

# Studies on Nearctic species of *Leucopis* (Diptera: Chamaemyiidae). I. The redescription of Nearctic *Leucopis* published before 1965

V.N. Tanasijtshuk

Tanasijtshuk, V.N. 2002. Studies on Nearctic species of *Leucopis* (Diptera: Chamaemyiidae). I. The redescription of Nearctic *Leucopis* published before 1965. *Zoosystematica Rossica*, 11(1): 193-207.

Revision of Nearctic types of *Leucopis* (Diptera, Chamaemyiidae) described before 1965 was realised. Types and corresponding materials were studied for the following species: *L. americana* Malloch, 1921; *L. atrifacies* Aldrich, 1925; *L. flavicornis* Aldrich, 1914; *L. maculata* Thompson, 1910; *L. major* Malloch, 1921; *L. minor* Malloch, 1921; *L. parallela* Malloch, 1921; *L. pemphigae* Malloch, 1921; *L. piniperda* Malloch, 1921; *L. simplex* Loew, 1869.

V.N. Tanasijtshuk, Zoological Institute, Russian Academy of Sciences, Universitetskaya nab. 1, St.Petersburg 199034, Russia; e-mail: brach@zin.ru

## Introduction

The species of *Leucopis* Meigen (Diptera: Chamaemyiidae) whose larvae prey on Aphidae and Coccidae, as well as Psyllidae (Stevenson, 1967; McLean, 1998), play a very important role in many biocenoses. However studies of this group have been uneven in different regions. Almost 70 species of this genus are known from the Palaearctic, but less than 20 species were described from the Nearctic (McAlpine, 1965, 1977, 1978; Tanasijtshuk, 1996), not all of which currently belong to this genus. This can be explained by the fact that determination of most species of *Leucopis* by external morphological features is almost impossible because of their uniformity. Therefore, a description of one species can be similar to ten others (of course there are some species with distinctive features that are easy to determine), so most species can be determined only by preparation of the male genitalia. Similar determination using female terminalia is not well developed at the moment, but has potential, as demonstrated by Raspi (1985, 1986, 1990, 1996), Raspi & Bertolini (1993), Beschovski (1995), and Beschovski & Merz (1998). However a female, even if collected and reared on the same aphids as species *X*, can belong to species *Y*; the exceptions are monophagous species, species clearly definable on external appearance, and species reared in culture from known parents by methods described by Gaimari & Turner (1997). So, determinations

of many species using females are doomed to be uncertain until some clearly defined criteria are developed and identified with particular species whose male was correctly described. Furthermore, a male holotype with female paratypes (or vice versa) quite often belong to different species.

I intend to publish a series of articles on Nearctic *Leucopis*; this one is devoted to species, which were published before the work of McAlpine (1965) published in "A catalog of the Diptera of America north of Mexico". This date was chosen because descriptions published later were typically carried out in more detail with drawings of the male genitalia.

## Material and methods

During my stay in the USA in 1992, I visited the collection of the Museum of Comparative Zoology, Harvard University (MCZ), where I studied the type of *Leucopis simplex* Loew. While in Canada in 1994, I studied the vast collection of *Leucopis* in the Canadian National Collection of Insects, Ottawa (CNC); Dr. J.F. McAlpine gave me his draft manuscripts about *Leucopis* including the species he has studied. These manuscripts included a key using external morphology, but without genitalic structure. Then I worked for three months with the collections of *Leucopis* in the National Museum of Natural History, Washington (NMNH) and the Illinois Natural History Survey, Urbana (INHS). I received also a series

of type specimens from Dr. W. Pulawski, California Academy of Sciences (CAS). Besides these, some materials were studied in the collection of CSIRO (Canberra, Australia) and the Zoological Institute of the Russian Academy of Sciences, St. Petersburg (ZIN). In total I studied more than 2000 specimens.

After returning to St. Petersburg, I received a significant portion (more than 700 specimens) of the collections of *Leucopis* belonging to CNC and NMNH, providing the framework of this study to be greatly expanded. As Dr. McAlpine (personal communication) assumed, it appears rather extensive.

McAlpine (1965) enumerated 15 species of *Leucopis* (then a subgenus of *Leucopis*) that were described from the Nearctic and one from the northern Neotropics (Cuba). Five of them (*bella* Loew, 1866, *bellula* Williston, 1889, *bivittata* Malloch, 1940, *ocellaris* Malloch, 1940 and *verticalis* Malloch, 1940) were singled out by McAlpine (1960) into the separate *ocellaris*-group. Their generic combinations are being changed by Tanasijtshuk & Gaimari (in press) to the genus *Leucopina*, along with 15 new species. Out of the remaining 11, one (*orbitalis* Malloch, 1921) is a synonym of *L. argenticollis* Zetterstedt, 1848 (McAlpine & Tanasijtshuk, 1972). I have studied the types and other material of the 10 remaining species; the results being the subject of this study.

Unfortunately, not all of the type specimens were male; what is more – sometimes specimens that were cited as male in their descriptions turned out to be female. Therefore, redescription of several types is neither complete nor satisfactory.

Male genitalia were studied in glycerin; drawings were made in glycerin jelly. Terminology – according to McAlpine (1981). OT (ocellar triangle) index refers to the ratio of the distance between posterior ocelli and the distance between any posterior ocellus and the anterior one.

## Descriptions

### *Leucopis americana* Malloch, 1921

Malloch, 1921: 354; 1940: 272.

*Types preserved in INHS.* Holotype specimen (which was glued on paper triangle) lost, empty pin labelled “# 46568”, “*Leucopis americana* Mall. – type” (written in pencil), “Type *Leucopis americana* Malloch ♂”, red label, “INHS Type # 0122”. On the same pin are three puparia and a small tube containing the abdomen in glycerin. This abdomen (without doubt, from holotype specimen) is female, not male as Malloch thought.

*Paratypes:* 1 ♀, labels “46568”, “allotype *Leucopis americana* Malloch ♀”, “INHS Type # 0123”; 2 ♀ (one

without head), with the same label “46568”. According to records at INHS, label “46568” means “Diptera destroying aphids; Evanston, Ill. May 15, 1912. D.K. McMillan”.

*Description. Female.* Body length 2.1–2.2 mm. Body light grey. Head 1.5–1.6 times as high as long. Frons 2.7–2.8 times narrower than head. Ocellar plate weakly marked; frontal stripe dark grey, with two dark brown stripes on its side. OT index 1.6. Lunule medium-sized. Antenna and arista black, 3rd arismere three times longer than 2nd. Gena height 4 times less than eye height. Minute bristles, arranged in one sparse row, present on gena; anterior bristle largest. Lateral stripes of mesonotum goldish brown, extending to distal 1/4 of mesonotum. Median stripes grey. Areas between stripes devoid of bristles over 2/3 of mesonotum. Two pairs of dorso-central bristles present. Legs black; apices of femora and bases of tibiae yellow; on fore legs tarsi nearly entirely black, on mid and hind legs first two tarsomeres yellow. On wings, veins *M* and *R*<sub>4+5</sub> converge in distal 1/3, *tp* 1.3 times less than distal section of *Cu*. Large black spot covering syntergite 1+2 up to posterior edge; two rather small spots present on tergite 3; dark median spots present on anterior edge of tergites 4–5.

*Taxonomic notes.* The description of Malloch (1921) is indistinct. For example, he wrote “Thorax with or without two brown vittae”, but added that the typical series “has the thorax vittate”. In reality, the presence or absence of lateral stripes is very serious taxonomic character, and *L. americana* sensu Malloch may be conceived as a complex of species. Studying the type series did not solve the problem – all paratypes were female, so analysis of male genitalia is impossible.

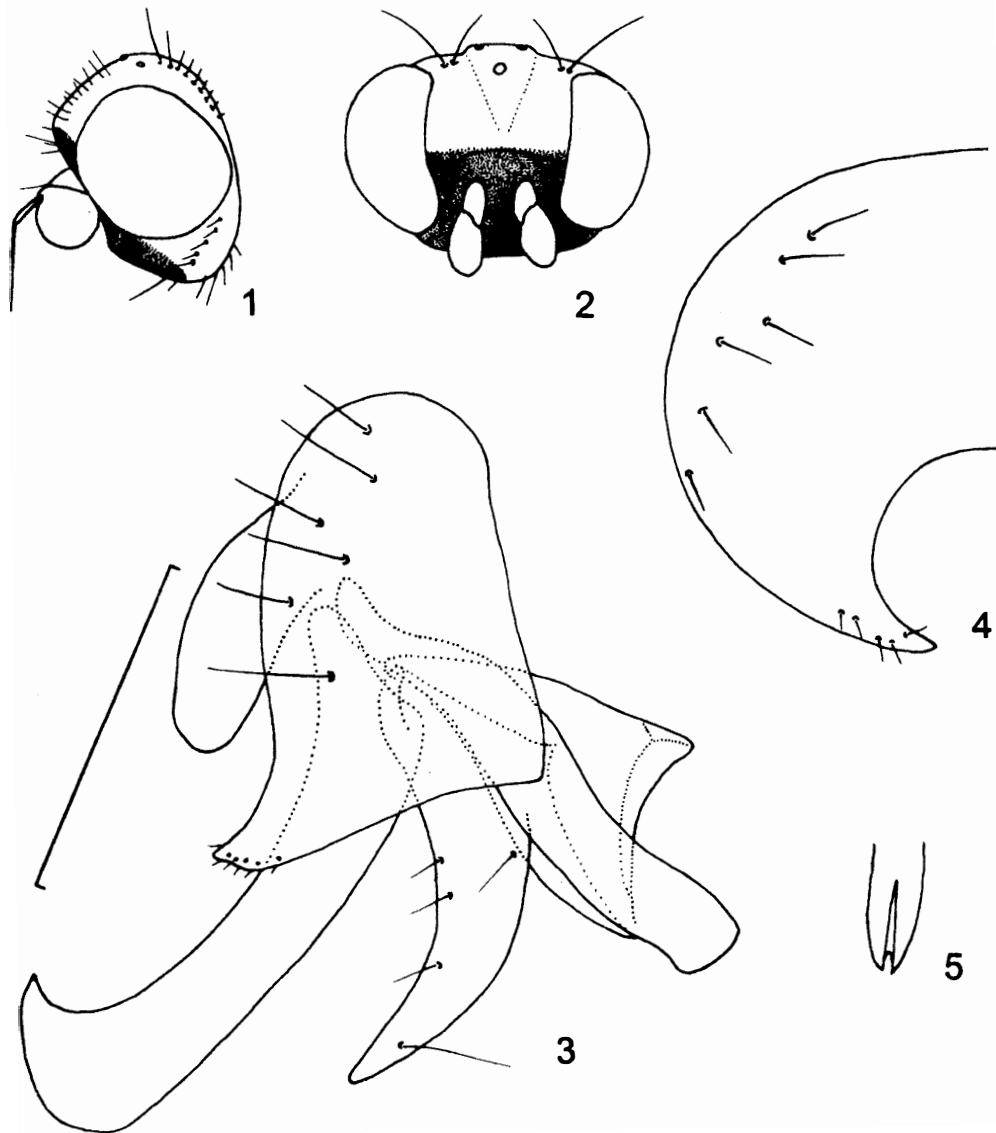
Near the type series in INHS is a tube with label “46568” (the same as type) and the second label “*Leucopis americana* Malloch, det. J.R. Malloch”. It contained 5 males and 14 females. I prepared all these males and discovered that they belong to *L. glyphinivora* Tanasijtshuk (Tanasijtshuk 1958, 1986). It is therefore probable that the type specimens also belong to this species, and *L. glyphinivora* should be accepted as a junior synonym of *L. americana*. But there is no distinct basis to prove or reject this thesis.

*Distribution.* Illinois. If this species is identical with *L. glyphinivora* – nearly cosmopolitan.

*Mode of life.* At least in part, larvae feed on aphids. If this species is identical with *L. glyphinivora*, its larvae feed on nearly one hundred species of aphids.

### *Leucopis atrifacies* Aldrich, 1925 (Figs 1–5)

Aldrich, 1925: 152.



**Figs 1-5.** *Leucopis atrifacies* Aldrich. 1, 2,-head; 3, male genitalia in profile; 4, epandrium from behind; 5, apex of aedeagus from below. Scale: 0.1 mm.

*Types.* Holotype, ♀, preserved in NMNH. Labels: "Type # 28212 USNM", "San Francisco Calif.", "E. Walther coll.", "In connection with *Thecodiplosis pini-radiatae*", "*Leucopis atrifacies* Ald". Paratypes: NMNH: 6 ♀ ("allotype", really paratype and 5 "paratypes") with the same labels; the California Academy of Sciences (CAS), 4 ♀, the same labels.

*Other material examined.* CAS: 3 ♂, 2 ♀, San Francisco Cal. I 27. 25, pres. by E. Walther coll. (on one ♂ pencil label "*Leucopis bella* O.S.?" and another label "*Leucopis atrifacies* Ald. Det. F.D. Bennett 1958"), and 1 ♀, the same label, but X 18. 1926. CNC: Washington

State: 12 ♂, 7 ♀, Goldendale Aug. 20 1959 em. Apr. 1960, pred. *Adelges piceae* (R.G. Mitchell); 1 ♂, 2 ♀, the same place and collector, "coll. 8 - 20 - 59". California: 1 ♂, San Francisco, Jan. 1928, on *Adelges* sp. on *Pinus* (E. Walther); 1 ♀ (?), Baldwin L. 6500', S.B. Co., 13 V 1955 (W.R.M. Mason); 1 ♀, Albany, Alameda Co 15 VI 1958, adult collected on Monterey pine (Fred D. Bennett); 1 ♀, the same label, but VII 1958; 3 ♂, 3 ♀, the same place and collector, *Pinus radiata*, VI 1958; 2 ♀, San Rafael Marin Co, 19 VI 1958, pred. on *Pinus* on Monterey pine (all specimens determined by F.D. Bennett as *L. atrifacies*). Mexico: 1 ♀, 3 mi E El Salto,

Dgo Mex. 8200', July 4, 1964 (J.F. McAlpine); 5 ♀, 10 mi W El Salto, Dgo., 9000' June 5 - 16 1964 (J.F. McAlpine); ZIN: 2 ♂, Albany, Calif. Alameda Co VI 1958 on *Pinus radiata* (Fred D. Bennett) (received from Dr. J.F. McAlpine in exchange). CSIRO: 1 ♂, 1 ♀, Golden Gate Pk S.F., California, Feeding on *Pineus* sp., bred June 1938 (F.J. Gay).

**Description.** *Male, female.* Body length 1.7-2.2 mm. Body grey. Head (Figs 1-2) of ♂ 1.5 times as high as long, of ♀ 1.3 (average). Anterior part of frons angular in profile. Frons barely widened anteriorly; in ♂, 2.1-2.2 times narrower than head, in ♀, 2.2-2.4 times. Orbital stripes light grey, widened anteriorly. Ocellar plate elongate triangular, slightly elevated. Frontal stripe also light grey. Frons with many thin white hairs, especially near lunule. Face, lunule and part of gena dark, nearly black. Lunule short, dorsal border curved slightly. OT index 1.6. Antenna black, 3rd aristomere 4-5 times longer than 2nd. Gena high, 2.4-2.6 times higher than eye height. Minute bristles on gena arranged in row; anterior bristle largest, often surrounded by small bristles. Palpi black. Mesonotum without stripes, covered, but not densely, by regular longitudinal rows of small bristles. Two pairs of dorsocentral bristles present. Femora black with yellow apices; tibiae black with yellow bases, although sometimes femora and tibiae entirely black; coloration of tarsi variable, e.g., entirely black, or first tarsomeres on middle and hind legs black and slightly yellow basally, or first tarsomeres yellow on all legs. On wings, veins *M* and *R*<sub>4+5</sub> slightly converge in distal 1/3 or are parallel. *tp* very short in comparison with distal section of *Cu*; ratio is 2.0-2.2. Abdominal syntergite 1+2 almost entirely brown; this coloration spreads to tergite 3 by two waves. Rather wide median longitudinal striae present on tergites 3-5 or 4-5. Dark fields of modified microtrichiae absent from lateral edges of first abdominal tergites in ♂.

Male genitalia (Figs 3-5). Epandrium massive, extending into very short, curved edites. Hypandrium nearly erect. Aedeagus long, widened apically, turned up. Gonopods absent, parameres large, smoothly tapered.

**Taxonomic notes.** In genital structure the species is close only to *L. piniperda* Malloch. Its determination by external appearance is simple; coloration of the head in combination with absence of stripes on the mesonotum are very characteristic. But it is necessary to consider the possibility of a mistake in comparison with dark-faced specimens of *L. piniperda*, from which *L. atrifacies* differs only in the structure of the male genitalia.

**Distribution.** USA (Washington, California), Mexico.

**Mode of life.** Larvae predators on *Adelges* spp. on *Pinus*.

### **Leucopis flavicornis** Aldrich, 1914 (Figs 6-8)

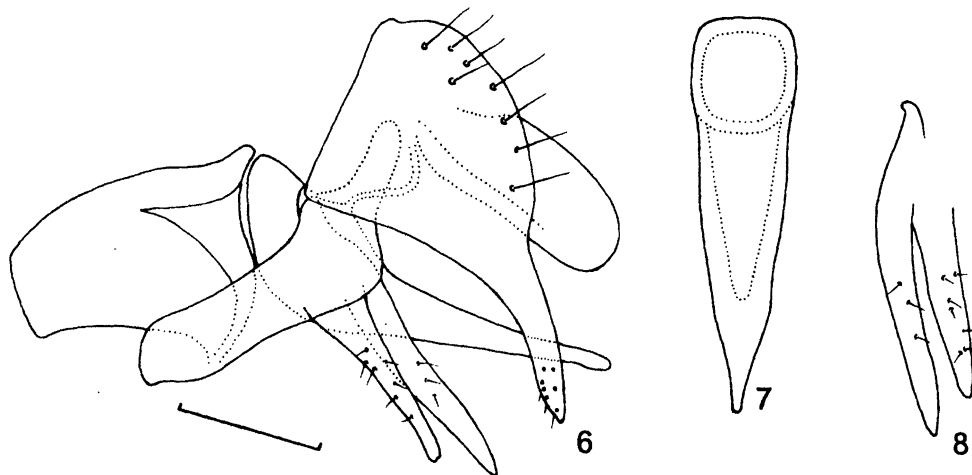
Aldrich, 1914: 404.

**Types preserved in NMNH.** Holotype, ♂. Labels: "Brownsville Tex. May 10, 1910"; "R.A. Vickery Collector"; "# 54"; red label "Type No 18428 U.S.N.M."; red label "Holotype *Leucopis flavicornis* Aldrich". Paratypes: 1 ♂, 5 ♀, the same place, time and collector. CNC: 1 ♀, the same place, time and collector.

**Description.** *Male, female.* Body length 2.0-2.6 mm. Body light grey. Head 1.7-2.0 times as high as long. Frons somewhat widening anteriorly; 2.6-2.7 times narrower than head. Frons usually monotone grey; however, may possess two dark grey stripes flowing around ocellar plate and reaching lunule. When frons monotone, ocellar plate barely outlined; in specimens with dark frontal stripes, appears oblong-triangular. Ocelli unevenly spaced from each other, OT index varying between 1.5 and 2.0. Scape and pedicel light brown, basoflagellomere and arista yellow; ratio between length of 3rd and 2nd arisal segments varied from 1.2:1 to 2.5:1. Lunule high, dorsal edge semi-rounded. Gena height 4.5-5.0 times less than eye height. Several bristles forming irregular row present on each gena; anterior bristles largest. Palpi dark brown. Grey medial stripes slightly darker than light grey background present on mesonotum together with wide lateral stripes of similarly light coloration extending beyond middle of mesonotum. Areas between medial stripes devoid of bristles; area between medial and lateral stripes with small bristles only extending to anterior 1/3. Two pairs of dorsocentral bristles present. Femora black, apices yellow; tibiae yellow, middle of anterior tibia darkened; tarsi yellow, except apical tarsomeres darkened. On wings, veins *M* and *R*<sub>4+5</sub> parallel or somewhat converging near apices. *tp* 1.1-1.3 times shorter than distal portion of *Cu*. Abdominal syntergite 1+2 darkened anteriorly; two small black or goldish spots sometimes evident on tergite 3, similar to small medial spots on tergites 3-5. Thecae of minute bristles on abdominal tergites encircled by small but noticeable black spots. Dark fields of modified microtrichiae on lateral edges of first abdominal tergites of males not evident.

Male genitalia (Figs 6-8). Epandrium medium-sized, with 8-12 pairs of large bristles; after notable constriction, extends into medium-sized, rather thin edites. Hypandrium widened in anterior part, slightly curved. Aedeagus widened in basal part, smoothly tapering toward thin, slightly rounded apex.

**Taxonomic notes.** *L. flavicornis* can be determined easily by the yellow colour of the basoflagellomere. This character is unique among



Figs 6-8. *Leucopis flavicornis* Aldrich. 6, male genitalia in profile; 7, aedeagus from below; 8, gonopods and parameres from above. Scale: 0.1 mm.

studied Nearctic species of *Leucopis*. On the contrary, structure of genitalia is not characteristic and determination only on this character can be unreliable.

*Distribution.* This species is known only from Texas.

*Mode of life* unknown.

***Leucopis maculata* Thompson, 1910**  
(Figs 9-13)

Thompson, 1910: 238.

*Types preserved in NMNH.* Holotype, ♀, "Calvert Neb. 10/15/09/", "♀, Type # 13141". Paratypes: 1 ♀, the same label; 1 ♂, the same label, plus additional label "Bred from *Eriopeltis coloradensis*". (In the description, Thompson wrote that type series was 3 ♂ and 1 ♀).

*Other material examined.* CNC: Canada: Alberta: 2 ♂, Scandia, 9 VII 1956 (O. Peck). Manitoba: 1 ♀, Winnipeg Sept. 1927, em. 13.IX 1927, ex grass scale (A. V. Mitchener, C.H. Curran); 4 ♂, 5 ♀, Wpg. 18.X 27, grass coccid (probably A.V. Mitchener); 4 ♂, 2 ♀, Wpg. Feb. 29, 1928 (A.V. Mitchener). NMNH: Indiana: 5 ♂, 1 ♀, La Fayette, VI-9-15 (J.M. Aldrich).

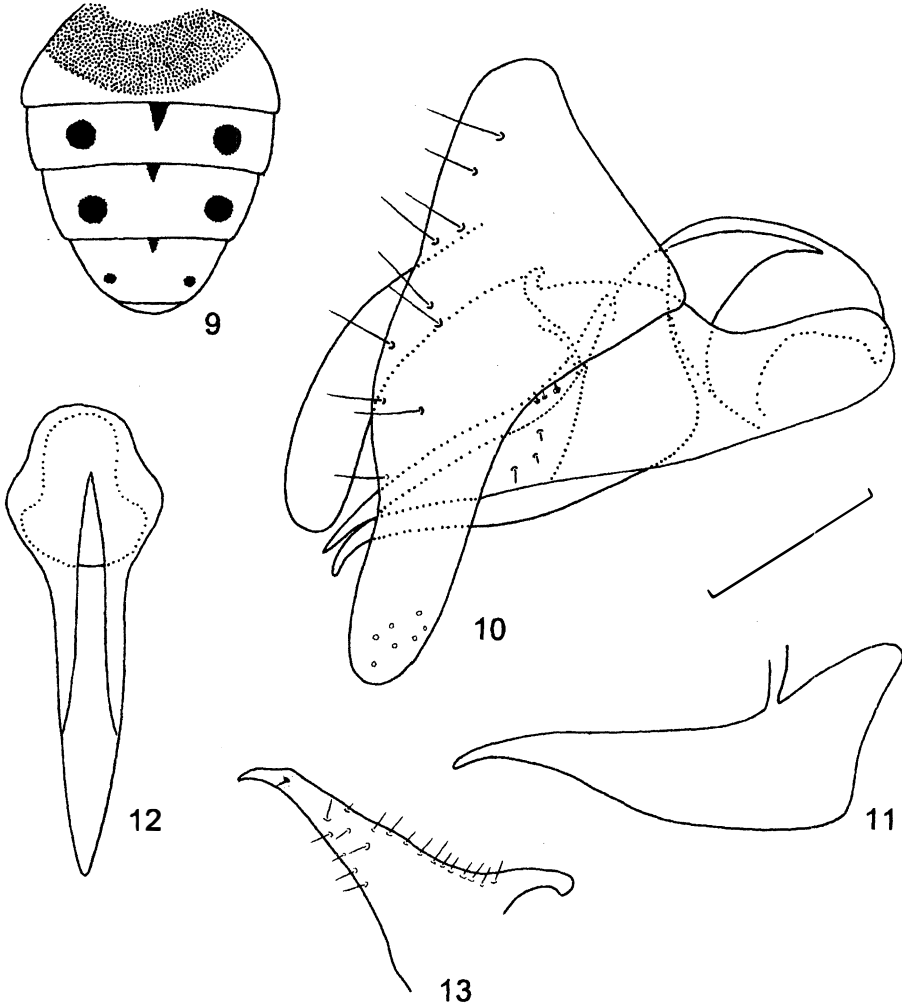
*Description. Male, female.* Body length 2.2-2.8 mm. Body light grey. Head 1.6 times as high as long. Frons somewhat dilated anteriorly; averaging 2.6 times narrower than head. Orbital stripes light grey. Ocellar plate outlined only by light grey coloration, proceeded towards lunule as narrow triangle. Frontal stripe grey, darker coloured. Frons densely covered with colourless hairs. OT index near 1.5. Antenna and arista black, 3rd aristomere 5 times as long as 2nd. Gena height 3.1-4.0 times less than eye height. Bristles on gena variable in number, arranged in 1-3 irregular rows; anterior bristle notably larger than

others. Palpi black. Lateral stripes of mesonotum inconspicuous or hardly conspicuous, medial stripes faintly noticeable only near anterior edge. Mesonotal surface evenly covered by minute bristles, areas between stripes not outlined. Two pairs of dorsocentral bristles. Femora black with yellow apices; tibiae and tarsi yellow. On wings, veins *M* and *R*<sub>4+5</sub> parallel; *tp* 1.1-1.4 times shorter than distal portion of *Cu*. On abdomen (Fig. 9), syntergite 1+2 almost entirely brown; rounded paired spots present on tergites 3-5; sometimes similarly large on tergites 3-4, minute on tergite 5, but usually evenly diminishing posteriorly. On tergites 3-5, black triangular spots also present medially. Lacking dark fields of modified microtrichiae on edges of first abdominal tergites in males.

Male genitalia (Figs 10-13). Epandrium bearing 10 pairs of bristles on posterior side, passing smoothly into distally rounded edites. Hypandrium short, massive, passing from beneath into parameres closely fused with it; gonopods completely reduced. Aedeagus slightly bent, smoothly tapering toward apex.

*Taxonomic notes.* The species is easily distinguishable in external appearance by the presence of paired spots on tergites 3-5, with almost complete absence of lateral stripes of mesonotum. Genitalic structure of *L. maculata* is uncommon for *Leucopis*; gonopods completely reduced.

*L. maculata* has an almost completely analogous counterpart in the Palaearctic represented by *L. szepligetii* Aczel, 1937, so far reported from the region from Hungary to Mongolia (Tanasijtshuk, 1986). It is distinguished from *L. maculata* in the presence of lateral stripes of mesonotum



**Figs 9-13.** *Leucopis maculata* Thompson. 9, abdomen; 10, male genitalia in profile; 11, aedeagus in profile; 12, aedeagus from below; 13, paramere from below. Scale: 0.1 mm.

(though highly varying in intensity of coloration), narrower gena, and in differences in genitalic structure – particularly, narrower surstyliar lobes and aedeagus. However, presence of paired spots on abdominal tergites 3-5 and similarity between basic genitalic characters (massive, rounded surstyliar lobes, general shape of aedeagus, absence of gonopods) are indicative of a close relationship between these species. The relationship between these species may also be judged by the fact that their larvae prey on scales from cereals, particularly on species of *Eriopeltis*. Evidently, these species have originated relatively recently from a common ancestor, and separated due to geographical isolation.

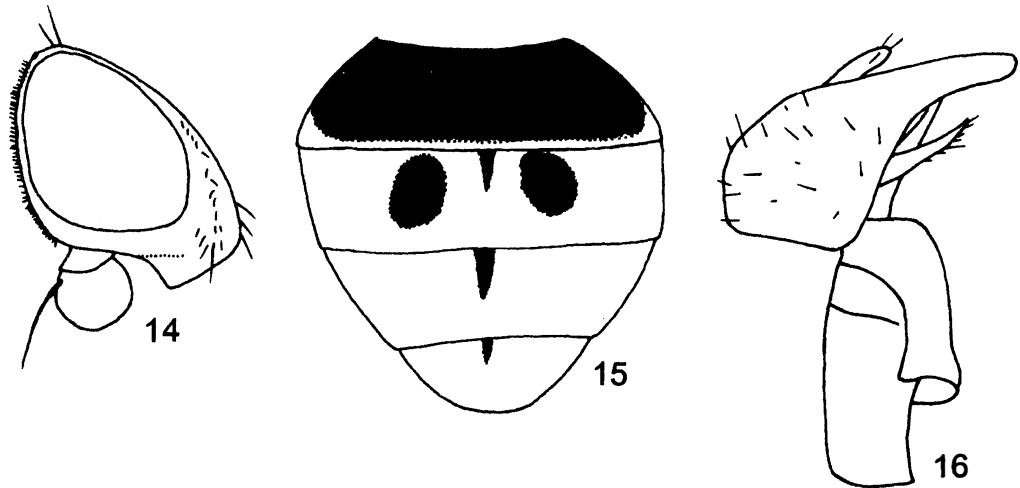
**Distribution.** Canada (Alberta, Manitoba), USA (Nebraska, Indiana).

**Mode of life.** Larvae are predators on *Eriopeltis* scales.

***Leucopis major* Malloch, 1921**  
(Figs 14-16)

Malloch, 1921: 352.

**Types preserved in INHS.** Holotype, ♀. Labels: "St. Joseph, Ill. May 3, '14"; "Salt Fork"; "*Leucopis major* Mall. Type" (in pencil); "Type *Leucopis major* Malloch ♀" (red label); "NHS Type # 124" Paratypes: 3 ♀, the same label. One paratype is greased, one without head. Allotype mentioned by Malloch absent. Probably it served for preparation of genitalia.



Figs 14-16. *Leucopis major* Malloch. 14, head; 15, abdomen; 16, male genitalia (after Malloch).

**Description. Female.** Body length 2.4-2.6 mm. Body light grey. Head (Fig. 14) 1.4-1.6 times as high as long. Frons distinctly widened anteriorly, 2.2-2.6 times narrower than head. Head smoothly rounded in profile. Frons with many light, relatively long hairs, perpendicular to frons. Orbital stripes light grey, slightly widened anteriorly. Frontal stripe identically light when viewed from front, but far darker when viewed from above. Ocellar plate not raised, distinguished only by light coloration. Anterior ocellus same size as posterior ones. OT index 1.4-1.6. Lunule arch-shaped; dorsal part with same hairs as frons, proclinate. Antenna black, arista dark brown; 3rd aristomere 4.0-4.5 times as long as 2nd. Gena height 3.3-3.4 times less than eye height. Minute bristles arranged in one regular row on gena; some anterior bristles forming tight cluster, with one larger bristle. Palpi black. Lateral stripes of mesonotum goldish brown, relatively narrow, extending to posterior pair of *dc*. Grey medial stripes rather pale, extending to middle of mesonotum; areas between stripes usually devoid of bristles on anterior 1/4 of mesonotum. Three pairs of dorsocentral bristles present. Femora black; tibiae black with yellow apices, frequently yellow on inner surface; tarsi yellow, two apical tarsomeres darkened. On wings, veins *M* and *R*<sub>4+5</sub> converge in distal 1/2; *tp* 1.3-1.65 times less than distal section of *Cu*. On abdomen (Fig. 15), syntergite 1+2 almost entirely dark (goldish when viewed from above and black from behind). Slightly oblique paired spots on tergite 3 coloured identically. Pale median longitudinal stria present on tergite 3; bright median striae present on tergites 4 and 5.

**Taxonomic notes.** Malloch (op. cit.) wrote "type female, allotype, and four female paratypes", and presented the sketchy drawing of male genitalia (Fig. 16). According to this drawing, *L. major* has a rather massive epandrium, moderately wide edites, a curved hypandrium, a large aedeagal apodeme, and a rather small aedeagus. But this drawing is inexact; the preparation used for this drawing was not found in the INHS collection. Besides, the most expressive characters for the species are the light frons with thin hairs, relatively wide gena and three pairs of *dc* (rather uncommon character; Malloch even wrote about "three and sometimes four dorso-centrals"). Unfortunately, among Nearctic *Leucopis* seen by me, I have not found more specimens with such a combination of characters and could not make preparations of male genitalia.

**Distribution.** Illinois.

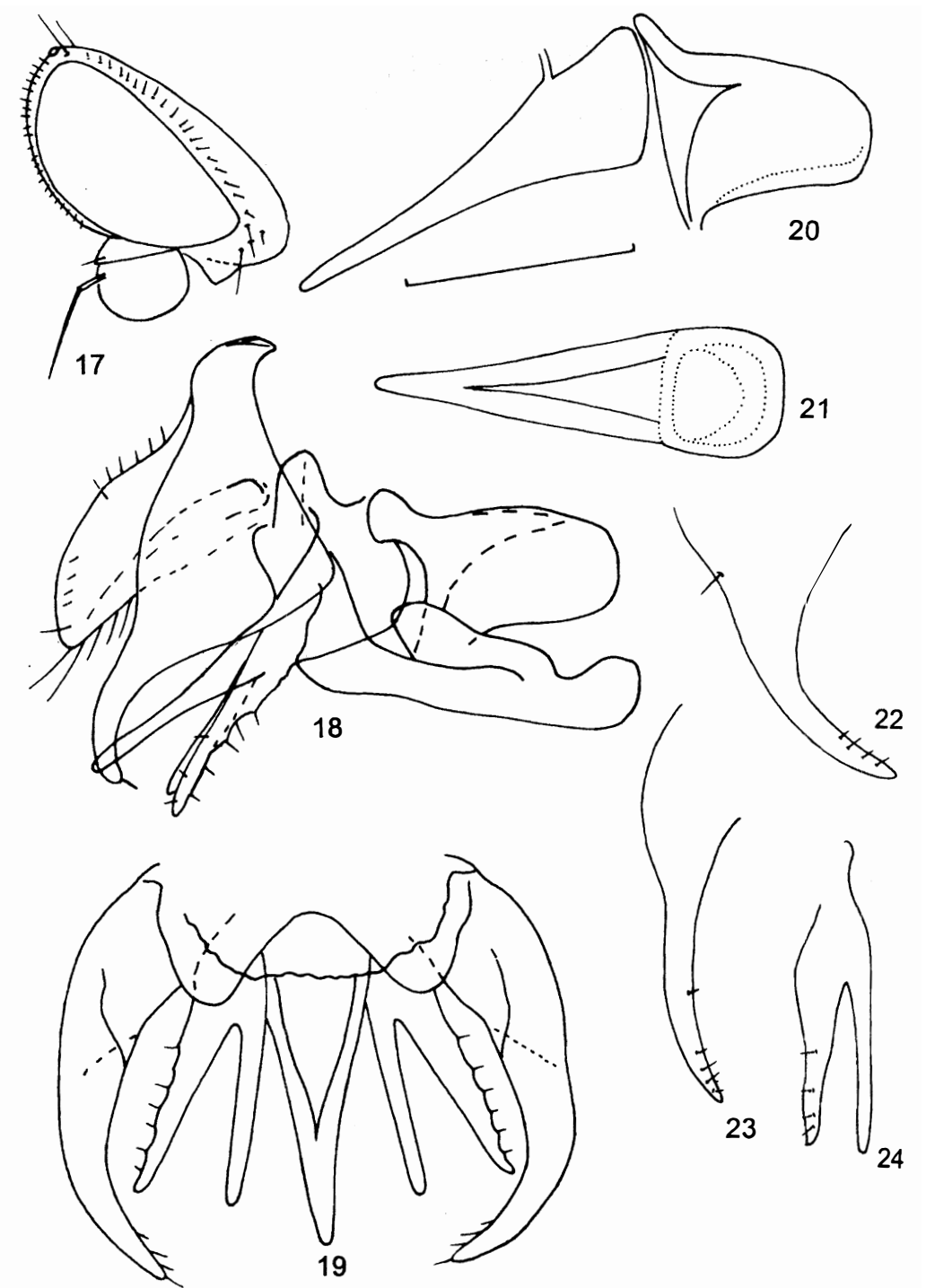
**Mode of life** unknown.

#### ***Leucopis minor* Malloch, 1921** (Figs 17-24)

Malloch, 1921: 354, 1940: 274.

**Holotype**, ♂, preserved in INHS. Labels: "Du Bois, Ill. Aug. 9, '17"; "*Leucopis minor* Mall. Type" (in pencil); "Type *Leucopis minor* Malloch ♂" (red); "INHS Type # 0125".

**Description. Male.** Body length 1.5 mm. Entire body greased, its colour, according to Malloch, lead-grey. Head (Fig. 17) 1.8 times as high as long. Frons not widened anteriorly, 3 times narrower than head. Orbital and frontal stripes equally dark. Short thin bristles present on frons and dorsal part of lunule. Ocellar plate cardiform,



Figs 17-24. *Leucopis minor* Malloch. 17, head; 18, 19, male genitalia in profile and from below (after McAlpine); 20, aedeagus and apodeme in profile; 21, aedeagus from below; 22, surstylar lobes in profile; 23, surstylar lobes from behind; 24, gonopods and parameres from below. Scale: 0.1 mm.



slightly lifted around anterior ocellus. OT index 1.8. Ocelli equal in size. Lunule arc-shaped. Antenna black; 3rd aristomere 6 times as long as 2nd. Gena height 5.2 times less than eye height. Minute bristles present on gena, irregularly arranged, one largest. Palpi black. Neither lateral nor medial stripes visible on greased mesonotum; Malloch did not discuss this character in his description; McAlpine, who saw the type specimen before preparation of genitalia, wrote (in litt.) that "mesonotum without dorsocentral stripes". Two pairs of dorsocentral bristles present. Femora black with yellow apices; tibiae black with yellow bases; fore tarsi entirely black, first 1-2 tarsomeres yellow on middle and hind tarsi. Wings crumpled, veins not discernible. According to Malloch, this species has "the spots on second tergite small and widely separated, the posterior margin of first tergite gray pubescent" (actually the reference points are syntergite 1+2 and tergite 3).

Male genitalia. I received from Dr. J.F. McAlpine sketchy drawings of the genitalia of the type specimen, made by him in 1968 (Figs 18-19). According to these, cerci rather large, hypandrium shape common to many *Leucopis* – curved in posterior 1/3. Preparate of genitalia overcleared, now hardly perceptible. Dorsal part of epandrium, cerci, and hypandrium dissolved almost entirely and lost their shape; only aedeagus with apodeme (Figs 20, 21), surstylar lobes (Figs 22, 23), gonopods and parameres (Fig. 24) were well preserved. Surstylar lobes thin in profile and from rear. Gonopods and parameres of equal length. Aedeagus thin, slightly expanded in basal part.

*Taxonomic notes.* Determination of this species by damaged type specimen, with short description of Malloch and partly destroyed genitalia is very unreliable. Among materials from Canada and USA are several species with similar genitalia, but they have lateral and medial stripes on the mesonotum.

*Distribution.* Illinois.

*Mode of life* unknown.

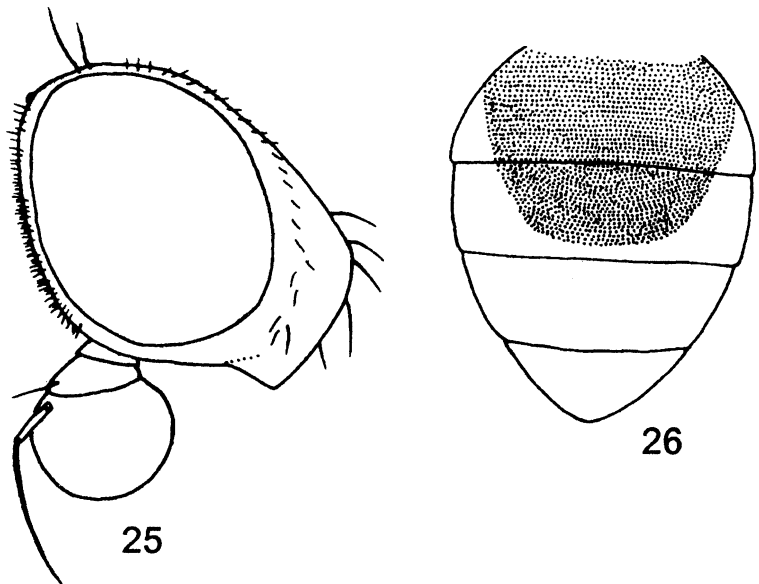
### ***Leucopis parallela* Malloch, 1921**

(Figs 25, 26)

Malloch, 1921: 353.

*Holotype*, ♀, preserved in INHS. Labels: "Muncie, Ill. Jul 5, '14"; "Stony Cr."; "*Leucopis parallela* Malloch, type" (in pencil); "Type *Leucopis parallela* Malloch, ♀" (red); "INHS Type # 0128".

*Description. Female.* Body 1.75 mm long, lead grey. Head (Fig. 25) 1.4 times as high as long. Frons slightly widened anteriorly, 3 times narrower than head. Orbital stripes light grey on exterior borders along eye margin; dark grey nearer to middle of frons, where their colour merges with frontal stripe. Both orbital and (to lesser extent) frontal stripes covered by perpendicular dark thin bristles or hairs. Ocellar plate not elevated, only slightly lighter than frontal stripe. OT index 1.5. Lunule wide, arc-shaped; with thin bristles or hairs. Antenna and arista black, 3rd aristomere 3.6 times as long as 2nd. Diameter of basoflagellomere rather large, 2.1 times less than eye height. Gena height 3.6 times less than eye height. Minute bristles, arranged in regular row, present on gena; anterior bristle slightly longer than pres-



Figs 25-26. *Leucopis parallela* Malloch. 25, head; 26, abdomen.

ceding ones. Palpi black. Mesonotum without stripes, covered by rather sparse rows of bristles. Two pairs of dorsocentral bristles present. Femora black, apices slightly yellowish; tibiae also slightly yellowish at apices; first tarsomeres yellow, distal ones dark. On wings, veins *M* and *R*<sub>4+5</sub> parallel, *tp* 1.5 times less than distal section of *Cu*. Large gold-brownish spot present on abdominal tergites 1+2 and 3 (Fig. 26).

**Taxonomic notes.** The species is very close to *L. simplex* Loew; the sole distinction in appearance is the greater size of the basoflagellomere.

**Distribution.** Illinois.

**Mode of life** unknown.

### *Leucopis pemphigae* Malloch, 1921 (Figs 27, 28)

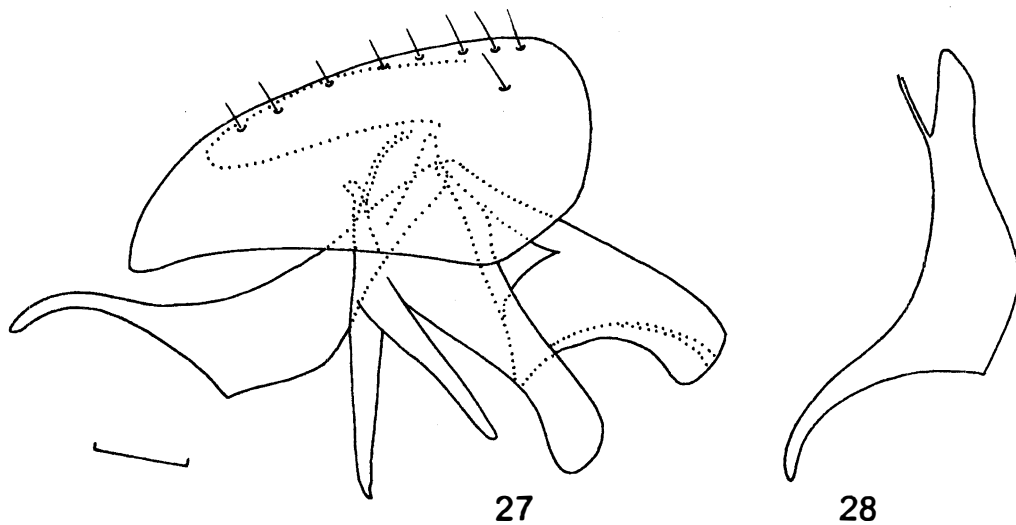
Malloch, 1921: 350.

**Types preserved in INHS.** Holotype, ♂. Labels: "Carbondale, Ill. July 6, 1909"; "42313"; "J.R. Malloch det., 1913"; "*Leucopis pemphigae* Mall. Type" (in pencil); "Type *Leucopis pemphigae* Malloch ♂" (red); "INHS Type # 0130". Allotype, ♀, the same labels, INHS Type # 129. Paratypes: 3 ♀, the same labels, 2 specimens # 42344 and 1 specimen # 42313. First two paratypes in poor condition, one lacking head and partly destroyed, the second with greased head. One paratype, ♀, kept in CNC. Labels: "J.R. Malloch det., 1913"; "Paratype *Leucopis pemphigae* ♀ Mal. # 2729"; (yellow); "Paratype *Leucopis pemphigae* Malloch ♀" (blue).

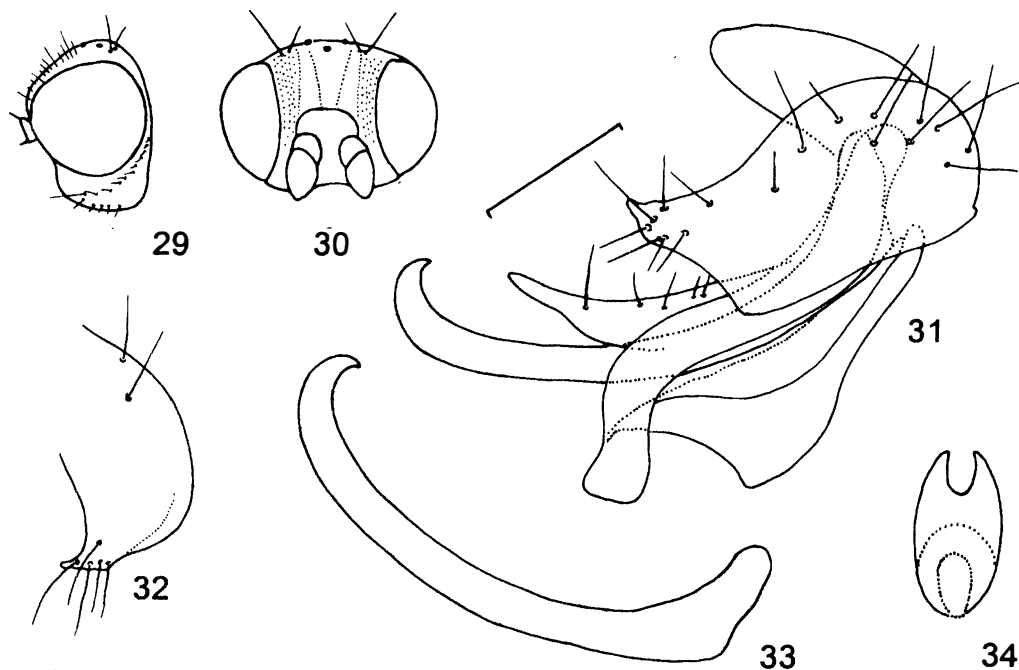
**Other material examined.** CNC: Canada: Alberta: 2 ♂, 2 ♀, Lethbridge, July 1955, poplar aphid gall (A.M. Harper). Ontario: 5 ♂, 4 ♀, Belleville, June 26 – Aug. 15 1962, ex *Pemphigus populicaulis* gall, *Populus deltoides* (N.H. Anderson); 4 ♀, Point Anne Hastings Co., June 29, 1962, ex *Pemphigus populicaulis* gall on *Populus*

*deltoides* (H.E. Bisdee); 3 ♂, Carrying Place Prince Eduard Co. Aug. 2 and 4, 1961 ex *Pemphigus* galls (N.H. Anderson); 1 ♂, the same place, June 12, 1962, ex *Pemphigus* galls (H.E. Bisdee); 1 ♀, Sultan, 7 III 68, *Populus balsamifera* (?). Quebec: 1 ♂, 1 ♀, Macdonald Coll p., Jul 1973, *Pemphigus* gall on poplar (E.H. Alleyne). USA: Montana: 1 ♂, 1 ♀, 2 mi. W Big Fork, VII 21.1967 (B.A. Foote). Ohio: 1 ♂, 1 ♀, 12 mi NE Alliance, VI. 18. 1970 (T.P. Sluss). Arizona: 2 ♀, Southw. Res. Sta., Cochise County VIII – 16-1969 (B.A. Foote). NMNH: USA: D.C.: 1 ♂, 1 ♀, Columbia Fed., par. on *Pemph. sp. transversalis*, ex Feb. 26/79 (E.A. Safverry). Indiana: 1 ♀, La Fayette, IV 26 (J.M. Aldrich). Louisiana: 3 ♂, Pt Allen, Sept. 15 – 15 (T.H. Jones); 1 ♂, Baton Rouge, May 13. 16, issued May 14 – 16, bred with *Pemphigus populitraversus* (T.H. Jones); 2 ♀, the same place, Apr. 11 – 18, issued Apr. 28 – 18, bred with *P. populicaulis* (T.H. Jones); 1 ♂, "Feeding on 54. gall on Elm-leaf".

**Description.** *Male, female.* Body length 2.0-2.7 mm. Body light grey. Head 1.5-1.6 times as high as long. Frons somewhat widening anteriorly; 2.8-3.0 times narrower than head. Orbital stripes light grey, frontal stripe varying in coloration between light grey and grey or dark grey with longitudinal clarification medially. Ocellar plate oblong-triangular, not raised, often faintly outlined. OT index around 1.2-1.3. Pedicel yellow, basoflagellomere black. 3rd aristal segment 4.5-5.5 times as long as 2nd. Several bristles on each gena, commonly arranged in row, anterior bristle much larger than others. Palpi black. Lateral stripes grey, sometimes with brownish hue, commonly faintly notable. Medial stripes grey, sharper outlined; areas between stripes devoid of bristles to middle of mesonotum. 3-4 pairs of *dc*, size sharply diminishing anteriorly. Femora yellow, occasionally darkened in middle; tibiae and tarsi entirely yellow. On wings, veins *M* and



Figs 27-28. *Leucopis pemphigae* Malloch. 27, male genitalia in profile; 28, aedeagus. Scale: 0.1 mm.



**Figs 29-34.** *Leucopis piniperda* Malloch. 29, 30, head; 31, male genitalia in profile; 32, surstylar lobes from behind; 33, aedeagus in profile; 34, apex of aedeagus from behind. Scale: 0.1 mm.

$R_{4+5}$  converging slightly in distal half; on average,  $tp$  equal to distal portion of  $Cu$ . On abdomen, syntergite 1+2 almost entirely dark brown or black; paired rounded, dark (sometimes bright) spots present on tergite 3; dark medial longitudinal striae occasionally noticeable on tergites 3-4. Lacking dark fields of modified microtrichiae on lower edges of first tergites.

Male genitalia (Figs 27-28). Epandrium wide, passing into wide surstylar lobes without constriction; 8-10 pairs of bristles present on posterior surface. Hypandrium almost straight in profile. Aedeagus smoothly swelling from base towards middle and sharply, with angular twist, tapering toward apex.

**Taxonomic notes.** The species is clearly distinguished from other species of *Leucopis* by the yellow pedicel, grey lateral stripes, 3-4 pairs of  $dc$ , and nearly entirely yellow legs. Form of genitalia is so characteristic, that it is often possible to determine males by the peculiar form of the aedeagus without dissection.

**Distribution:** Canada (Alberta, Ontario, Quebec), USA (Arizona, Montana, D.C., Indiana, Louisiana).

**Mode of life.** Larvae preying in galls of *Pemphigus* on *Populus*.

### ***Leucopis piniperda* Malloch, 1921** (Figs 29-34)

Malloch, 1921:351.

**Types preserved in INHS.** Holotype, ♂. Labels: "Urbana, Ill. Apr. 29 '16"; "Forestry"; "*Leucopis piniperda* Mall. type" (in pencil); red type label; "INHS Type # 131". Mesonotum of holotype greased. Genitalia of holotype were prepared (probably by J.F. McAlpine). Allotype - "Urbana, Ill. Jul 5 '15"; "on tree". Allotype entirely greased. Paratype, ♂, mentioned by Malloch, absent.

**Other material examined.** CNC: Canada: British Columbia: 1 ♂, Victoria, em. Aug. 19/59, host: *Adelges picea* (J.W.E. Harris); 1 ♀, the same place and collector, larva coll. 8/8/64, pup. 8/18/64, em. 8/31/64, *Adelges piceae*; 1 ♀, the same place and collector, 26 IV 65, *Pinus contorta*; 1 ♂, 8 ♀, the same place and collector, Aug. 14 1967, *Abies grandis*; 1 ♂, (fly absent, preparation of genitalia present), the same place, Aug. 14 1967, *Abies grandis* (?); 1 ♀, Thetis Lk, the same collector, 20 Aug. 59, on bark of *Abies grandis* inf. by *Adelges piceae*; 2 ♂, 1 ♀, the same place and collector, on Fir, em. Apr. 25 - 26, 1960; 1 ♀, the same place and collector, 8 June; 1 ♂, Saanich, Thetis Lake Park, on *Abies grandis* infested with *Adelges piceae*, rear. 17 June 65 (B.J. Crawford); 1 ♀, Anarchist Mt, Osoyoos, 20 V 1959 (R.E. Leech); 1 ♂, Clinton, *Pinus contorta*, 9.7.73 (without name of collector); 1 ♂, Francis Pk, Apr. 29 1969, *Abies grandis* (D. Evans); 1 ♀, Summit L. m. 392 Alaska Hwy, 4200', 19 - 21 VIII 59 (E.E. MacDougall). Alberta: 2 ♂, 6 ♀, 2 mi S, 7 mi W Gironville

Peace R., June 6, 1963, reared ex *Adelges* on *Picea glauca* (E. Goutreau); 1 ♀, Seebe (?), 11.1.71, around *P. contorta* (L.S. Skaley); 1 ♀, Elkwater L. 20 VIII 56 (O. Peck). Ontario: 1 ♂, 4 ♀, Ottawa, 4.VII 1963, larvae in galls of *Pineus similis* on *Picea glauca*, adult em. July 12/63 (J.R. Vockeroth); 4 ♂, 9 ♀, 17 VIII 1963, the same label; 1 ♂, 2 ♀, 22 VII 1963 and 3 ♀, 23 VII 1963, the same place and collector; 1 ♀, the same place, coll. 3 VII, em. 15 VIII, *Picea glauca*, *Pineus similis* (A.W. Steffen). Quebec: 1 ♀, Bertierville, 7-6-1950, *Taniva albolineana* (L. Daviault); 1 ♂, Laniel, 7 VI 1943 (O. Peck). New Brunswick: 1 ♂, F'ton, May 11, 1959, Host – *Pineus strobi* (N.R. Brown). USA: Washington: 1 ♂, 2 ♀, Centralia, Aug. 5 1959 (F.N.E. Jonson). Oregon: 2 ♂, 3 ♀, Corvallis, IV 27 61, predator on *Pineus* sp. (R.G. Mitchell). Washington, D.C.: 3 ♀, Arlington, 17 June 1981, ex *Pineus strobi* on *Pinus strobus* (?). North Carolina: 1 ♂, 7 ♀, Highlands, 3800', 4 VI and 24–25 VI 57 (J.R. Vockeroth). California: 2 ♂, 3 ♀, Pioneer Basin Fresno Co. X-23-59, *Pinus* sp. (E.I. Schlinger). NMNH: Oregon: 1 ♂, 2 ♀, Corvallis, reared V-11 and V-14-58, predators on *Chermes piceae* (R.G. Mitchell). Idaho: 1 ♂, Granite Creek, Idaho City, 17 August 1969, Ponderosa pine, lab. reared (E. Nebekew) (note: specimen with dark face, very similar to *L. atrifacies*). Maryland: 2 ♂, 5 ♀, College Pk, VI-7-33, ex *Chermes* on pine (W.L. Rice). California: 1 ♂, Lassen N.P. 4.16.33, *Pinus contorta* (K.A. Salmon). Arizona: 5 ♂, 15 ♀, Ft Valley Exp. Stn., Lots I – VII and Lot 9, dated from February to July of 1928 and from March to July of 1929 (collector ?).

**Description. Male, female.** Body length 1.5 – 2.5 mm. Body light grey. Head of ♂ (Figs 29-30) 1.4-1.5 times as high as long; ♀ 1.3 times. Anterior frons convex, appearing angular in specimens with shrunken heads. Frons barely widened anteriorly; 2.4-2.6 times narrower than head in ♂, 2.2-2.35 times in ♀. Orbital stripes nearly white; ocellar plate triangular; frontal stripe usually not different in coloration from orbits, and entire frons may look unicolourous white. Frons with sparse erect white hairs. Lunule not high, dorsal border nearly straight. OT index 1.6-2.2. Antenna black, 3rd aristomere 3.5-4.5 times as long as 2nd but some specimens with deformed, shortened arista. Gena height 2.7-3.2 times less than eye height; gena with several small bristles, anterior bristle much larger. Palpi black. Mesonotum lacking stripes; covered sparsely with small bristles arranged in nearly regular rows. 2 pairs, or rarely 3, of *dc* present. Femora black with yellow apices; tibiae usually yellow with darkening in the middle, or black with yellow bases and apices; specimens with light tibia also with light yellow tarsi, only 5th tarsomere darkened; specimens with darker tibia with only first 1 or 2 tarsomeres yellow. On wings, vein *M* parallel with *R*<sub>4+5</sub> or converging slightly; *tp* 2.0-2.4 times less than distal section of *Cu*. Coloration of abdomen varied; most commonly, syntergite 1+2 greyish brown with golden hue, extending onto tergite 3 by two rounded waves. Faint median longitudinal striae can be present on tergites 3-5, but sometimes absent. Lacking dark fields of modified microtrichia on

lateral edges of first abdominal tergites in ♂.

Male genitalia (Figs 31-34). Epandrium short, with very short surstylar lobes. Hypandrium slightly S-shape curved, uniformly wide through length. Aedeagus extremely long, curved, slightly thickened at base. Aedeagal apodeme very long dorsoventrally.

**Taxonomic notes.** This species is closely related to *L. atrifacies*, according to the structure of the genitalia, absence of stripes on the mesonotum, and mode of life. Identification is simple by the shape of the aedeagus, which can often be recognised without dissection. But identification by external appearance is more questionable. The light colour of the face is not always constant; in some specimens, mostly from British Columbia, the face is more or less darkened, appearing like in *L. atrifacies* almost entirely, but with retention of characters of *L. piniperda* genitalia. Some of these were determined by J.F. McAlpine as "n. sp. #15".

**Distribution.** Canada (British Columbia, Alberta, Ontario, Quebec, New Brunswick), USA (Washington, Oregon, Illinois, Idaho, Maryland, D.C., North Carolina, California, Arizona). Probably through all area of *Adelges* and *Pineus*.

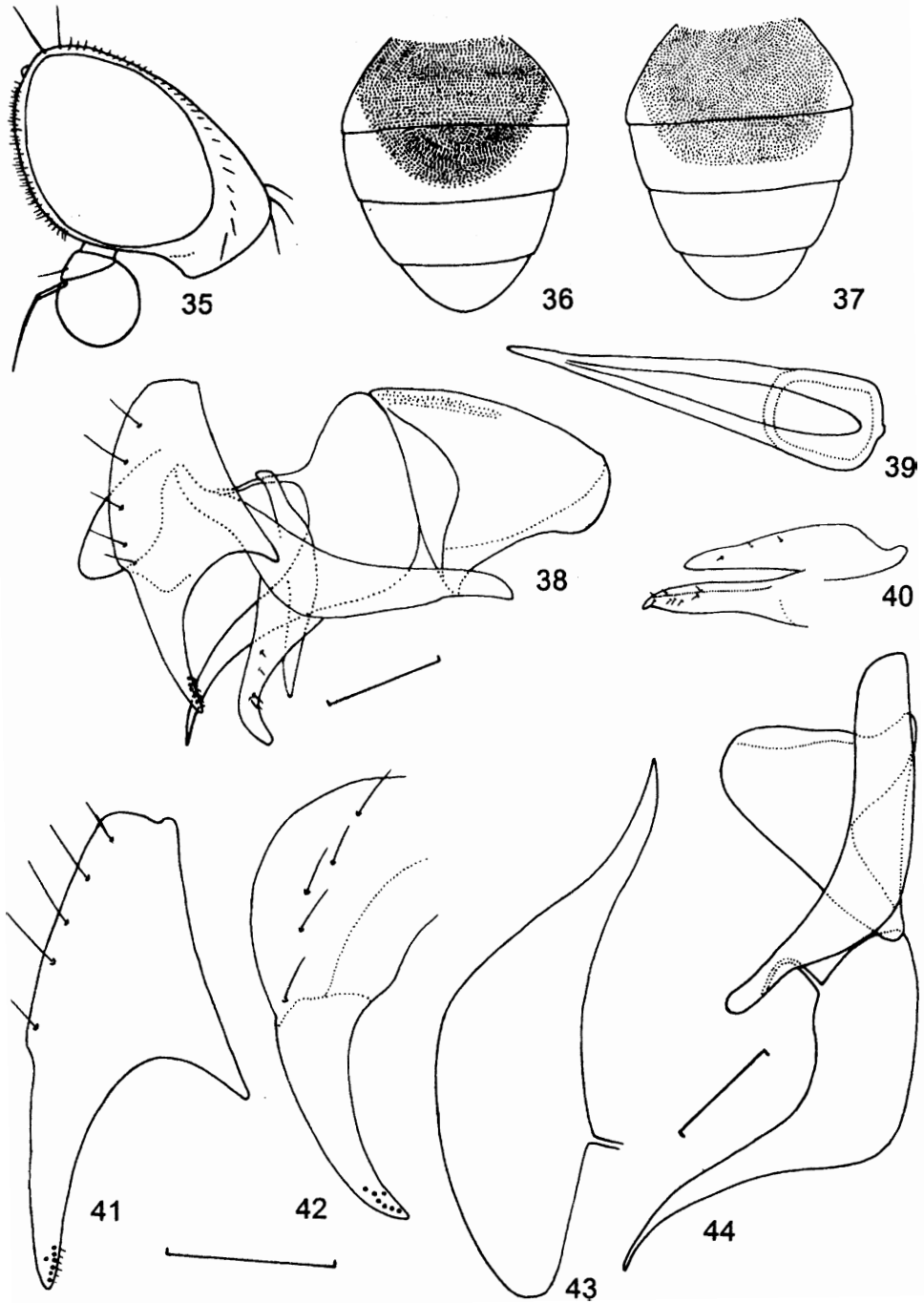
**Mode of life.** Larvae are predators on *Adelges* and *Pineus* species.

### **Leucopis simplex** Loew, 1869 (Figs 35-44)

Loew, 1869: 51; Coquillett, 1898: 76; Thompson, 1910: 238; Malloch, 1921: 350; 1940: 274; McAlpine, 1965: 709; Stevenson, 1967: 815; McAlpine, 1987: 970. - *phylloxerae* Riley, 1883: 39.

**Type preserved in MCZ.** Lectotype (designated here for stability of nomenclature), ♂ (?). Labels: "350"; "Loew coll."; "simplex m."; "type 13455". Loew added in his description: "New York; Osten-Sacken".

**Other material examined.** MCZ: 2 on one pin (and remains of third). Labels: "350. *Leucopis simplex* Lw"; "Osten-Sacken coll."; "Parasite of a gall on the grape, Walsh, Schimer". Loew did not mention these specimens in his description; for this reason they are not considered paralectotypes. 3 ♂, 6 ♀, "418-010 2 Aug. 91"; 1 ♂, 1 ♀, "418-0 Aug. 16. 83"; 1 ♂, 3 ♀, "418-0 Aug. 19. 83."; 1 ♀, "418-0 Feb. 9. 84" (on one specimen, label: "probably sampled by A.K. Carothers in Texas"). CNC: 1 ♀, labels: "350. *Leucopis Leucopis simplex* Lw ♀"; "Parasite of gall on w. grape, Walsh and Schimer"; "Osten Sacken coll."; "350": "This one of three specimens on a single pin in MCZ"; "Homotype *Leucopis simplex* Lw. M.A. 59". Canada: Ontario: 1 ♂, 2 ♀, Vineland, Aug. 1962 (A.B. Stevenson); 1 ♂, Ottawa, 7 VIII 1946, attacking aphids on gall on grape leaf (A.R. Brooks); 1 ♀, Niagara Glen, 29 V 1956, 43°8'N, 79°3'W (J.R. Vockeroth). Quebec: 1 ♂, 1 ♀, Deshènes, 13 VII 1963, reared from wild grape infested with *Phylloxera* sp. (C.H. Mann); 1 ♂, the same label, 19 VIII 1963; 1 ♂, 2 ♀, Breckenridge, 10 IX 1962, ex leaf galls of *Phylloxera* sp. on wild grape (C.H. Mann). USA: Ohio: 2 ♂, 3 ♀, Ashtabula Co., Sept. 1988, reared ex pupa on grape phylloxera (M. McLeod). North Caro-



**Figs 35-44.** *Leucopis simplex* Loew. 35, head; 36, 37, variations of abdomen; 38, male genitalia in profile, specimen from Vineland, Ontario; 39, aedeagus from below, the same specimen; 40, gonopods and parameres from below, the same specimen; 41, epandrium in profile, specimen from Ottawa, Ontario; 42, epandrium from behind, the same specimen; 43, aedeagus in profile, the same specimen; 44, aedeagus, apodeme and hypandrium, specimen from Dushesnes, Quebec. Scales: 0.1 mm.

lina: 1 ♂, Highlands 3800, 25 VI 1957 (J.R. Vockeroth); 2 ♂, 2 ♀, Buncombe Co., Biltmore est., 17 VIII 1978, phylloxera galls on French hybrid grapes (K.B. Corrette). NMNH: USA: Ohio: 4 ♂, 3 ♀ (on two pins), Sioux City, reared from mine in lvs *Aquilegia* (no date) (C.N. Ainslie). Texas (?): 3 ♂, 6 ♀, "418-010 2n Aug. 11. 91"; 1 ♂, 1 ♀, "418.0 Aug. 16. 83"; 1 ♂, 3 ♀, "418.0 Aug. 19. 83"; 1 ♀, "418.0 Feb. 9. 84"; one specimen from this series with label "probably sampled by A.K. Carrothers in Texas".

**Description.** *Male, female.* Body length 1.4-1.8 mm. Body grey. Head (Fig. 35) 1.4-1.7 times as high as long. Frons slightly widened anteriorly; 2.8-3.3 times narrower than head. Orbital stripes light grey, frontal stripe grey or dark grey. Both orbital and frontal stripes covered with short black hairs or bristles, also present on dorsal part of short arc-shaped lunule. Ocellar plate elongate triangular, not elevated. OT index 1.2-1.5. Antenna and arista black; 3rd aristomere 2.5-3.5 times as long as 2nd. Diameter of basoflagellomere small, 2.5-2.8 times less than eye height. Gena height 3.2-3.8 times less than eye height. Several minute bristles on gena arranged in row, anterior bristle largest. Palpi black. Stripes of mesonotum absent when viewed from above, but short, dark grey or nearly black medial stripes detectable when viewed from rear. Surface of mesonotum covered with small black bristles, not always arranged in rows; areas devoid of bristles present anteriorly on mesonotum. Two pairs of dorsocentral bristles present. Femora black or dark grey with yellow apices; tibiae black with yellow bases and apices; on fore tarsi, first 2-3 tarsomeres yellow, the last ones black; on mid and hind tarsi, 3-4 tarsomeres yellow. On wings, veins *M* and  $R_{4+5}$  parallel or slightly convergent in apical half; *tp* 1.5-1.9 times less than distal section of *Cu*. On abdomen, brownish black or dark bronze spot present on syntergite 1+2 and tergite 3; posterior border varies even within one series of specimens (for example, Ashtabula series); can be rounded or nearly straight (Figs 36-37). Lacking dark fields of modified microtrichia on lateral edges of first abdominal tergites in ♂.

Male genitalia (Figs 38-44). Epandrium medium-sized, with 4-8 pairs of large bristles on posterior surface; after notable constriction, extends into thin (in profile) surstylar lobes with cluster or row of short bristles at apex; forward end with characteristic projections symmetric to edites. Hypandrium relatively thin in profile. Gonopods longer than parameres. Aedeagus with distinctly wide base; smoothly tapered to sharp apex.

**Taxonomic notes.** The species is easily distinguishable by the absence of mesonotal stripes when viewed from above and very characteristic brownish black or bronze spot on syntergite 1+2 and tergite 3 (bronze colour is best observed in freshly-reared specimens). Male genitalia are

characterised by an epandrium with a distinct projection, thin hypandrium, and peculiar shape of the aedeagus with a wide base and sharp apex.

The type specimen of *L. simplex*, preserved in MCZ, coincided in appearance with a series identified as *L. simplex* from CNC and NMNH. I did not analyze the male genitalia because its hypopygium is turned up and preparation may destroy the specimen. It is thus impossible to observe whether the specimen is male, as stated by Loew, or female.

*Leucopis parallela*, described by Malloch (1921), is very close to *L. simplex*. In his description of *L. parallela*, Malloch based his distinction of this species from *L. simplex*: "entire fore metatarsus yellow; genal bristles very short; frontal lunule setulose; ... veins 3 and 4 parallel apically". But in series of *L. simplex*, coloration of legs varies widely (which is often the case in *Leucopis*), length of genal bristles varies, the dorsal part of the lunule is setulose, and veins *M* and  $R_{4+5}$  can be slightly convergent or parallel. Dimensions of head, arista, and wing veins of *L. simplex* are identical with the dimensions of the type specimen of *L. parallela*. The sole difference appears to be the size of the basoflagellomere, which is appreciably larger in *L. parallela*.

**Distribution.** This species is known from Canada (Ontario, Quebec) and USA (Ohio, N. Carolina, Texas (?)), and is likely widely distributed.

**Mode of life.** Larvae are preying upon eggs of *Phylloxera*. Stevenson (1967) wrote that "*L. simplex* would appear to be the most important predator occurring in or about the phylloxera leaf galls in Ontario". The label of C.N. Ainslie about finding *L. simplex* in mines on leaves of *Aquilegia* causes doubt.

#### Acknowledgements

I wish to express my deep gratitude to the researchers of the Systematic Entomology Laboratory, ARS, USDA for arranging my visit to Canada and USA, warm hospitality, constant help in carrying out my studies, and for the loan of collections. My first thanks are due to Dr. F.C. Thompson and Dr. M.B. Stoetzel, and also to Dr. A.L. Norrbom, Dr. D.R. Miller, Dr. N.J. Vandenberg and Dr. A.S. Konstantinov. I am very obliged to Dr. J.K. Wetterer (Museum of Comparative Zoology, Harvard University) for the opportunity to inspect the collection of Chamaemyiidae in MCZ. I especially want to thank Dr. D.W. Webb (Illinois Natural History Survey) for permitting me to work with the type specimens of Malloch. I am most grateful to my Canadian colleagues from the Biosystematic Research Centre, Agriculture Canada for permitting me to use in my studies their collections and materials, for versatile help and friendly hospitality. First of all I wish to express my warmest feelings to my old friend Dr. J.F. McAlpine, and to thank Dr. J.R. Vockeroth, Dr. J.M. Cumming, Dr. D.M. Wood, Dr. F. Brodo. And

last but not least, I am very thankful to my colleague in the study of Chamaemyiidae Dr. S.D. Gaimari, now California State Collection of Arthropods, Sacramento, for help in work with Malloch's collection and for correcting my English. The work was carried out with financial support from the Russian Foundation for Basic Research (grants 99-04-49-809 and 96-15-97910) and from the State Science and Technology Programme (grant "Biological Diversity").

## References

- Aldrich, J.M.** 1914. A new *Leucopis* with yellow antennae. *J. econ. Entomol.*, **7**: 404-405.
- Aldrich, J.M.** 1925. A new *Leucopis* from San Francisco. *Pan-Pacific Entomol.*, **1**: 152.
- Beshovski, V.L.** 1995. Contribution to the knowledge of the taxonomy and distribution of the *Chamaemyia* species established in Bulgaria (Insecta, Diptera, Chamaemyiidae). *Acta zool. bulg.*, **48**: 34-47.
- Beschovski, V.L. & Merz, B.** 1998. Contribution to the knowledge of the Chamaemyiidae (Diptera), with particular reference to the fauna of Switzerland. *Mitt. schweiz. entomol. Ges.*, **71**: 83-106.
- Coquillett, D.W.** 1898. On the habits of the Oscinidae and Agromyzidae reared at the United States Department of Agriculture. *U.S. Dep. Agric. Bull.* (N. S.), **10**: 70-79.
- Gaimari, S.D. & Turner, W.J.** 1997. Methods for rearing aphidophagous *Leucopis* spp. (Diptera: Chamaemyiidae). *J. Kansas entomol. Soc.*, **69**(4): 363-369.
- Loew, H.** 1869. Diptera Americae septentrionalis indigena. Centuria octava. *Berlin. entomol. Z.*, **13**: 1-52.
- Malloch, J.R.** 1921. Forest insects in Illinois. 1. The subfamily Ochthiphilinae (Diptera, family Agromyzidae). *State Illinois natur. Hist. Surv. Bull.*, **13**: 345-361.
- Malloch, J.R.** 1940. The North American genera of the dipterous subfamily Chamaemyiinae. *Ann. Mag. natur. Hist.* (11), **6**: 265-274.
- McAlpine, J.F.** 1960. A new species of *Leucopis* (*Leucopella*) from Chile and a key to the world genera and subgenera of Chamaemyiidae (Diptera). *Canad. Entomol.*, **92**(1): 51-58.
- McAlpine, J.F.** 1965. Chamaemyiidae. In: Stone, A. et al. A catalog of the Diptera of America north of Mexico. *U.S. Dep. Agric. Handbook*, **226**: 706-709.
- McAlpine, J.F. & Tanasijtshuk, V.N.** 1972. Identity of *Leucopis argenticollis* and description of a new species (Diptera: Chamaemyiidae). *Canad. Entomol.*, **104**: 1865-1875.
- McAlpine, J.F.** 1977. A remarkable new species of *Leucopis* from western Canada (Diptera: Chamaemyiidae). *Proc. entomol. Soc. Washington*, **79**: 14-18.
- McAlpine, J.F.** 1978. A new dipterous predator of balsam woolly aphid from Europe and Canada (Diptera: Chamaemyiidae). *Entomol. german.*, **4**: 349-355.
- McAlpine, J.F.** 1979. Diptera. In: Danks, H.V. (Ed.). Canada and its insect fauna. *Mem. entomol. Soc. Canada*, **108**: 389-424.
- McAlpine, J.F.** 1981. Morphology and terminology – adults. In: McAlpine, J.F. et al. (eds.). Manual of Nearctic Diptera, Vol. 1. *Res. Branch, Agric. Canada, Ottawa, Monogr.*, **27**: 9-63.
- McAlpine, J.F.** 1987. Chamaemyiidae. In: McAlpine, J.F. et al. (eds.). Manual of Nearctic Diptera, Vol 2. *Res. Branch, Agric. Canada, Ottawa, Monogr.*, **28**: 965-971.
- McLean, I.F.G.** 1998. *Leucopis psyllidiphaga* sp. n., a new species of silverfly (Diptera, Chamaemyiidae) from Britain. *Dipterists Digest*, **5**: 49-54.
- Raspi, A.** 1985. Contributi alla conoscenza dei ditteri camemiidi. III. Considerazione sulla *Leucopis palumbii* Rondani e descrizione di *Leucopis gloriae* n. sp. *Frustula entomol.* (n. s.), **6**, (1983): 351-367.
- Raspi, A.** 1986. Contributi alla conoscenza dei ditteri camemiidi. IV. Su due specie del genere *Leucopis* (Diptera Chamaemyiidae) predatrici di *Aphis fabae* Scop.: *Leucopis fiorii* n. sp. e *Leucopis glyphiniivora* Tanas. *Frustula entomol.* (n. s.), **7-8** (1984-1985): 477-485.
- Raspi, A.** 1990. Contributi alla conoscenza dei ditteri camemiidi. V. Su alcune specie del genere *Leucopis* viventi a spese di afidi eriosomatidi. *Frustula entomol.* (n. s.), **11**, (1988): 75-117.
- Raspi, A.** 1996. *Thaumatomyia elongatula* (Becker) (Chloropidae) and *Leucopis annulipes* Zetterstedt (Chamaemyiidae): two Diptera preying on *Phloeomyzus passerinii* (Signoret) (Homoptera: Phloeomyzidae) in Italy. *Proc. entomol. Soc. Washington*, **98**: 509-516.
- Raspi, A. & Bertolini, L.** 1993. Contributions to knowledge of Diptera Chamaemyiidae. VI. Ethological and morphological notes on *Leucopis* (*Leucopomyia*) *silesiaca* Egger and *Leucopis* (*Leucopomyia*) *alticeps* Czerny. *Frustula entomol.* (n. s.), **16**: 119-132.
- Riley, C.V.** 1883. Dipterous enemies of the *Phylloxera vastatrix*. *Canad. Entomol.*, **15**: 39.
- Stevenson, A.B.** 1967. *Leucopis simplex* (Diptera: Chamaemyiidae) and other species occurring in galls of *Phylloxera vitifoliae* (Homoptera: Phylloxeridae) in Ontario. *Canad. Entomol.*, **99**: 815-820.
- Tanasijtshuk, V.N.** 1958. New species of the genus *Leucopis* (Diptera, Chamaemyiidae) from Leningrad Region. *Trudy zool. Inst. Akad. Nauk SSSR*, **24**: 89-98. (In Russian).
- Tanasijtshuk, V.N.** 1986. Family Chamaemyiidae. *Fauna SSSR* (no. 134), *Nasekomye dvukrylye*, **14**(7): 1-335. (In Russian).
- Tanasijtshuk, V.N.** 1992. Morphological differences and phylogenetic relationships between the genera of chamaemyiid flies (Diptera, Chamaemyiidae). *Entomol. Obozr.*, **71**(1): 199-230. (In Russian; translated in *Entomol. Rev.*, Washington, **72**: 66-100).
- Tanasijtshuk, V.N.** 1996. Two species of *Leucopis* Meigen (Diptera: Chamaemyiidae) predacious on the Russian wheat aphid, *Diuraphis noxia* (Mordvilko) (Homoptera: Aphididae), in North America. *Proc. entomol. Soc. Washington*, **98**: 640-646.
- Tanasijtshuk, V.N. & Gaimari, S.D.** (in press). Revision of the genus *Leucopina* (Diptera, Chamaemyiidae) from Nearctic and Neotropic.
- Thompson, W.R.** 1910. A new species of the genus *Leucopis*. *Canad. Entomol.*, **42**: 239-242.

Received 10 July 2002