical part, of complex structure; apical setae few. Left surstylus extremely thick-walled and strongly



Figs 13—15. *Dorylomorpha laticlavia* sp. n., holotype, male.
13, epandrium (*epa*) and right surstylus (*r. sst*), lateral view; **14**, right surstylus (*r. sst*), lateral view; **15**, left surstylus (*l. sst*), lateral view.

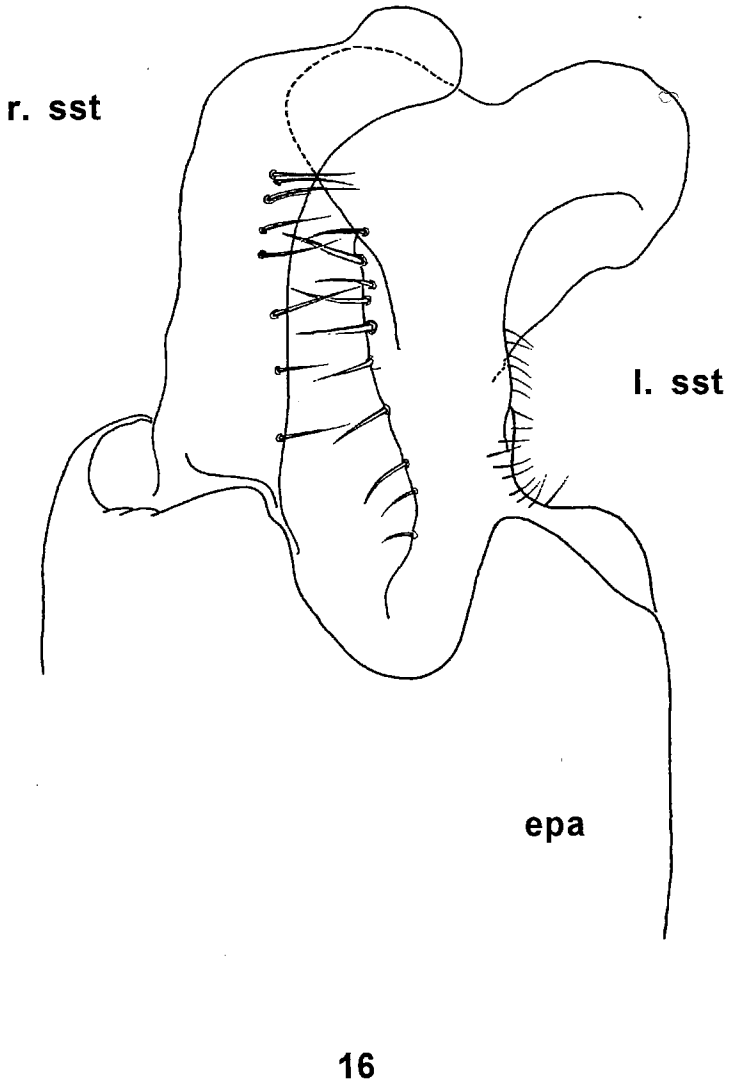


Fig. 16. *Dorylomorpha laticlavia* sp. n, holotype, male genitalia. right (*r. sst*) and left surstyli *(l. sst*), dorsal view.

sclerotised, highly modified; outer lobe distally fused with the inner lobe; apical setae few .

Hypandrium. Basal rim broad; lateral arms usually long and narrow in lateral view; ventral membranous area of moderate size; basal lobes of moderate size.

Aedeagus with proximal part rather long, more or less parallel-sided; distal part of moderate length, more or less evenly tapering toward the apex which is elongate and hooded, with evenly rounded sides; tip roundedly acute, almost truncate with a constricted point. Setae: 1 small dorsal (or a trace of a dorsal) present; laterals absent. Membranes developed.

Ejaculatory duct with moderately long stiff tubules, almost subequal in length; longitudinal and terminal membranes and membranous teeth or folds weekly developed; sheath short, its basal end free.

Ejaculatory apodeme extremely flattened, broadly toadstool-shaped when seen from the flattened side.

Distribution. Far East of Russia.

D. (Dorylomorpha) insulana sp. n.
(Figs 17—20)

Holotype. ♂, **Россия**, *Курильские о-ва*, о-в Кунашир, Менделеево (**Russia**, *Kuril Islands*, Kunashir Isl., Mendeleevo), 10 VIII 1971 (E. Nartshuk).

Paratypes. 1 ♂, **Россия**, *о-в Сахалин*, 12 км S Холмска, Правда (**Russia**, Far East, *Sakhalin Isl.*, 12 km S Holmsk, Pravda), 25 VII 1971 (E. Nartshuk); 1 ♂, *о-в Сахалин*, 15 км СЗ Анивы, Урожайное (*Sakhalin Isl.*, 15 km NW Aniva, Urozhaynoe), 23 VI 1989 (A. Barkalov); 1 ♂, *о-в Сахалин*, Южно-Сахалинск (*Sakhalin Isl.*, Yuzhno-Sakhalynsk), 21 VI 1989 (A. Barkalov); 1 ♂, *Приморье*, р. Корсуновка, кл. Абрикосовый (Far East, *Prymorskyy Terr.*, Korsunovka riv., Abrykosovyy), 5 VI 1986 (V. Makarkin).

Diagnosis. Close to *Dorylomorpha (Dorylomorpha) confusa* (Verrall, 1901), from which it is easely separated by the shape and structure of the male genitalia, Figs 17—20.

Description

Body length 5.5 mm.

Head. Frons in male at its narrowest point about as wide as anterior ocellus. Third antennal segment long and narrow, long-rostrate, light brownish in basal, and whitish in apical part. Arista dark brown.

Thorax. Hairs short, less than 1/3 as long as height of humerus.

Wing 5.75 mm long, with a faint trace of a coloured stigma at the extreme apex of cell *Sc*. Cross-vein *r-m* at 1/6 from the base of cell *M*.

Legs. Hind femur slightly thickened, all femora black, in apical 1/3 yellow. Tibiae without bristly-hairs outstanding from the general pubescence, only fore and middle tibiae with apical ventral spur; all tibiae yellow. Tarsi yellow, last tarsal segment brown.

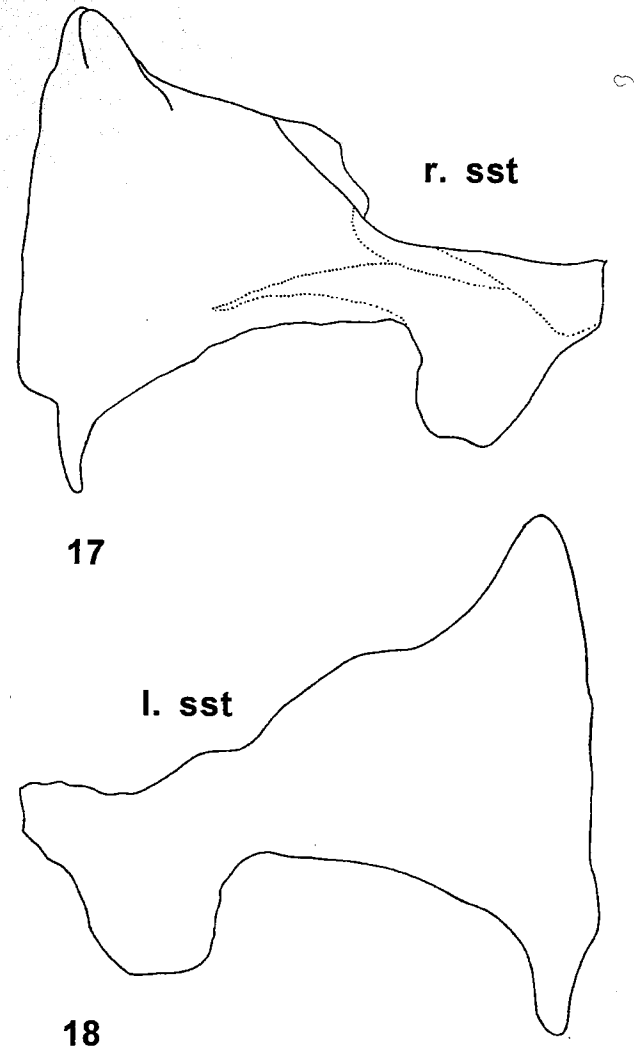
Abdomen entirely black, elongate. Sternite 8 in male more then half as long as tergite 5 in dorsal view, without terminal membranous area.

Male genitalia. Sternite 6 brownish, moderately thick-walled and rather strongly sclerotised, especially along the margins; outer part rather broad; inner part narrow, irregular, without a ventral appendage, indistinctly delimited from the tergite.

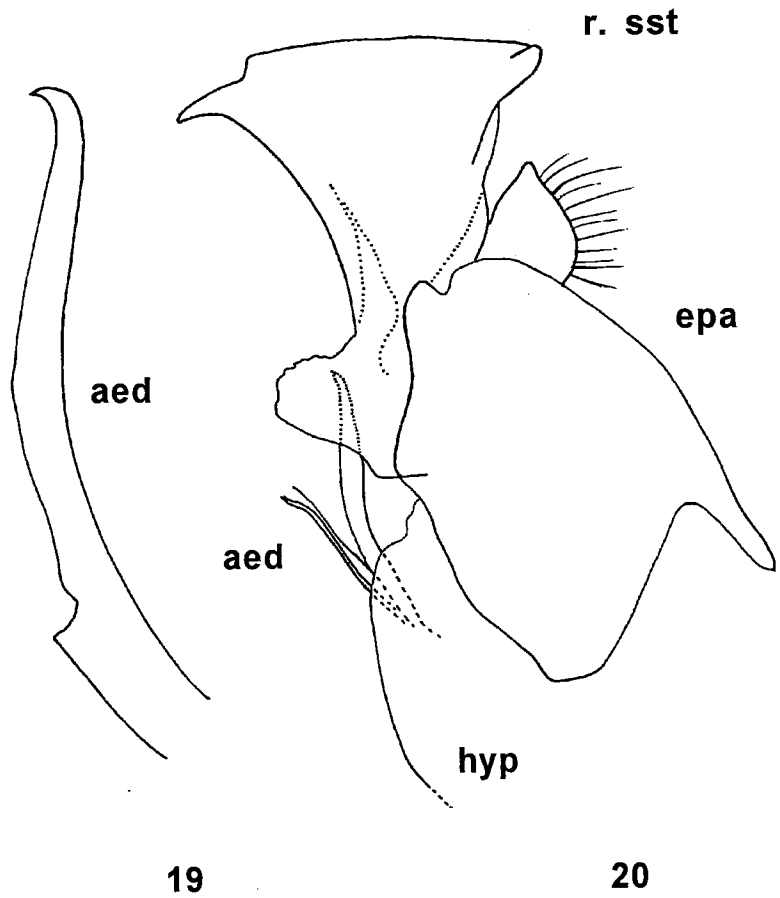
Sternite 7 black, simple and unmodified. Epandrium as in Fig. 20.

Surstyli as in Figs 17, 18, 20, identical or almost so, broad, laterally flattened, rather simple to moderately modified, moderately thick-walled and sclerotised, with limited pubescence; apical setae numerous.

Hypandrium although less elongate, basal rim rather broad; lateral arms broad



Figs 17, 18. *Dorylomorpha insulana* sp. n, holotype, male genitalia.
17, right surstylus (*r. sst*), lateral view; **18**, left surstylus (*l. sst*), lateral view.



Figs 19, 20. *Dorylomorpha insulana* sp. n, holotype, male genitalia.
19, aedeagus (*aed*); **20**, epandrium (*epa*) and right surstylus (*r. sst*), lateral view.

in lateral view; ventral membranous area rather small, basal lobes large.

Aedeagus as in Fig. 19, with proximal part long, parallel-sided; distal part very long and narrow, parallel-sided; apex parallel-sided in basal half, rapidly tapering apically and strongly downcurved; tip acute. Proximal membrane weak and thin (difficult to see); distal membrane well developed, very narrow in basal half or slightly more, broad and projecting apically, the projecting part almost evenly rounded.

Ejaculatory duct with extremely short, more or less straight tubules, two of which have more or less distinct longitudinal membranes, the third with small membranous teeth; sheath short, its proximal end free.

Distribution. Far East of Russia.

D. (Dorylomorpha) confracta sp. n.

(Figs 21—23)

Holotype. ♂, **Россия**, *Ю. Приморье*, Хасанский р-н, Рязановка (Far East, *Prymorskyy Terr.*, Hasan distr., Ryazanovka), 7 VI 1989 (S. Kuznetzov).

Diagnosis. Close to *Dorylomorpha (Dorylomorpha) confusa* from which it is easely separated by the shape and structure of the male genitalia, Figs 21—23.

Description

Body length 4.4 mm.

Head. Frons in male at its narrowest point about 1 1/2 as wide as anterior ocellus. Third antennal segment long and narrow, long-rostrate, light brownish in basal, and whitish in apical part. Arista brown.

Thorax. Hairs short, less than 1/3 as long as height of humerus.

Wing 4.62 mm long, with a faint trace of a coloured stigma at the extreme apex of cell *Sc*. Cross-vein *r-m* at 1/4 from the base of cell *M*.

Legs. Hind femur thickened in apical half, all femora black, in apical 1/4 yellow. Tibiae without bristly-hairs outstanding from the general pubescence, only fore and middle tibiae with apical ventral spur; all tibiae yellow. Tarsi yellow, last tarsal segment brown.

Abdomen entirely black, elongate. Sternite 8 in male more then half as long as tergite 5 in dorsal view, without terminal membranous area.

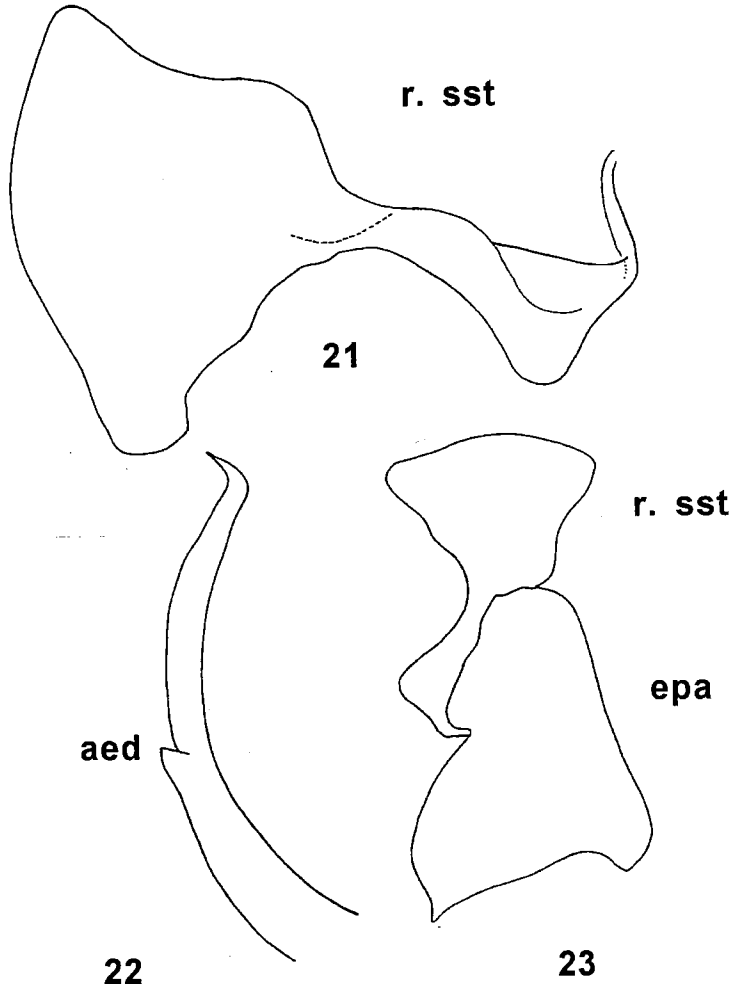
Male genitalia. Sternite 6 brownish, moderately thick-walled and rather strongly sclerotised, especially along the margins; outer part rather broad; inner part narrow, irregular, without a ventral appendage, indistinctly delimited from the tergite.

Sternite 7 black, simple and unmodified. Epandrium as in Fig. 23.

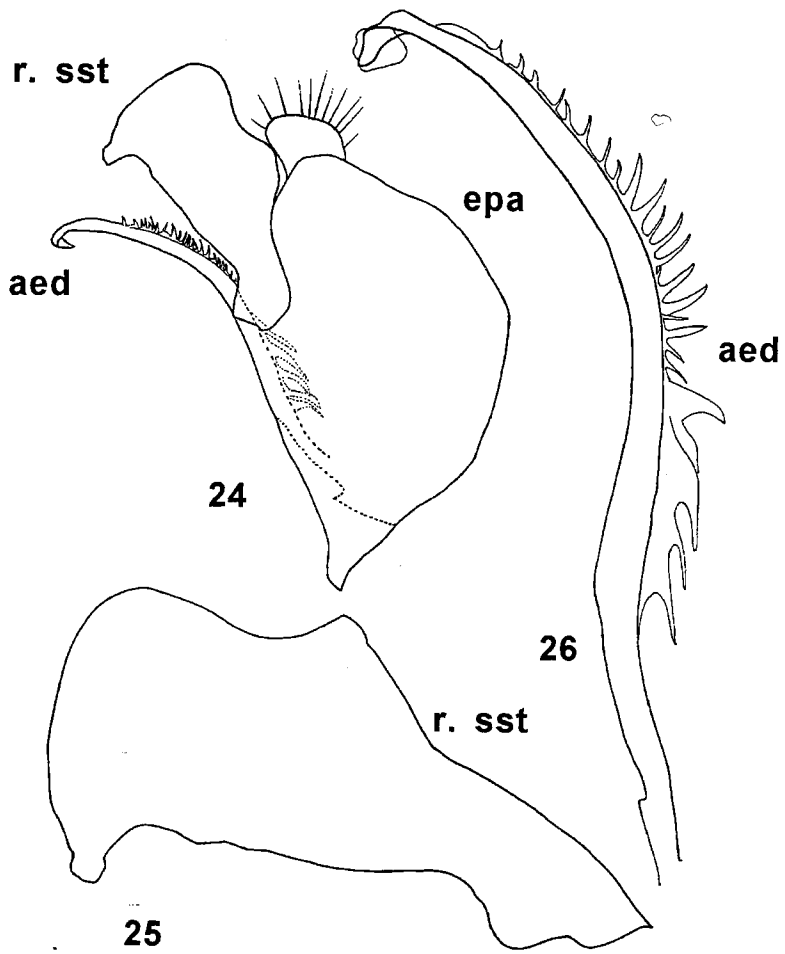
Surstyli as in Figs 21, 23, identical or almost so, broad, laterally flattened, rather simple to moderately modified, moderately thick-walled and sclerotised, with limited to extensive pubescence; apical setae numerous.

Hypandrium although less elongate, basal rim rather broad; lateral arms broad in lateral view; ventral membranous area rather small, basal lobes large.

Aedeagus as in Fig. 22, with proximal part long, parallel-sided; distal part very long and narrow, parallel-sided; apex parallel-sided in basal half, rapidly tapering apically and strongly downcurved; tip acute. Proximal membrane weak and thin (difficult to see); distal membrane well developed, very narrow in basal half or slightly more, broad and projecting apically, the projecting part almost evenly rounded.



Figs 21—23. *Dorylomorpha confracta* sp. n, holotype, male genitalia.
21, right surstylus (*r. sst*), lateral view; **22**, aedeagus (*aed*); **23**, epandrium (*epa*) and right surstylus (*r. sst*), lateral view.



Figs 24—26. *Dorylomorpha spinosula* sp. n, holotype, male genitalia.
24, epandrium (*epa*) and right surstylus (*r. sst*), lateral view; **25**, right surstylus (*r. sst*), lateral view; **26**, aedeagus (*aed*).

Ejaculatory duct with extremely short, more or less straight tubules, two of which have more or less distinct longitudinal membranes, the third with small membranous teeth; sheath short, its proximal end free.

Distribution. Far East of Russia.

D. (Dorylomorpha) spinosula sp. n. (Figs 24—26)

Holotype. ♂, **Россия**, *Ю. Приморье*, Анисимовка (**Russia**, Far East, S *Prymorskyy Terr*., Anisimovka), 21 V 1989 (S. Kuznetzov & N. Kuznetzova).

Diagnosis. Close to *D. (Dorylomorpha) spinosa* and *D. (D.) aberrans* Albrecht, 1990, from which it is easely separated by the shape and structure of the male genitalia, Figs 24—26.

Description

Body length 4.9 mm.

Head. Frons in male at its narrowest point about 11/2 as wide as anterior ocellus. Third antennal segment long and narrow, long-rostrate, dark brown in basal and in apical part. Arista brown.

Thorax. Hairs short, about 1/3 as long as height of humerus.

Wing 5.35 mm long, with a faint trace of a coloured stigma at the extreme apex of cell *Sc*. Cross-vein *r-m* at 1/6 from the base of cell *M*.

Legs. Hind femur slightly thickened, all femora black, in apical 1/3 yellow. Tibiae without bristly-hairs outstanding from the general pubescence, only fore and middle tibiae with apical ventral spur; all tibiae yellow. Tarsi yellow, last tarsal segment brown.

Abdomen entirely black, elongate. Sternite 8 in male more then half as long as tergite 5 in dorsal view, without terminal membranous area.

Male genitalia. Sternite 6 brownish, moderately thick-walled and rather strongly sclerotised, especially along the margins; outer part rather broad; inner part narrow, irregular, without a ventral appendage, indistinctly delimited from the tergite.

Sternite 7 black, simple and unmodified.

Epandrium as in Fig. 24.

Surstyli as in Figs 24, 25, identical or almost so, broad, laterally flattened, rather simple to moderately modified, moderately thick-walled and sclerotised, with limited to extensive pubescence; apical setae numerous.

Hypandrium although less elongate, basal rim rather broad; lateral arms broad in lateral view; ventral membranous area rather small, basal lobes large.

Aedeagus as in Fig. 26, with proximal part long, parallel-sided; distal part very long and narrow, parallel-sided; apex parallel-sided in basal half, rapidly tapering apically and strongly downcurved; tip acute. Proximal membrane modified into numerous very strong, irregularly furcate, spines along the lateral margins of the aedeagus; distal membrane well developed, very narrow in basal half or slightly more, broad and projecting apically, the projecting part almost evenly rounded.

Ejaculatory duct with extremely short, more or less straight tubules, two of which have more or less distinct longitudinal membranes, the third with small membranous teeth; sheath short, its proximal end free.

Distribution. Far East of Russia.

Acknowledgements

I would like to thank Dr. H. Schumann (Berlin), Dr. F. Menzel (Eberswalde-Finow) and Dr. J. Ziegler (Eberswalde-Finow) for

allowing us to study the collections of the Zoological Museum of the Humboldt University in Berlin and German Entomological Institute in Eberswalde-Finow.

I am grateful to G. Soros Foundation for the award of a subsidiary grant.

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Received 7.V.1992

Review of mining flies of the genus *Napomyza* Westwood (Diptera: Agromyzidae). II. *annulipes*-group

VLADIMIR V. ZLOBIN

Zlobin V. V. 1993: Review of mining flies of the genus *Napomyza* Westwood (Diptera: Agromyzidae). II. *annulipes*-group. *Dipterological Research*, **4**(1–2): 69—80.

New species group for 6 closely related Palaearctic species is established. 5 species are described as new to science. The morphological characteristics and key for identification of Palaearctic species are given.

V. V. Zlobin, 199034, Zoological Institute, Russian Academy of Sciences, St.Petersburg, Russia.

Index words: Diptera, Agromyzidae, *Napomyza*, taxonomy.

This paper continues publication of new information on the Palaearctic species of the genus *Napomyza*. The species of *annulipes*-group are readily distinguished from other members of *Napomyza* by the following combination of characters: orbits usually strongly projecting above eye in profile, large epistom frequently present, *tp* always present, humerus at least partly yellowish, scutellum dark, median sclerites of hypophallus always present, apical part of distiphallus greatly enlarged. The species of *annulipes*-group are closely related to *elegans*-group but easely distinguishable by dark colour of scutellum. This group consists of *Napomyza annulipes* (Meigen) and 5 new species described below. Probably Nearctic species *Napomyza suda* Spencer having yellowish humerus may be placed to *annulipes*-group too.

annulipes (new group)

Morphological characteristics of *annulipes*-group

Head in profile triangulate or suboval. Frons usually broad, 0.8—1.1 times as long as wide (in *N. tenuifrons* sp. n. — 1.7 times), 2—3 times width of eye. Orbits moderate to strongly projecting in profile, increasingly so towards base of antennae. Cheeks forming broad ring below eye, in lowest point broadly rounded or distinctly angulated. Jowls usually extended at rear. Eyes oval or round. Third

antennal segment usually longer than broad, anteriorly with distinct angle or rounded. Arista normal, only slightly enlarged at the base. The pubescence of arista and third antennal segment always short. 1—2 *ors* and 2—4 *ori*. Orbital hairs usually short and sparse, in 2—4 rows in front. Epistom always present, sometimes as long as height of face. 3+1 strong *dc*. *acr* short, irregularly in 2 rows, posteriorly not reaching to level of 2. *dc ia* usually absent. *ia* hairs very sparse. *tp* always present, in continuation of *ta*. Second costal section 0.8—1.3 times longer than fourth. Wing length 1.7—3.4 mm. Epandrium saddle-shaped; inner wall of epandrium at upper hind corner with corn-shaped projection. Bacilliform sclerites broadly separated. Hypandrium with moderately broad walls, at apex with short but distinct apodeme. Cerci very short. Basiphallus consists of a pair long sclerites which connected each other by membranous fold. Hypophallus consists of a pair lateral sclerites and a median sclerite. The sclerites of paramesophallus converging anteriorly, sometimes with long narrow membranous projections on ventral margin. Distiphallus always unpaired; its apical part broadly enlarged. Ejaculatory apodeme usually with narrow handle, sometimes stalk elongate. VIII sternite represented by a well defined sclerite or membranous strip completely fused with VI tergite.

Frons, face, orbits, cheeks and jowls always bright yellow. Third antennal segment, palpi and ocellar triangle black. First and second antennal segments yellow or black. Hind margin of eye with black spot or completly yellow. Thorax conspicuously ash-gray. Mesopleura with upper margin yellow. Humerus at least partly yellow. Fore coxae and trochanters frequently partly yellowish. All femora largely black but knees always bright yellow in apical 1/3—1/5. All tibiae black, sometimes slightly yellowish at the base. All tarsi black or first segments sometimes yellowish. Abdomen largely black, with tergites usually narrow or moderately broad yellow-bordered, sometimes broadly yellow laterally. Wings hyaline or with slight milky tinge. Veins dark-brownish. Squamae and fringe bright yellow, sometimes pale.

Life history of larvae is known only for *N. annulipes* Mg. The larva of this species forms galls on Artemisia.

Distribution. Palaearctic region. Nearctic region (?).

Key to Palaearctic species

1 First and second antennal segments bright yellow. Fore coxae yellow distally. 2
— All antennal segments black. Fore coxae black. 4
2(1) Orbits broad. Orbital hairs numerous, in 4—5 irregular rows in front. Jowls abnormally deep, equal to height of eye (Fig. 2). . . . . *N. annulipes* (Meigen)
— Orbits less broad. Orbital hairs sparser, in 2 irregular rows in front. Jowls at most 3/4 height of eye 3
3(2) 1 *ors* and 4 *ori*. Frons broad, 0.9—1.1 times longer than broad. Third antennal segment small, angulate. Second costal section 1.2 times longer than fourth (Fig. 9). Hind margin of eye yellow. Humerus largely yellow. Femora up to 1/3 yellow apically. First and second segments of tarsi yellowish brown. Wing length 3 mm. . . . . *N. flavivertex* sp. n.
— 2 *ors* and 2 *ori*. Frons narrow, 1.7 times longer than broad. Third antennal segment large, rounded. Second costal section 0.8 times longer than fourth (Fig. 8). Hind margin of eye partly black. Humerus largely black. Femora up to 1/5 yellow apically. Tarsi black. Wing length 1.7 mm. . . . . *N. tenuifrons* sp. n.
4(1) Second costal section 1.3 times longer than fourth (Fig. 29) . . . . . *N. flavohumeralis* sp. n.
— Second costal section shorter than fourth 5
5(4) Third antennal segment almost round. 2 *ors* and 2 *ori*. Sclerites of mesophallus without ventral projection. Distiphallus evenly broadening apically (Fig. 25). Antero-ventral margin of distiphallus smooth (Fig. 26). . . . . *N. humeralis* sp. n.
— Third antennal segment longer than broad, cut away below (Fig.38). 1 *ors* and 3 *ori*. Sclerites of mesophallus with long membranous projection ventrally (Fig. 39). Distiphallus sharply broadening apically. Antero-ventral margin of distiphallus with small projection (Fig. 40). . . . . *N. nigricoxa* sp. n.

Napomyza annulipes (Meigen, 1830)
(Figs 1—5)

Meigen, 1830: 190 (*Phytomyza*); Hendel, 1931—1936: 307 [*Phytomyza* (*Napomyza*)]; Spencer, 1966: 36 (*Napomyza*).

Host plant. Artemisia scoparia Waldst. & Kit.

Distribution. Austria, Germany, Hungary, Russia, Kazakhstan.

Material. **Hungary**: 1 ♀, Pest, 7 V. **Russia**: 1 ♂, 1 ♀, *Leningrad Reg*., Kolomjagi, 5 VI 1952 (leg. Kozhanchikov); 1 ♂, Rakovitchi, 7 km S of St. Petersburg, 13 V 1897 (leg. Pleske); 1 ♂, Transbaikalia, basin of river Vitim, Dzhindotoy, 11 VI 1961 (leg. B. Rohdendorf). **Kazakhstan**: 1 ♂, 1 ♀, Yanvartsevo, right beech of Ural, 10 V 1950 (leg. Grunin).

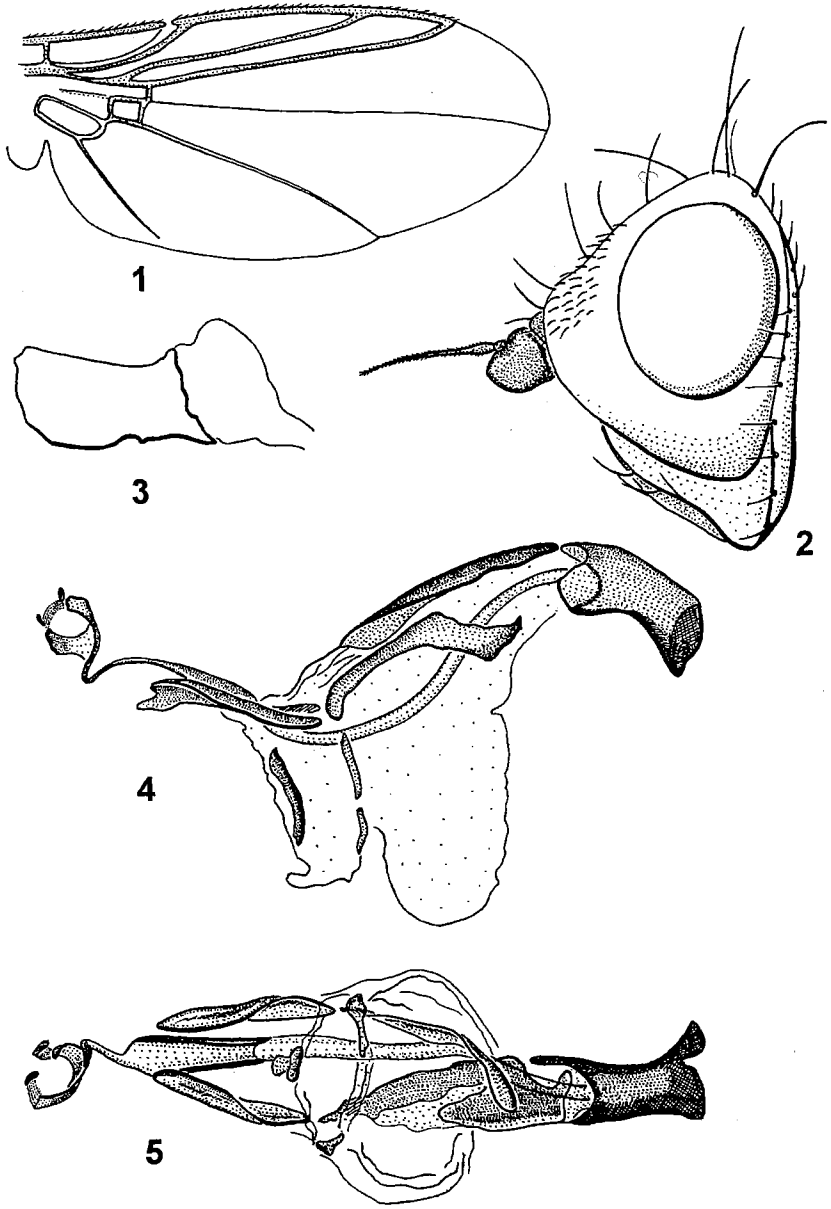
Napomyza flavivertex sp. n.
(Figs 9—15)

Holotype. ♀, **Mongolia**, 40 km ESE of Chojbalsan, 4 VI 1967 (leg. Kerzhner).

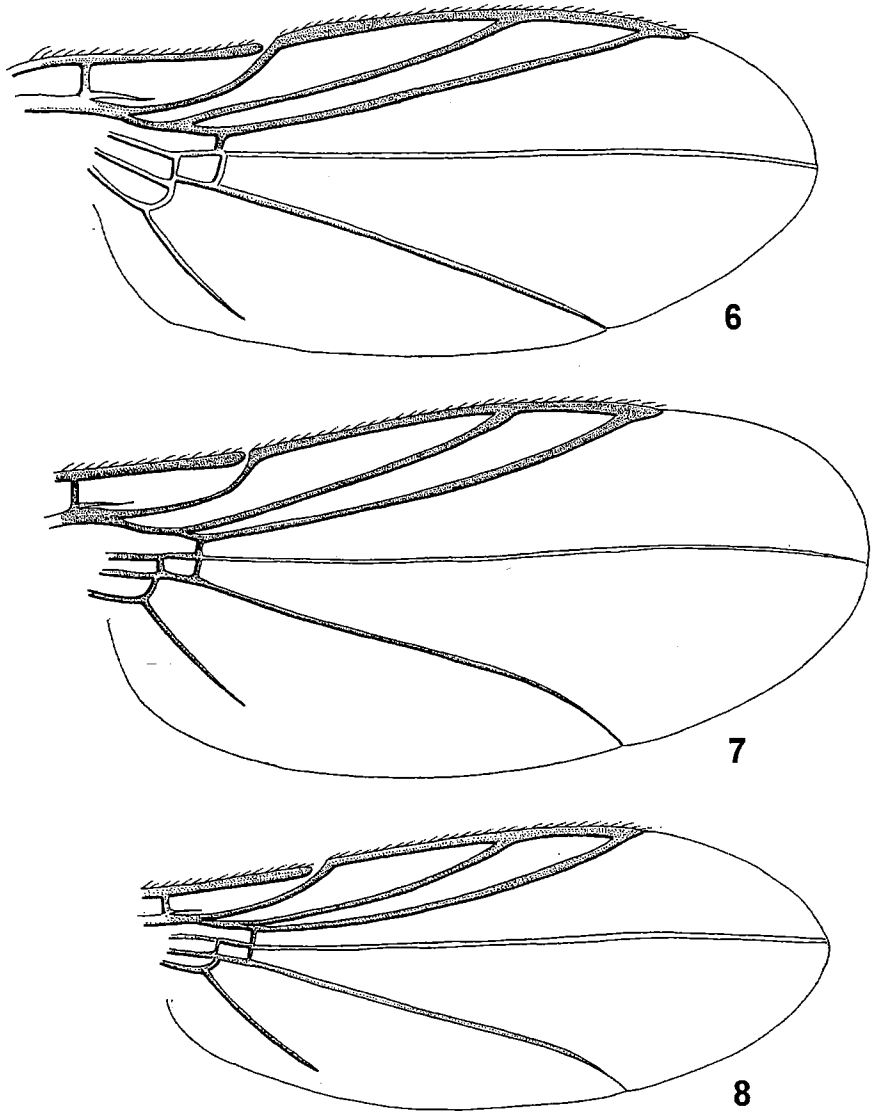
Paratype. ♀, **Russia**, *Irkutsk Reg*., Kuytun distr., Kharik, 26 VI 1934 (leg. Rubzov).

Head in profile triangulate, sharply cut away below. Frons as long as wide, 2.5 times wider than eye. Orbits above eye flat, anteriorly so broad as length of third antennal segment. 1 *ors*, 4 *ori*. Orbital hairs numerous, anteriorly in 3—4 irregular rows. Cheeks below eye very broad, angulate. Jowls deep, equal to height of eye. Epistom broad, its length subequal to height of face. Third antennal segment small, anteriorly angulate. Second costal section 2.5 times longer than third and 1.2 times longer than fourth. Wing length 3 mm. First and second antennal segments bright yellow. Hind margin of eye completly yellow. Humerus largely yellow, with small black spot before the base of humeral bristle. Fore coxae largely yellow, middle and hind coxae yellowish inside. All trochanters bright yellow. Femora up to 1/3 yellow distally. Tibiae largely black but at the base indistinctly yellowish. First and second segments of all tarsi yellowish brown, other segments dark. Abdominal sternites laterally and along hind margins with broad yellow bands. Squamae bright yellow.

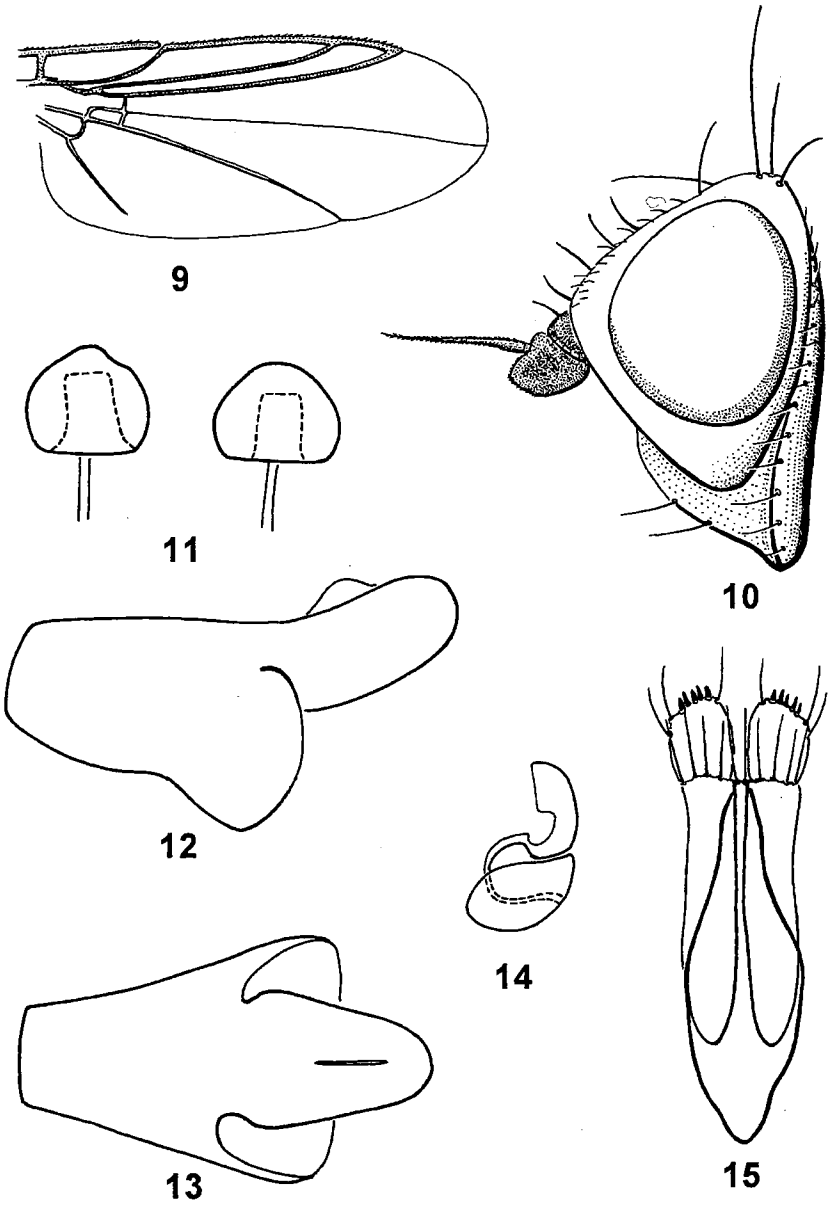
Basal conus of ovipositor sheath with dorsal ridge. Spermathecae subspherical, with cut off base. Head of ventral seminal receptacle directed forwards. IX tergite trifurcate, bearing 4 pairs of bristles. Cerci with 5 pairs of small teeth.



Figs 1—5. *Napomyza annulipes* (Meigen), ♂.
1, wing; **2**, head; **3**, ejaculatory apodeme; **4**, aedeagus, lateral view; **5**, same, ventral view.



Figs 6—8. *Napomyza* spp., wing.
6, *N. humeralis* sp. n.; **7**, *N. nigricoxa* sp. n.; **8**, *N. tenuifrons* sp. n.



Figs 9—14. *Napomyza flavivertex* sp. n., ♀.
9, wing; **10**, head; **11**, spermathecae; **12**, ovipositor sheath, lateral view; **13**, same, dorsal view; **14**, receptaculum seminis, laretal view; **15**, IX segment.

Napomyza tenuifrons , sp. n.
(Figs 8, 16—21)

Holotype. ♂, **Mongolia**, 40 km ESE of Chojbalsan, 4 VI 1967 (leg. Kerzhner).
Paratypes. 2 ♂, 1♀, the same data (M. Kozlov).

Head in profile more or less oval, lower margin not cut away. Frons narrow, 1.7 times longer than broad and twice wider than eye. Orbits and cheeks broad; cheeks below eye occupied almost 2/3 of jowls height. Epistom moderately broad. 2 *ors*, upper pair reclined and its tips directed slightly inwards. 2 *ori* directed inwards. Third antennal segment longer than broad, cut away below. Second costal section 1.4 times longer than third and 0.8 times longer than fourth ones. Wing length 1.7 mm.

First and second antennal segment bright yellow. Hind margin of eye with black spot. Humerus with small yellowish spot at hind corner. Fore coxae in apical half yellow, middle and hind coxae inside partly yellowish. Femora less than 1/5 yellow distally. Tibiae and tarsi black. Squamae completly bright yellow.

Sclerites of paramesophallus strongly curved ventrally in apical 1/3, ventral margin with membranous projection. „Trichter" of distiphallus on lower front margin smooth and narrow. Ejaculatory apodeme very narrow, with long ventral projection at the base.

Distribution. Mongolia.

Diagnosis. The coloration of *N. tenuifrons* sp. n. most resembles to *N. flavivertex* sp. n. *N. tenuifrons* sp. n. readily distinguishable by narrow frons, short second costal section, number of *or*, smaller size, shape of head and third antennal segment.

Napomyza humeralis sp. n.
(Figs 6, 22—27)

Holotype. ♂, **Russia**, Verkhnaya Dneprovka, left beech of Ural, near Orenburg, 27 V 1932 (leg. L. Zimin).

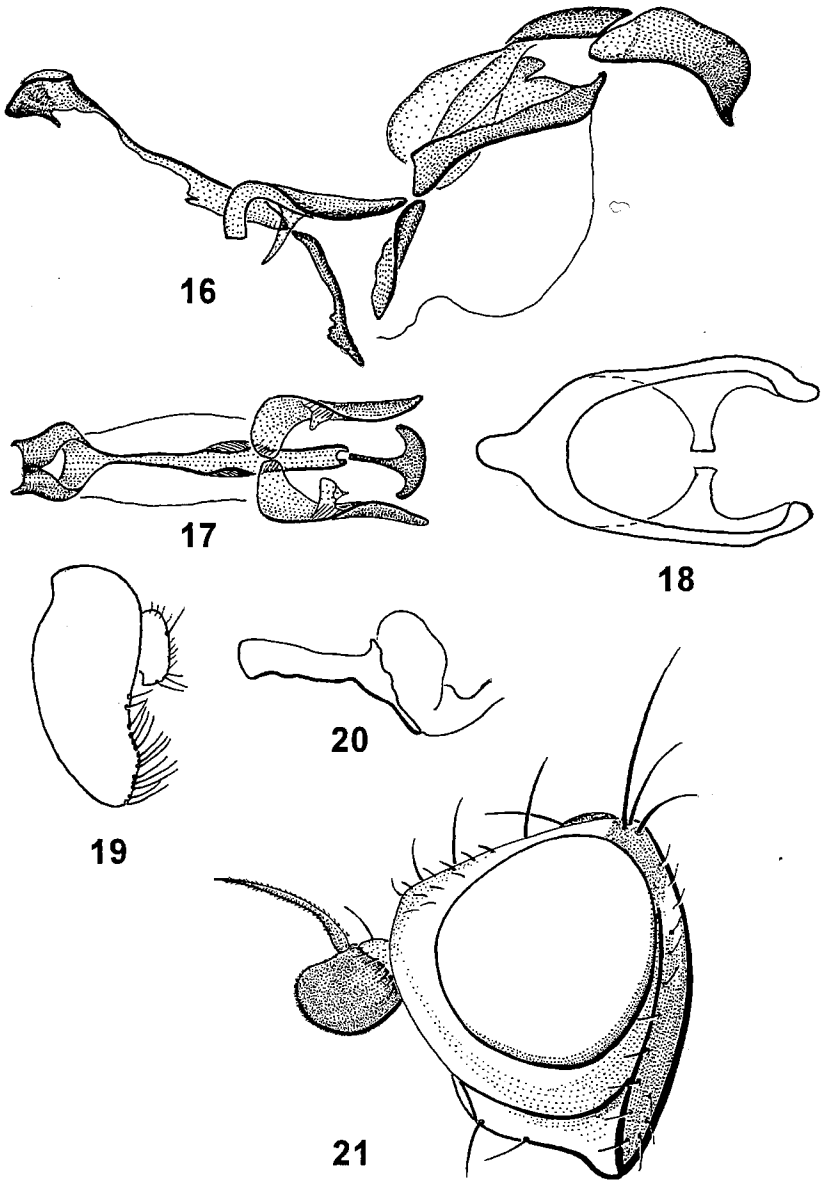
Head slightly cut away below. Orbits and cheeks forming moderate broad ring. 2 *ors* and 2 *ori*. Frons 0.9 times longer than broad and 3.1 times width of eye. Cheeks near base of antennae one half of length of third antennal segment, below eye twice shorter than jowls. Epistom narrow. Third antennal segment only slightly longer than broad, rounded below. Second costal segment 1.5 times longer than third and 1.1 times longer than fourth. Wing length 2.4 mm.

First and second antennal segments black. Hind margin of eye with black spot. Humerus with large yellow spot behind the base of humeral bristle and small indistinct yellowish strip on inner margin. Upper margin of mesopleura with yellow band, its lower margin connects anterior angle of mesopleura and base of mesopleural bristle. Fore coxae completly black, middle and hind coxae partly yellowish at inner side. Femora less than 1/5 contrasting yellow distally. Tibiae and tarsi black.

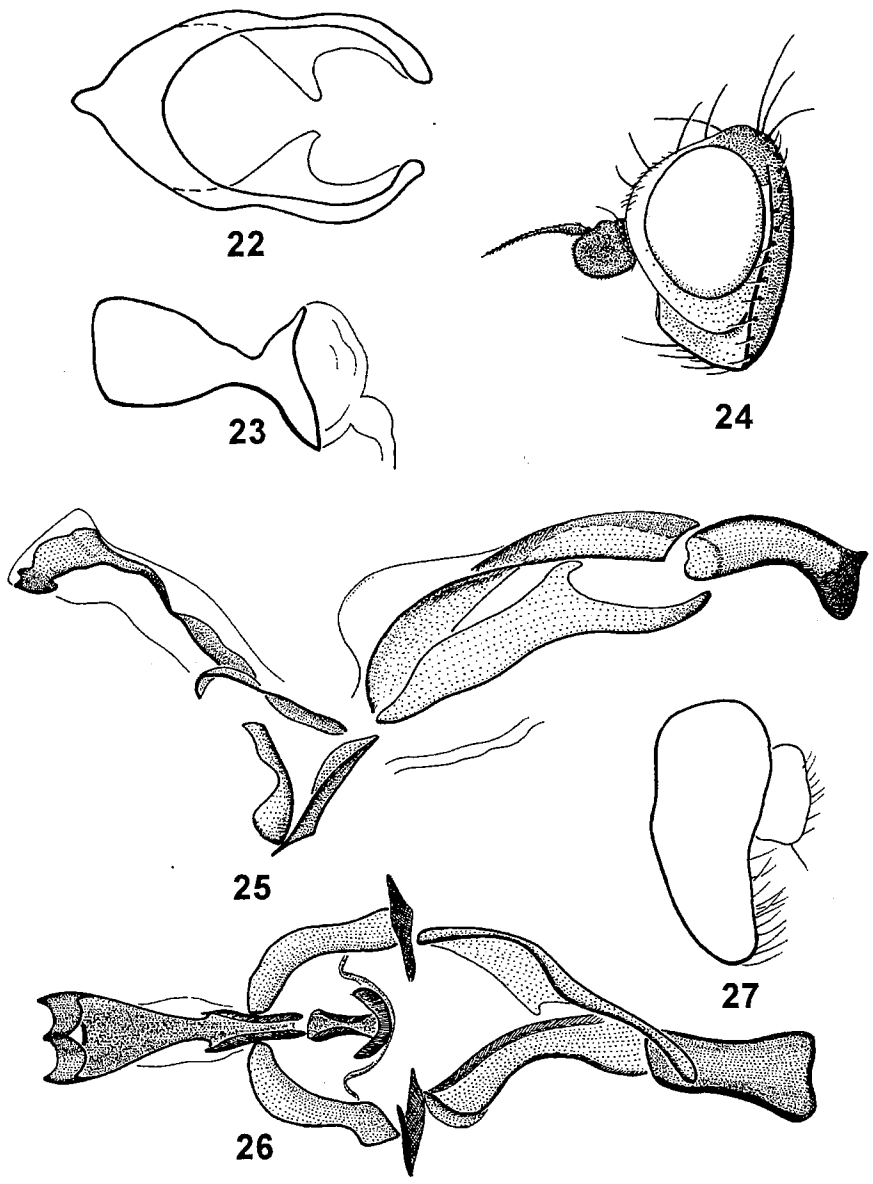
Left sclerite of basiphallus on upper margin near the middle with short finger-like projection. Sclerites of paramesophallus gradually curved inwards (ventral view), without projection on ventral margin, at apex slightly curved ventrally. Distiphallus moderately long, evenly widening in proximal half. The lower front edge of „trichter" in the middle with projection (ventral view). Postgonite broad. Ejaculatory apodeme with narrow handle and well defined dorsal and ventral stalks at the base.

Distribution. South-East of European part of Russia (SE European).

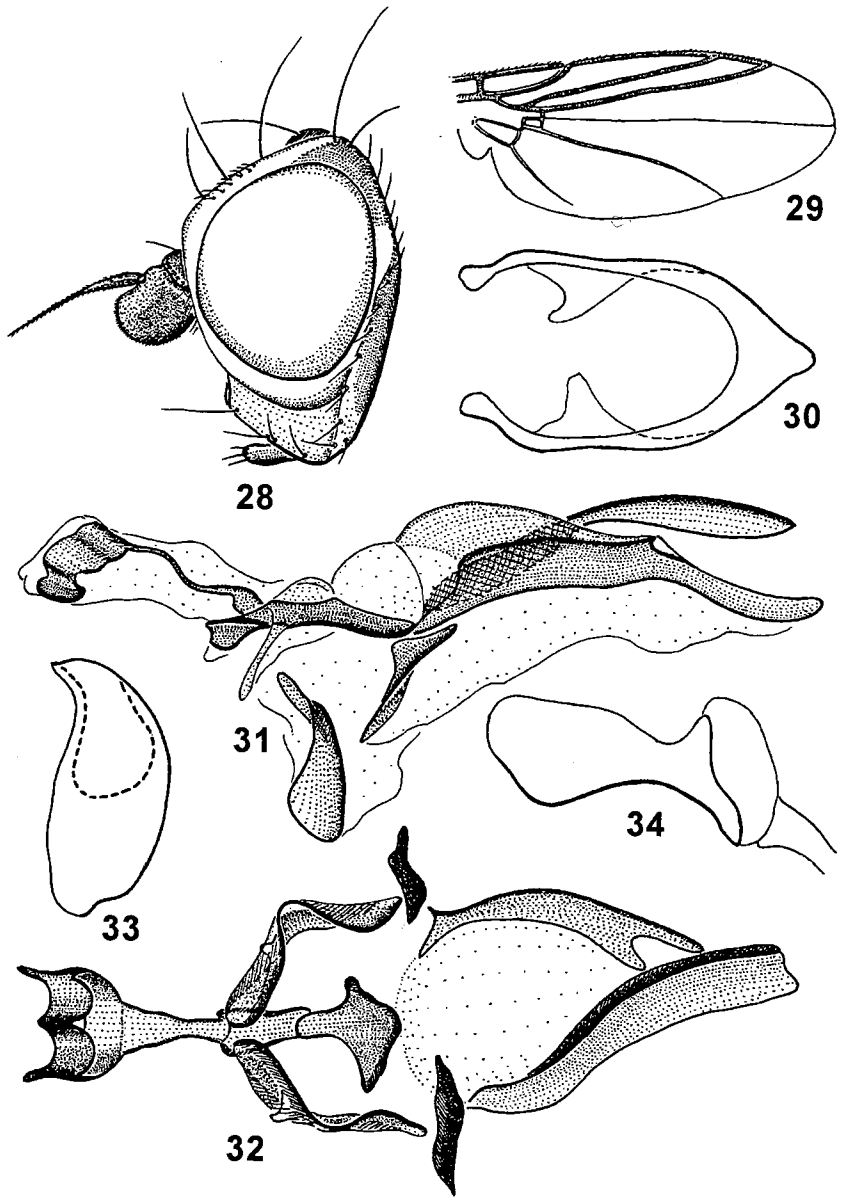
Diagnosis. A new species very similar to *N. flavohumeralis* sp. n. and *N. nigricoxa* sp. n. The differences between these species mentioned in key for identification.



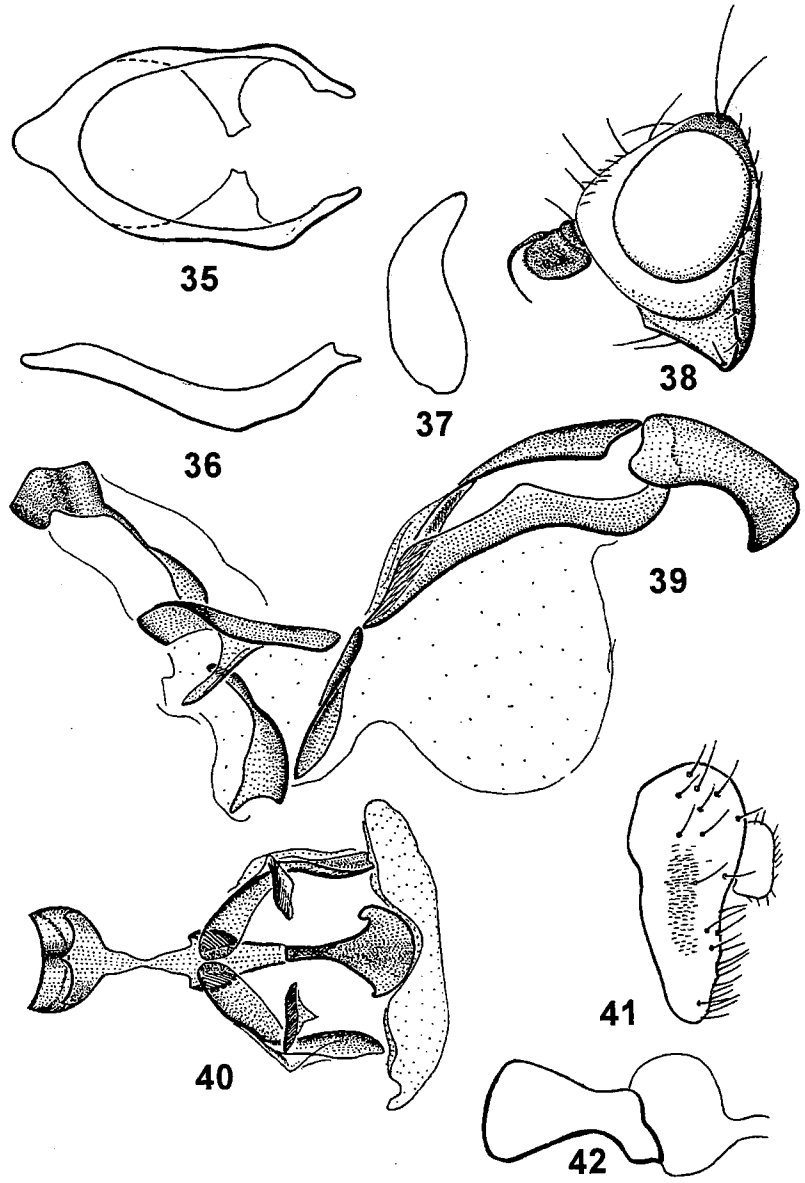
Figs 16—21. *Napomyza tenuifrons* sp. n., ♂.
16, aedeagus, lateral view; **17**, same, ventral view; **18**, hypandrium, dorsal view; **19**, epandrium, lateral view; **20**, ejaculatory apodeme, lateral view; **21**, head.



Figs 22—27. *Napomyza humeralis* sp. n., ♂.
22, hypandrium, dorsal view; **23**, ejaculatory apodeme, lateral view; **24**, head; **25**, aedeagus, lateral view; **26**, the same, ventral view; **27**, epandrium, lateral view.



Figs 28—34. *Napomyza flavohumeralis* sp. n., ♂.
28, head; **29**, wing; **30**, hypandrium, dorsal view; **31**, aedeagus, lateral view; **32**, same, ventral view; **33**, postgonite, lateral view; **34**, ejaculatory apodeme, lateral view.



Figs 35—42. *Napomyza nigricoxa* sp. n., ♂.
35, hypandrium, dorsal view; **36**, same, lateral view; **37**, postgonite, lateral view; **38**, head; **39**, aedeagus, lateral view; **40**, same, ventral view; **41**, epandrium, lateral view; **42**, ejaculatory apodeme.

***Napomyza flavohumeralis* sp. n.**
(Figs 28—34)

Holotype. ♂, **Russia**, *Primorsk Territory*, Natural Reserve „Kedrovaya pad", 22 V 1983 (leg. Zlobin).

Paratype. 1 ♀, *Primorsk Territory*, Khasan, 26 V 1979 (leg. Zinovjev).

Generally resembling *N. humeralis* sp. n. but with the following distinguishing features: orbits and cheeks less broad; cheeks below eye 1/3 height of jowls. Second costal section 2.7 times longer than third and 1.5 times longer than fourth ones. Wing length 2.9 mm. Basiphallus on upper margin near the middle with small projection. Sclerites of paramesophallus in middle angulate (ventral view), on ventral margin with long membranous projection. Distiphallus in apical part only slightly widening. „Trichter" on lower front edge with angulate projection in centre. Postgonite broad. Upper projection of ejaculatory apodeme shorter than lower.

Distribution. Russian Far East.

***Napomyza nigricoxa* sp. n.**
(Figs 7, 35—42)

Holotype. ♂, **Mongolia**, river Numregin-gol, 32 km SE of mountain Solkhit, 14 VI 1967 (leg. Kerzhner).

Closely resembling *N. humeralis* sp. n. and *N. flavohumeralis* sp. n., but distinguishable by the following combination of features: orbits and cheeks broad; cheeks forming ring distinctly broader than 1/2 height of jowls in the middle. Third antennal segment distinctly longer than broad, cut away below. 1 *ors* and 3 *ori*. Second costal section 1.8 times longer than third and 0.85 times longer than fourth. Wing length 2.9 mm. Humerus with only small yellowish bar at hind corner. All coxae black. Tibiae and tarsi black. Squamal margin and fringe pale.

Left sclerite of basiphallus on dorsal margin without finger-like projection. Sclerites of paramesophallus in the middle angulate (ventral view) and with long membranous projections on ventral margins. „Trichter" of distiphallus on lower front edge smooth. Ejaculatory apodeme only with ventral projection at the base. Postgonite narrower.

Distribution. Mongolia.

Acknowledgements

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Received 21.II.1993

Notes on „*Pseudonapomyza spicata* Malloch" from Canary and Cape Verde Islands (Diptera: Agromyzidae)

Vladimir V. Zlobin

Zlobin V. V. 1993. Notes on „*Pseudonapomyza spicata* Malloch" from Canary and Cape Verde Islands (Diptera: Agromyzidae). *Dipterological research*, 4(1–2): 81—89.

Re-examination of material identified by Hering and Spencer as *Pseudonapomyza spicata* Malloch, shown that no one specimens belong to this species. Three new species are described: *Ps. insularis* (Cape Verde and Canary Islands), *Ps. confusa* (Cape Verde Islands) and *Ps. australiana* (Australia).

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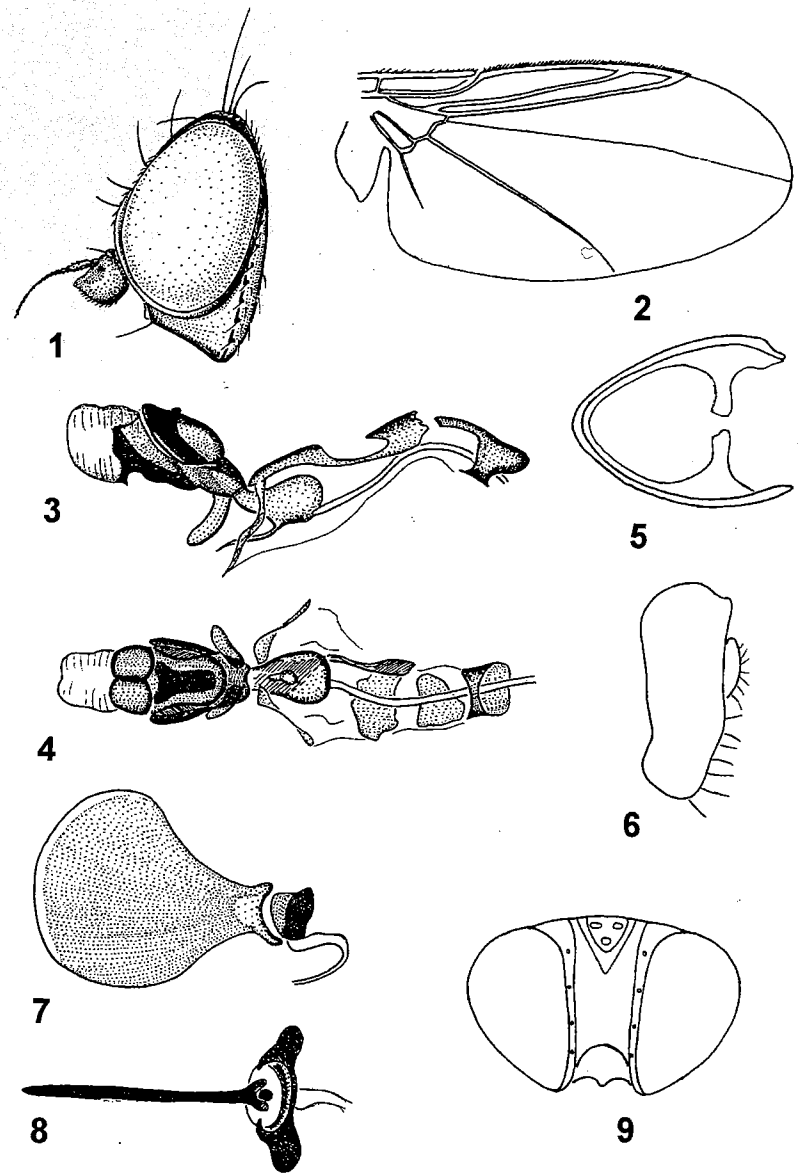
Index words: Diptera, Agromyzidae, *Pseudonapomyza*, new species, taxonomy.

During my short-time visit to the Zoological Museum of Helsinki University I had opportunity to study the material discussed by Spencer(1959) and Hering (in Spencer, 1968) under name *Pseudonapomyza spicata* (Malloch, 1914). One specimen was identified by Hendel as *Ps. atra* Mg. but he never published this information. The results of my study are given below.

The important information on the genus *Pseudonapomyza* can be found in publications of Frick (1952), Spencer (1959, 1973, 1985, 1990), Černy (1992), etc. According to my data at present time the world fauna of the genus *Pseudonapomyza* consist of at least 64 species. But most of oriental species need re-examination of type specimens in order to clarify their correct generic position and specific status. The descriptions about 30 new species from Palaearctic region waiting publication. All species described below belong to *atra*-group.

***Pseudonapomyza insularis* sp. n.**
(Figs 1—9)

Pseudonapomyza spicata (not Malloch, 1914): Spencer, 1959: 318.



Figs 1—9. *Pseudonapomyza insularis* sp. n., ♂.
1, head, lateral view; **2**, wing; **3**, aedeagus, lateral view; **4**, same, ventral view; **5**, hypandrium, dorsal view; **6**, epandrium, lateral view; **7**, ejaculatory apodeme, lateral view; **8**, same, dorsal view; **9**, head, dorsal view.

Holotype. ♂, *Ins. Cabo Verde*, Boavista Fundo de Figueiras, 30.I.1954 (Lindberg), labelled „*Pseudonapomyza spicata* Mall., det K. A. Spencer“.

Paratypes. *Ins. Cabo Verde*: 1 ♂, 1 ♀, same data; *Tenerife*: 1 ♂, San Andres (leg Stora), N 1775, labelled by F. Hendel „*Pseudonap. atra*“.

Description. Frons dark brownish in upper half becomes paler. Genae brownish. Orbits and ocellar triangle distinctly shining. Mesonotum mat greyish-black, but with distinct subshine. At least two first tarsal segments yellowish, other segments becoming darker distally. Wing venation yellowish. Squamae completly white. Frons narrow, 0.8 times width of eye at level of anterior ocellus, almost parallel-sided. Orbits as wide as 1/5 width of frons, conspicuously narrowing anteriorly, only slightly projecting above eye in profile. Eye 1.5 times higher than broad, slightly slanting, egg-shaped. Cheeks very narrow, linear. Genae in middle 1/9 and at rear 1/3 height of eye. Third antennal segment small, angulate, flat above, only finely pointed at upper corner, rounded below, covered with sparse but distinct pubescence. Arista short, finely pubescent. *acr* in 4—5 irregular rows. Second costal segment 0.8—0.9 length of fourth. R_{2+3} almost straight. Wing length 1.4—1.5 mm.

Vth sternite of male trapeziform, lateral sides almost straight, front margin flat, covered with sparse bristles. Ventral margins of epandrium approximated, each with a group of bristles; lateral margins (caudal view) rounded. Cerci very short, triangulate. Distiphallus as shown in fig. 3—4; its apical part membranous, basal part with prominent curving ventral sclerites at rear. Mesophallus pear-like, with long narrow projection ventrally. Ejaculatory apodeme broadly expanded distally. Hind wall of sperm pump provides with strongly chitinized band.

Distribution. Palaearctic region: Cape Verde Islands and Canary Islands.

Diagnosis. All specimens of type seria belong to material which has been discussed by Spencer (1959) and Hering (in Spencer, 1968) under name *Pseudonapomyza spicata* Malloch, but among of them only one specimen was labelled by Hering and others ones by Spencer. They both overlooked yellowish colour of basal segments of tarsi. This feature is readily distinguish *Ps. insularis* sp.n. from other known *Pseudonapomyza* species from Cape Verde Islands. Apart from colouration this species is distinctive, having characteristic shape of aedeagus and strongly chitinized hind wall of sperm pump. Type material deposited in Zoological Museum of Helsinki University, one paratype in collection of Zoological Institute (St. Petersburg).

Pseudonapomyza spicata (Malloch, 1914)

Malloch, 1914: 334 (*Phytomyza*); Hennig, 1941: 173 (*Pseudonapomyza*); Frick, 1952: 418; Spencer, 1959: 318; 1961a: 4; 1961b: 93; 1963: 160; 1973: 4, 236, 262, 263; 1974: 150; 1977: 212, 220; 1990: 356, 357—377; Sasakawa, 1963a: 47; 1963b: 505; 1963c: 833; 1972: 73; 1985: 285; Hering (in Spencer), 1968: 250, 255, 285, 308; Tandon, 1970: 285; Singh & Ipe, 1973: 145.

This species originally was described by Malloch (1914) in *Phytomyza* from Takao (Formosa). Hennig (1941) correctly placed it to *Pseudonapomyza*. Spencer (1961b: 93, fig. 48) examined and illustrated male terminalia of holotype, which deposited in Hungarian Natural History Museum (Budapest). Unfortunately, the

drawing of aedeagus was made inaccurate and positive identification after it is very difficult. Later Spencer (1973) gave more pricise illustration of aedeagus, but he did not mentioned the origin of studied material. He stated that „distiphallus small, pale, clearly divided into separate sections“. Sasakawa (1963a) under name *Pseudonapomyza spicata* (Malloch) published short description and illustration of male terminalia specimens from Formosa. He mentioned that these formosan specimens have „the spinulose ventral membrane and the endophallus surrounded by spinulose membrane“. The shape of aedeagus and pecularities mentioned above indicated that this species is distinct from holotype of *Ps. spicata* and represents a separate species. The specimen from New Britain „has less shiny mesonotum and abdomen, wing length 1.38 mm, and o terminalia slightly different from the typical form, having 22—23 minute setulae on the surstylus, and the longer endophallus“ (Sasakawa, 1963c). Seems to be the population from New Britain is distinct too. According to Malloch (1914, 1935), Frick (1952), Spencer (1959, 1961a, 1961b, 1963, 1973, 1974, 1977, 1979), Sasakawa (1963a, 1963b, 1963c, 1972), Sasakawa & Fan, 1985), Tandon (1970), Singh & Ipe (1973) *Pseudonapomyza spicata* recorded from Cape Verde Islands, Egypt, Sudan, Tanganyika, Israel, Iraq, Nepal, India, Formosa, Micronesia, Fiji, Samoa, New Britain, Australia, Hawaii. Spencer (1990) suggested that *Ps. spicata* apparently not widespread in tropical Africa or Australia and confused in the past with *Ps. spinosa*. Very wide range may be explained recent introduction by man because Zea mays, Triticum aestivum, Panicum miliaceum, Saccharum officinarius recorded as host plants of this leaf miner.

The status of many populations outside of type locality requires further clarification. It has now been possible to examine material from Cape Verde Islands discussed by Spencer (1959) and Hering (in Spencer, 1968) as *Ps. spicata*. This material represents a mixture of species and no one male belongs to *Ps. spicata*.

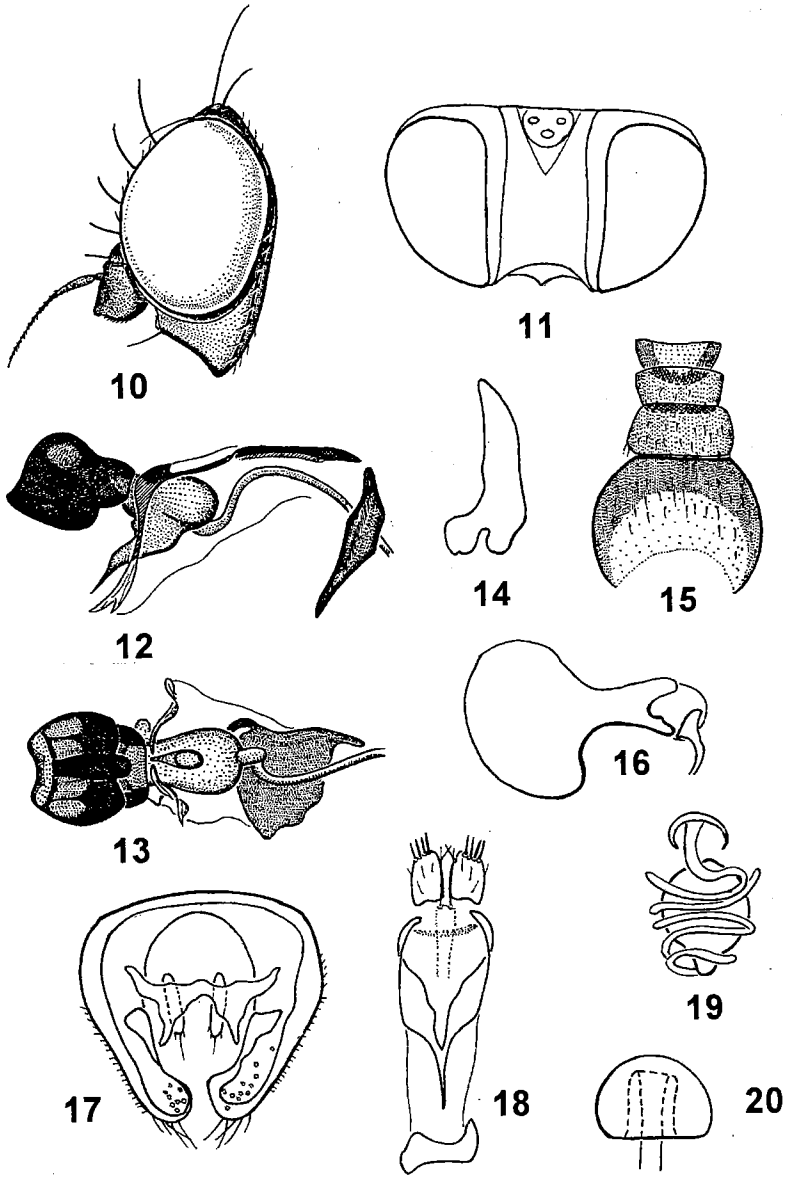
Pseudonapomyza spinosa Spencer, 1973

(Figs 10—20)

Spencer, 1973: 275; 1974: 151; 1977: 219—221; 1990: 357, 375—377.

The type seria of *Ps. spinosa* includes material from Egypt, N. Nigeria, S. Africa, India, Australia, Micronesia and Samoa. During my study of material from Cape Verde Islands and Canary Islands I established that one male and three females identified by Spencer and Hering as *Ps. spicata* Malloch are conspecific with holotype of *Ps. spinosa*, which illustrated by Spencer (1973). Apart from in collection of Zoological Institute (St.Petersburg) there are two specimens of *Pseudonapomyza* from Australia. A comparision of material from Cape Verde Islands and Australia shown that these closely resembling populations represent distinct species. Below after australian material I describe a new species and occurence of *Ps. spinosa* in Australia needs conformation.

Specimens examined. 1 ♂, *Gr. Canaria*, Las Palmas, N 382 (leg R. Stora); Ins. Cabo Verde: 1 ♀, S. Antao Pombas, 23—26.12.1953 (leg Lindberg), labelled „*Pseudonapomyza spicata* Malloch, det. Hering, 1958“; 1 ♀, Antao Cha de Morte, 5.I.1954 (leg Lindberg), labelled „*Pseudonapomyza spicata* Malloch, K. A. Spencer det“; 1 ♀, S. Antao Pombar, 23—26.12.1953 (leg Lindberg).



Figs 10—20. *Pseudonapomyza spinosa* Spencer.
10, head, lateral view; **11**, same, dorsal view; **12**, aedeagus, lateral view; **13**, same, ventral view; **14**, postgonite, lateral view; **15**, IInd—Vth sternites, ventral view; **16**, ejaculatory apodeme, ventral view; **17**, epandrium, anterior view; **18**, IXth segment of ovipositor; **19**, receptaculum seminis; **20**, spermatheca.

***Pseudonapomyza australiana* sp. n.**
(Figs 21—31)

Holotype. ♂, **Australia**, Alice-Springs, 12.V.1978 (leg Tobias).
Paratype: 1 ♀, same data, 14.V.1978.

Description. Frons black or brownish black. Orbits mat. Mesonotum black, somewhat mat. Legs completly black. Radial veins of wing black. Squamae white.

Frons narrow, equal to width of eye, only slightly narrowing anteriorly. Ocellar triangle small, equilateral. Orbits narrow, not projecting above eye in profile. Eye oval, almost upright. Third antennal segment only finely pointed at upper corner, with short pubescence along anterior margin. Arista normal, with short pubescence. Jowls narrow, at rear about 1/3 of eye height. 3+0 *dc*. *acr* in 4—5 irregular rows. Second costal section 1.32 times longer than fourth. Wing length 1.4 mm in male, 1.6 mm in female. Vth sternite of male distinctly longer than broad. Epandrium saddle-shaped. Ventral projections of bacilliform sclerite acite. Cerci short, straight. Postgonite at lower corner with small acute projection. Phallophor relatively short. Mesophallus with long projection below. Distiphallus distinctly compressed laterally in apical 1/3 (in ventral view). Ejaculatory apodeme with long handle and moderate broad blade. Sperm pump completly unchitinized. Spermathecae unequal size, suboval, distinctly higher than semicircle. Body of receptaculum semenis strongly narrowing distally. Cerci long and narrow.

Distribution. Australia.

Diagnosis. On external morphology and also in the form of genitalia *Ps. australiana* sp.n. is closely related to *Ps. spinosa* Spencer. There appears to be no significant difference in side view but in ventral view (fig. 24) the two can be readily differentiated. Apart from there are differences in shape of bacilliform sclerites, Vth sternite of male, postgonite, spermathecae, receptaculum semenis, cerci of ovipositor.

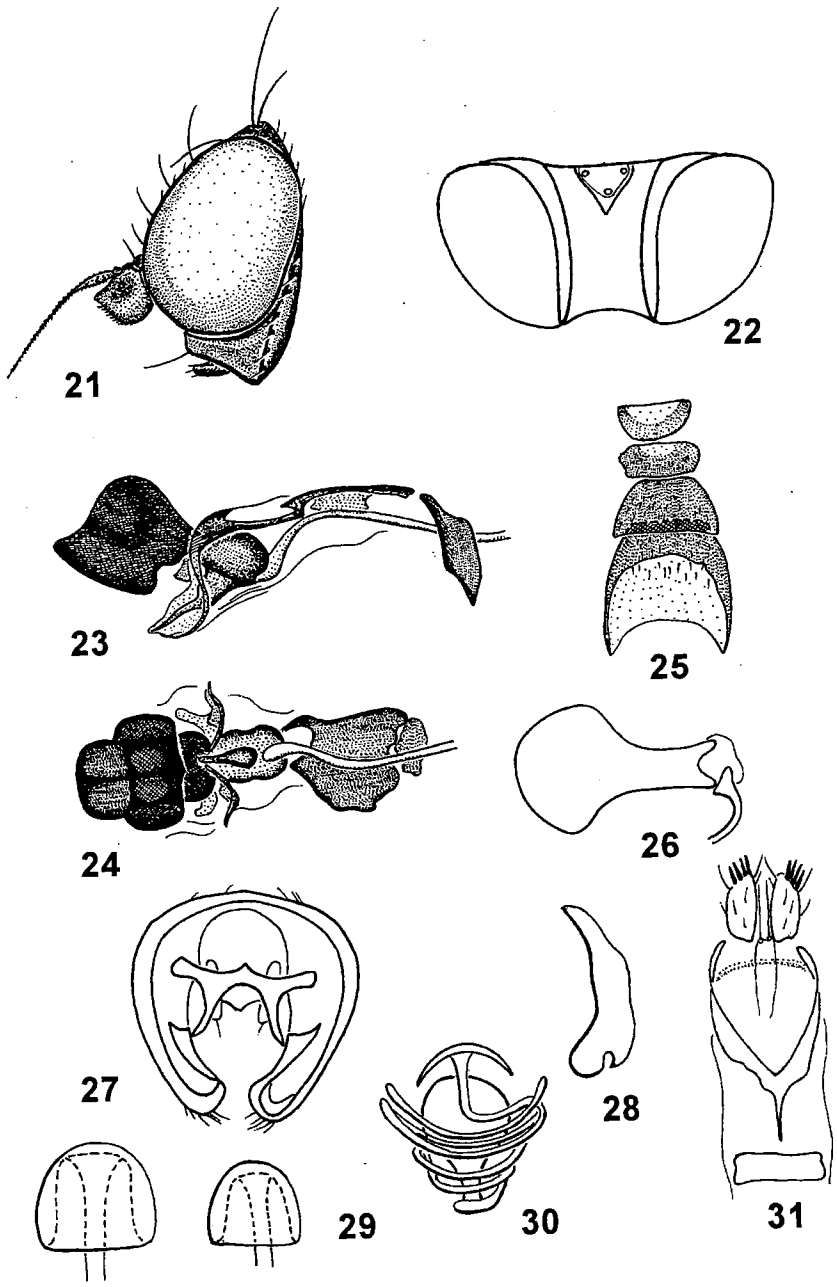
***Pseudonapomyza confusa* sp. n.**
(Figs 32—39)

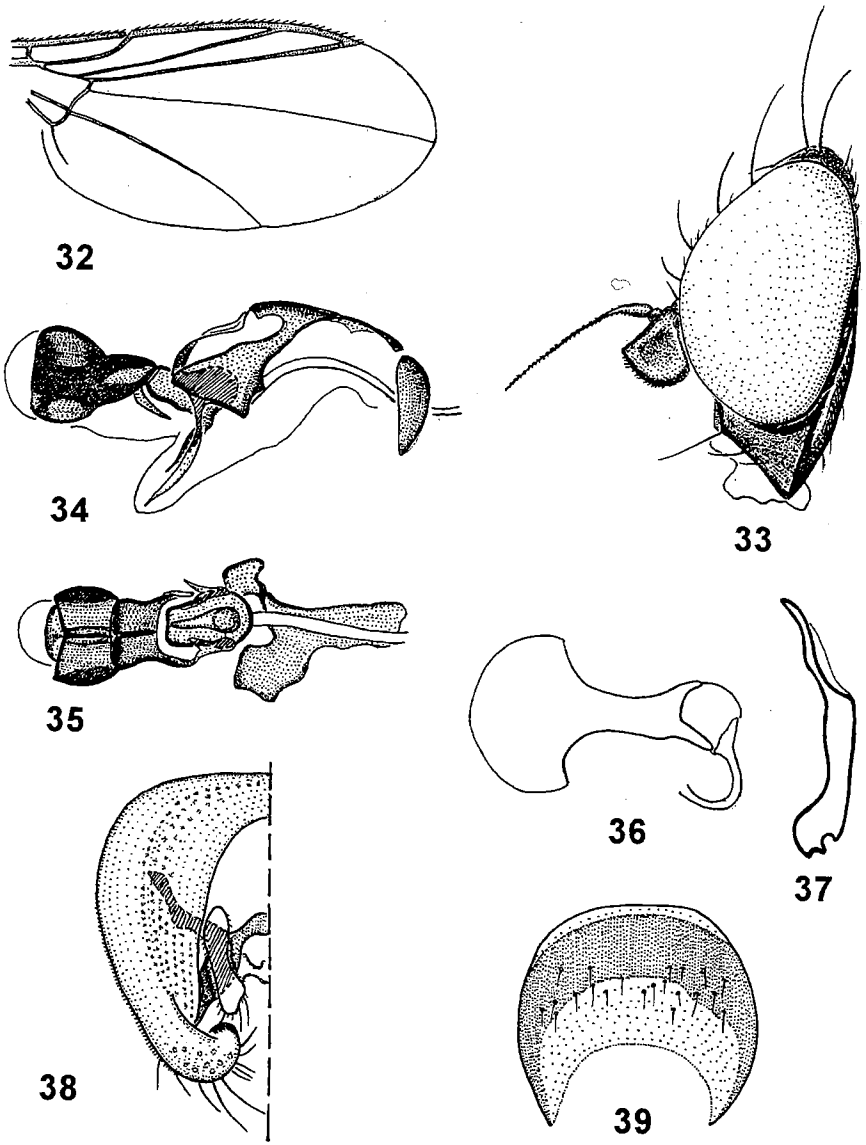
Holotype. ♂, Ins. Cabo Verde, Nicolau Rib., Bravo, 6—19.12.1953 (leg Lindberg), labelled „*Pseudonapomyza spicata* Mall., det K. A. Spencer“.

Description. Frons completly black, orbits weakly shiny. Mesonotum moderately shining black. Legs completly black. Radial veins of wing dark brown.

Frons slightly narrowing anteriorly, 1.5 times wider than eye. Orbits narrow, not projecting above eye in profile. Eye egg-shaped, upright, 1.6 times higher than broad. Cheeks narrow, linear. Jowls deepest at rear, 3.5 times shorter than height of eye. Third antennal segment small, upper apical angle acute, with distinct but short fringe of hairs. Arista short, its pubescence short. *acr* in 4 regular rows. Second costal segment 1.1 times longer than fourth. Wing length 1.1 mm. Vth sternite higher than semicircle, its lateral margins rounded. Cerci normal.

Figs 21—31. *Pseudonapomyza australiana* sp. n.
21, head, lateral view; **22**, same, anterior view; **23**, aedeagus, lateral view; **24**, same, ventral view; **25**, IInd—Vth sternites, ventral view; **26**, ejaculatory apodeme, lateral view; **27**, epandrium, anterior view; **28**, postgonite, lateral view; **29**, spermathecae; **30**, receptaculum seminis; **31**, IX segment of ovipositor.





Figs 32—39. *Pseudonapomyza confusa* sp. n.
32, wing; **33**, head, lateral view; **34**, aedeagus, lateral view; **35**, same, ventral view; **36**, ejaculatory apodeme, lateral view; **37**, postgonite, lateral view; **38**, left half of epandrium, posterior view; **39**, Vth sternite, ventral view.

Ventral projections of bacilliform sclerites acute. Apical part of postgonite long and slender. Mesophallus with long, narrow projection ventrally. Distiphallus strongly chitinized, expanded distally, at rear with narrow acute projection directed backwards. Ejaculatory apodeme with narrow long handle. Sperm pump completly unchitinized.

Distribution. Cape Verde Islands.

Diagnosis. The unique male specimen was misidentified by Spencer as *Pseudonapomyza spicata* Malloch. Among available material there are two females which similar to this new species but somewhat different. Therefore I did not included them to type seria.

Acknowledgements

I am grateful to G. Soros Foundation for the award of a subsidiary grant.

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A new *Phytomyza* species from Kamchatka (Diptera: Agromyzidae)

VLADIMIR V. ZLOBIN

Zlobin, V. V. 1993. A new *Phytomyza* species from Kamchatka (Diptera: Agromyzidae). *Dipterological Research*, 4(1–2): 91—94.

Description of *Phytomyza ranunculiphila* sp. n. (Kamchatka Prov.) is given.

V. V. Zlobin, 199034, Zoological Institute, Russian Academy of Sciences, St.Petersburg, Russia.
Index words: Diptera, Agromyzidae, *Phytomyza*, new species, taxonomy.

During expedition to Kamchatka in 1985 I catched only a pair specimens of a new species which easily distinguishable by external characters from other members of the largest genus of the family Agromyzidae. Holotype deposited in Zoological Institute, St.Petersburg.

Phytomyza ranunculiphila sp. n.

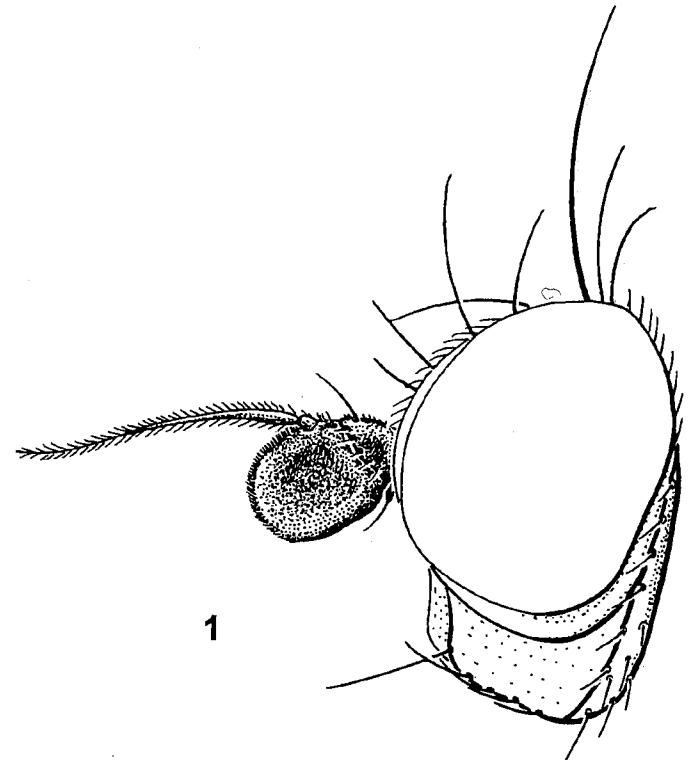
(Figs 1—2)

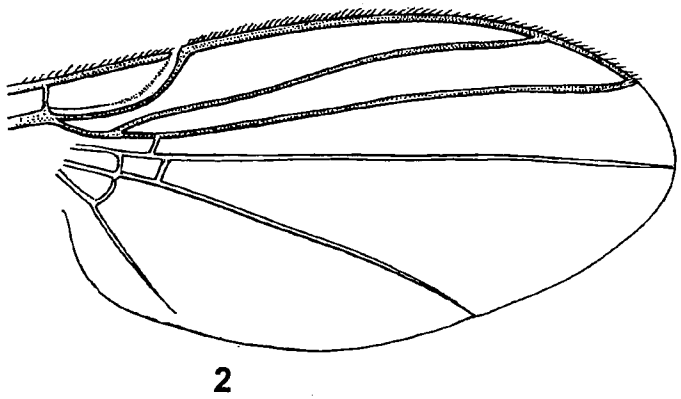
Holotype. ♂, **Russia**, *Kamchatka*, Mil'kovo, 7 VII 1985 (V. Zlobin).

Paratype. ♀, **Russia**, *Kamchatka*, Kozyrevsk, 12 VII 1985 (V. Zlobin).

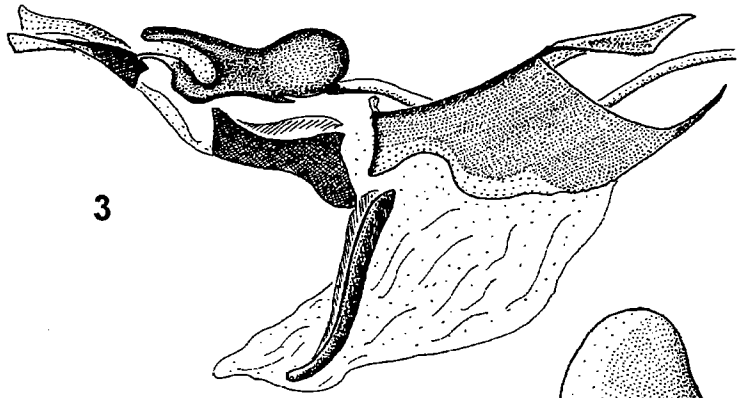
Description. Head largely yellow; ocellar triangle and palpi black; hind margin of eye dark beyond base of *vte*; facial grooves brownish. First antennal segment bright yellow; second and third black. Mesonotum and scutellum dark brown, mat, but with weak subshine. Mesonotum of paratype with small yellow patches at hind-corners and a pair of indistinct yellowish strips at level of outer interalar hairs. Humerus, notopleura and mesopleura conspicuously whitish-yellow; lower pleura divided by yellow above mid-coxae. Legs largely bright yellow; fore coxae slightly darkened basically; tarsi brownish. Abdomen with tergites conspicuously yellow-bordered. Ovipositor sheet black, shiny. Wings hyaline, radial veins brownish. Squamae white, fringe dark.

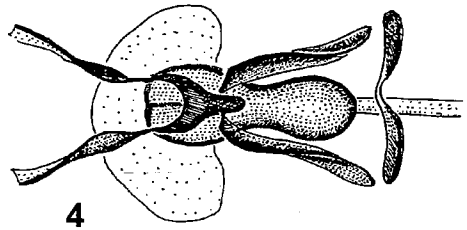
Frons parallel-sided, shorter than broad and twice wider than eye. Orbits only slightly projecting above eye in profile. 2 *ors*, the upper distinctly shorter; 2 *ori*, the lower weaker and shorter. Orbital hairs short, proclinate, in one row. Third antennal segment large, oval, distinctly longer than broad, with distinct pubescence at

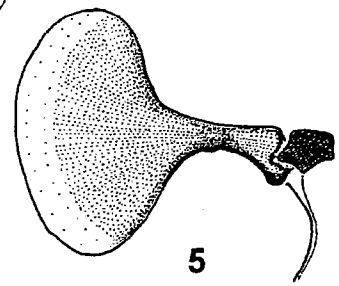


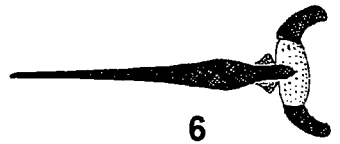


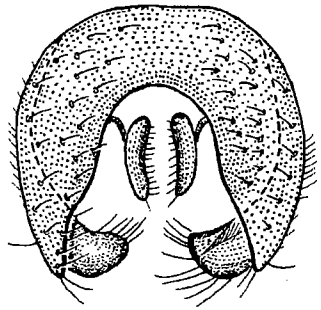
Figs 1—2. *Phytomyza ranunculiphila* sp. n., female.
1, head, lateral view; **2**, wing.

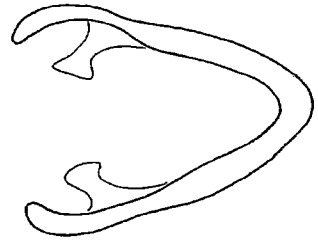












Figs 3—8. *Phytomyza ranunculiphila* sp. n., male genitalia.
3, aedeagus, lateral view; **4**, the same, ventral view; **5**, ejaculatory apodeme, lateral view; **6**, same, dorsal view; **7**, epandrium, caudal view; **8**, hypandrium, dorsal view.

upper corner. Arista normal, conspicuously pubescent along whole length. Eye oval, upright, 1.2 times heigher than broad. Jowls at rear 1/3 height of eye. Cheeks below eye linear. *3+1* strong *dc. acr* in 4 irregular rows. *C* extending to vein R_{4+5}. Second costal section 3.4 times longer than fourth. Second cross-vein present, well beyond first. Wing length 2.6 mm.

Aedeagus with distal sclerites diverging from base, attached to lower edge of mesophallus. Mesophallus conspicuously extended above. Paramesophallus consists of a pair black sclerites, prominent below mesophallus. Ventral lobes long, fused distally. Ejaculatory apodeme broadly expanded distally; sperm pump strongly chitinized laterally. Surstyli separated from epandrium by distinct suture.

Host plant unknown.

Distribution. Russian Far East.

Diagnosis. All Palaearctic *Phytomyza* species having second cross-vein were placed by Hendel (1931-1936) into subgenus *Napomyza* Westwood. Later *Napomyza* was raised to full generic rank. In spite of presence second cross-vein *P. ranunculiphila* sp. n. clearly belongs to genus *Phytomyza*. The new species may be readily distinguishable from *Phytomyza* and *Napomyza* species by follow combination of characters: second cross-vein present; frons, sides of thorax and legs yellow. The genitalia is of the characteristic form noted in species feeding on Ranunculaceae. No doubt that *Ph. ranunculiphila* sp. n. feeds on the same plant family.

Acknowledgements

I am grateful to G. Soros Foundation for the award of a subsidiary grant.

Reference

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Received 5.VI.1993

Contribution to the knowledge of the sphaerocerid fauna of the North Korea (Diptera: Sphaeroceridae)

Natalia V. Kuznetzova & Milan Kozánek

N. V. Kuznetzova & M. Kozánek. 1993. Contribution to the knowledge of the sphaerocerid fauna of the North Korea (Diptera: Sphaeroceridae). *Dipterological Research*, **4**(1–2): 95—100.

A contribution to the knowledge of the sphaerocerid fauna of the North Korea is presented. 21 species are recorded for the first time.

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M. Kozánek, Institute of Experimental Phytopathology and Entomology, Slovak Academy of Sciences, 900 28 Ivanka pri Dunaji, Slovakia

Introduction

The family Sphaeroceridae includes very small ussually dark flies. The larvae are saprophagous in the widest sense. A significant number of species are living in droppings of mammals and on dung heaps, munerous species develop in mud, in forest litter, in fungi, in decaying vegetable refuse, in caves, in nests and runs of small mammals, in nests of insects and birds and on carrion.

Investigation of Korean Sphaeroceridae is only preliminary (Papp, 1972, 1979; Rochaček, Marshal, 1986). Despite of the fact that family Sphaeroceridae is relatively the large Diptera family within the Palearctic, very little have been known about it in Korean Peninsula. First information concerning Sphaeroceridae in North Korea, was could find in L. Papp (1972), where *Ischiolepta oedopoda* has been described. Next data on that matter was reported by L. Papp (1979), with one species — *Coproica coreana* described as new. Another new species, *Trachyopella artivena*, *T. mitis* and *T. operta*, described by J. Rohaček and S. A. Marshall (1985), and *T. kozaneki*, described by N. V. Kuznetzova (1991) has also not been repeatedly found so far.

The aim of this work is to improve our knowledge of species of this family from North Korea. The specimens examined here were made mainly during the entomological expeditions on the basis of the Slovak-

North Korean Cultural Agreement in May 1988 and August 1989, and now deposited in the collection of the Slovak National Museum, Bratislava, Slovakia (SNM).

Species new to the North Korean fauna

Subfamily COPROMYZINAE

***Copromyza equina* Fallén, 1820**

Material examined. 1 ♂, **North Korea**, *Kangwon Prov.*, Manmulsang, Mt. Kumgang-san, 25.V.1988 (M. Kozánek), (SNM).

Distribution. Europe: Iceland, Sweden, Finland, Estland, Latvia, Lithuania, Denmark (incl. Faeroes), Great Britain, Ireland, France, Belgium, Germany Poland, Czechia, Slovakia,Hungary, Austria, Switzerland, Spain, Roumania, Yugoslavia, Greece; Russia; Asia: China, Japan, North Korea (**new record**); North Africa: Algeria, Tunisia; Azores, Madeira, Canary Is.; Nearctic, Neotropic and Pacific Regions.

***Lotophila atra* (Meigen, 1830)**

Material examined. 3 ♂, 3 ♀, **North Korea**, Onsupjong, Mt. Paektu-san, 19.VIII.1989 (M. Kozánek), (SNM).

Distribution. All parts of Europe; Russia; Asia: Afganistan, Mongolia, North Korea (**new record**); North Africa: Algeria, Tunisia; Canary Is., Madeira Is., Nearctic Region.

***Crumomyia subaptera* (Malloch, 1923)**

Material examined. 1 ♀, **North Korea**, Paekdusan, Mts. Paekdu, 16.VIII.1989 (M. Kozánek), (SNM).

Distribution. Asia: North Korea (**new record**); Nearctic Region.

Subfamily LIMOSININAE

***Trachyopella kozaneki* N. Kuznetzova, 1991**

Distribution. Asia: North Korea.

***Poecilosomella* sp.**

Material examined. 1 ♂, **North Korea**, Taesongsan Mts., Pyonyang, 4.V.1988 (M. Slovák); 1 ♂, **North Korea**, Okryu Valley, Kumgangsan Mts., 21.V.1988 (M. Slovák); 10 ♂, 1 ♀, **North Korea**, 10 km NW of Pyongsong, 1.VIII.1989 (M. Kozánek).

***Chaetopodella scutellaris* (Haliday, 1836)**

Material examined. 3 ♂, **North Korea**, 10 km NW of Pyongsong, 1.VIII.1989 (M. Kozánek), (SNM).

Distribution. Europe: Sweden, Finland, Ireland, Estland, Latvia, Lithuania, Denmark, Great Britain, Germany, Poland, Czechia, Slovakia, Austria, Hungary, Roumania, Yugoslavia, Bulgaria, Switzerland, Italy, Spain; Russia; Asia: Afganistan, North Korea (**new record**).

***Opacifrons septentrionalis* (Stenhammar, 1854)**

Material examined. 2 ♀, **North Korea**, Paekdusan Mts., MUPO, 30 km N of Samjiyon, 18.VIII.1989 (M. Kozánek), (SNM).

Distribution. Europe: Great Britain, Sweden, Finland, Latvia, Denmark, Germany, Roumania, Bulgaria; Russia; Asia: Mongolia, North Korea (**new record**).

***Opacifrons* sp.**

Material examined. 3 ♂, **North Korea**, 10 km NW of Pyongsong, 1.VIII.1989 (M. Kozánek).

***Leptocera caenosa* (Rondani, 1880)**

Material examined. 2 ♂, 1 ♀, **North Korea**, Paekdusan Mts., Sobaek, 17.VIII.1989 (M. Kozánek), (SNM).

Distribution. All parts of Europe; Russia; Asia: Mongolia, Afganistan, North Korea (**new record**); Azores; Nearctic, Neotropical Regions and New Zealand; Afrotropical Region.

***Leptocera nigra* Olivier, 1813**

Material examined. 1 ♂, **North Korea**, Suyangsan Mts., 10 km NW of Haeju, 29.VII.1989 (M. Kozánek); 17 ♂, 2 ♀, **North Korea**, 10 km NW of Pyongsong, 1.VIII.1989 (M. Kozánek); 1 ♀, **North Korea**, Myonyangsan Mts., 5 km SW of Hyangsan, 4.VIII.1989 (M. Kozánek); 2 ♂, **North Korea**, Paekdusan Mts., Mt. Sobaek, 17.VIII.1989 (M. Kozánek); 1 ♂, **North Korea**, Paekdusan Mts., MUPO, 30 km N of Samjiyon, 18.VIII.1989 (M. Kozánek); 1 ♂, **North Korea**, Paekdusan Mts., Samjiyon, 18.VIII.1989 (M. Kozánek); 2 ♀, **North Korea**, Paekdusan Mts., Onsupjong, 19.VIII.1989 (M. Kozánek), (SNM).

Distribution. All parts of Europe except for subarctic regions; Russia; Asia: Afganistan, Nepal, North Korea (**new record**), Japan; North Africa: Algeria, Tunisia, Egypt; Canary Is.; Afrotropical and Oriental Regions.

***Rachispoda lutosa* (Stenhammar, 1854)**

Material examined. 1 ♂, **North Korea**, Suyangsan Mts., 10 km NW of Haeju, 29.VII.1989 (M. Kozánek); 1 ♀, **North Korea**, Paekdusan Mts., Mt. Paekdu, 16.VIII.1989 (M. Kozánek); 1 ♀, **North Korea**, Paekdusan Mts., Mt. Samjiyon, 18.VIII.1989 (M. Kozánek), (SNM).

Distribution. All parts of Europe; Russia; Asia: Afganistan, North Korea (**new record**); North Africa; Nearctic Region.

***Terrilimosina schmitzi* (Duda, 1918)**

Material examined. 1 ♂, **North Korea**, Paekdusan Mts., Samjiyon, 15.VIII.1989 (M. Kozánek); 11 ♂, 7 ♀, **North Korea**, Paekdusan Mts., Mt. Sobaek, 17.VIII.1989 (M. Kozánek), (SNM).

Distribution. Finland, Great Britain, Denmark, Germany, Poland, Austria, Czechia, Slovakia, Roumania; Russia; Asia: Mongolia, North Korea (**new record**); Nearctic Region.

***Minilimosina vitripennis* (Zetterstedt, 1847)**

Material examined. 1 ♀, **North Korea**, Paekdusan Mts., Onsupjong, 19.VIII.1989 (M. Kozánek), (SNM).

Distribution. All parts of Europe; Russia; Asia: Afganistan, Mongolia, North Korea (**new record**).

***Paralimosina fucata* (Rondani, 1880)**

Material examined. 17 ♂, 5 ♀, **North Korea**, NW of Pyongsong, 1.VIII.1989 (M. Kozánek), (SNM).

Distribution. Great Britain, Belgium, Denmark, Latvia, Germany, Poland, Czechia, Slovakia, Hungary, France (incl. Corsica), Spain, Italy, Yugoslavia, Bulgaria; Asia: North Korea (**new record**); North Africa: Algeria, Tunisia.

***Spelobia pseudonivalis* (Dahl, 1909)**

Material examined. 2 ♂, **North Korea**, Paekdusan Mts., Sobaek, 17.VIII.1989 (M. Kozánek), (SNM).

Distribution. Sweden, Finland, Great Britain, Netherlands, Latvia, France, Germany, Czechia, Slovakia, Hungary; Asia: North Korea (**new record**).

***Spelobia luteilabris* (Rondani, 1880)**

Material examined. 2 ♂, **North Korea**, Paekdusan Mts., Samjiyon, 15.VIII.1989 (M. Kozánek); 1 ♀, **North Korea**, Paekdusan, Mts. Paekdu, 16.VIII.1989 (M. Kozánek); 1 ♂, **North Korea**, Paekdusan Mts., Sobaek, 17.VIII.1989 (M. Kozánek), (SNM).

Distribution. Iceland, Finland, Great Britain, Denmark, Netherlands, Latvia, Belgium, France, Germany, Poland, Czechia, Slovakia, Austria, Hungary, Italy, Yugoslavia, Bulgaria; Russia; Asia: North Korea (**new record**); Azores, Madeira Is.; New Zealand.

***Spelobia parapusio* (Dahl, 1909)**

Material examined. 1 ♀, **North Korea**, Paekdusan, Mts. Paekdu, 16.VIII.1989 (M. Kozánek), (SNM).

Distribution. Sweden, Finland, Great Britain, Denmark, Latvia, Belgium, France, Germany, Poland, Czechia, Slovakia, Austria, Hungary, Italy, Yugoslavia, Bulgaria, Spain; Russia; Asia: North Korea (**new record**); North Africa: Tunisia, Madeira Is.

***Spelobia cambrica* (Richards, 1929)**

Material examined. 1 ♂, **North Korea**, Paekdusan Mts., Samjiyon, 15.VIII.1989 (M. Kozánek);1 ♀, **North Korea**, Paekdusan, Mts. Paekdu, 16.VIII.1989 (M. Kozánek); 1 ♂, 1 ♀, **North Korea**, Paekdusan Mts., Sobaek, 17.VIII.1989 (M. Kozánek), (SNM).

Distribution. Finland, Great Britain, Czechia, Slovakia; Asia: North Korea (**new record**).

***Pullimosina moesta* (Villeneuve, 1918)**

Material examined. 1 ♀, **North Korea**, Paekdusan Mts., Samjiyon, 15.VIII.1989 (M. Kozánek); 1 ♀, **North Korea**, Paekdusan Mts., Sobaek, 17.VIII.1989 (M. Kozánek), (SNM).

Distribution. Finland, Great Britain, Denmark, Latvia, Belgium, France, Germany, Czechia, Slovakia, Austria, Switzerland, Hungary; Asia: North Korea (**new record**); Canary Is.

***Opalimosina mirabilis* (Collin, 1902)**

Material examined. 1 ♀, **North Korea**, Paekdusan, Mts. Paekdu, 16.VIII.1989 (M. Kozánek); 1 ♀, **North Korea**, Paekdusan

Mts., Sobaek, 17.VIII.1989 (M. Kozánek), (SNM).

Distribution. Great Britain, Denmark, Latvia, Germany, Czechia, Slovakia, Austria, Hungary, Bulgaria, Spain; Asia: Iran, Mongolia, Nepal, North Korea (**new record**); Nearctic Region.

***Opalimosina collini* (Richards, 1929)**

Material examined. 1 ♀, **North Korea**, Paekdusan Mts., Samjiyon, 15.VIII.1989 (M. Kozánek); 1 ♂, **North Korea**, Paekdusan, Mts. Paekdu, 16.VIII.1989 (M. Kozánek); 2 ♀, **North Korea**, Paekdusan Mts., Onsupjong, 19.VIII.1989 (M. Kozánek), (SNM).

Distribution. Finland, Great Britain, Latvia, Czechia, Slovakia, Hungary; Asia: North Korea (**new record**).

Sphaeroceridae recorded from the North Korea

*: species recorded for the first time.

Subfamily COPROMYZINAE

Ischiolepta
oedopoda L. Papp, 1972

Copromyza
equina Fallen, 1820*

Lotophila
atra (Meigen, 1830)*

Crumomyia
subaptera (Malloch, 1923)*

Subfamily LIMOSININAE

Coproica
coreana L. Papp, 1979

Trachyopella
artivena Rohaček et Marshall, 1985
kozaneki N. Kuznetzova, 1991
mitis Rohaček et Marshall, 1985
operta Rohaček et Marshall, 1985

Poecilosomella
*sp.**

Chaetopodella
scutellaris (Haliday, 1836)*

Opacifrons
septentrionalis (Stenhammar, 1854)*
*sp.**

Leptocera
caenosa (Rondani, 1880)*
nigra Olivier, 1813*

Rachispoda
lutosa (Stenhammar, 1854)*

Terrilimosina
schmitzi (Duda, 1918)*

Minilimosina
vitripennis (Zetterstedt, 1847)*

Paralimosina
fucata (Rondani, 1880)*

Spelobia
cambrica (Richards, 1929)*
luteilabris (Rondani, 1880)*
parapusio (Dahl, 1909)*
pseudonivalis (Dahl, 1909)*

Pullimosina
moesta (Villeneuve, 1918)*

Opalimosina
collini (Richards, 1929)*
mirabilis (Collin, 1902)*

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