

Preliminary key for the identification of the nymphs of North European Homoptera Cicadinea. II. Cicadelloidea

Juhan Vilbaste

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Illustrated preliminary keys for the identification of last instar nymphs of the northern European species of Cicadelloidea are presented together with a general description of the morphology of the nymphs of the family Cicadellidae.

Two new genera are established: *Dryocyba*, type species *Typhlocyba carri* Edwards 1914 and *Zonocyba*, type species *Typhlocyba bifasciata* Boheman 1852.

Juhan Vilbaste, Institute of Zoology and Botany of the Academy of Sciences of the Estonian S.S.R., Vanemuise 21, SU-202400 Tartu, U.S.S.R.

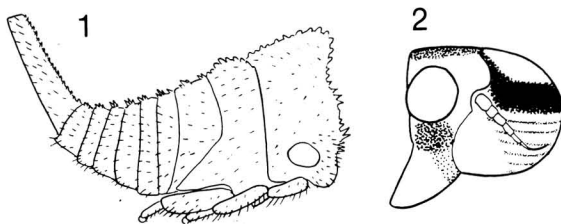
1. Introduction

This paper forms the second part of a long-term investigation into the taxonomy of nymphal Homoptera Cicadinea, which began several years ago (Vilbaste 1968, 1971). My studies on Cicadelloidea have already been briefly discussed (Vilbaste 1972, 1975, 1977), and I now present my findings in detail, incorporating more recent research, including that of other workers (Walter 1975, 1978; Wilson 1978).

The following key refers only to final instar nymphs, but may also be used to identify earlier instars: In all instances nymphs were identified by association with adults consistently present in field samples. Since this is only a preliminary key, I shall welcome any useful comments from those using it.

2. Key to families of Cicadelloidea

- 1 (2) Pronotum strongly elevated, conical. Last abdominal segment longer than remaining abdomen, narrowing to a somewhat conical tube (Fig. 1).
..... Fam. Membracidae (p. 2)
- 2 (1) Pronotum flattened, not elevated. Last abdominal segment very short, usually shorter than penultimate one.
- 3 (4) Nymphs inhabit spittle mass ("cuckoo spit"). Frons greatly swollen; abdominal sternites covered by paratergites, which form a special air canal on the ventral surface of abdomen
..... Fam. Aphrophoridae (p. 1)
- 4 (3) Nymphs free-living. Frons not strongly swollen; paratergites small, situated on sides of sternites
..... Fam. Cicadellidae (p. 2).



Figs. 1-2. — 1. *Centrotus cornutus* (L.), N₅. — 2. *Lepyrionia coleoptrata* (L.), head, lateral view.

3. Fam. Aphrophoridae

A key for the identification of the nymphs of six Swedish species was published by Ossianilsson (1950). The following key is a somewhat expanded version of this. I have examined nymphs of all eleven froghopper species found in Estonia; however, I have so far not discovered any reliable characters for distinguishing nymphs of *Aphrophora salicina* (Gz.) and *A. costalis* (Mm.).

- 1 (2) Blackish-brown transverse band present beneath anterior margin of head (Fig. 2); pronotum with 2 dark brown longitudinal bands or dark patches; dorsal surface of abdomen with pale longitudinal median band, ventral surface darkened
Lepyrionia A.-S. *L. coleoptrata* (L.)
- 2 (1) No dark band beneath anterior margin of head; pronotum uniformly pale or dark, or with numerous vaguely delimited brownish spots; dorsal surface of abdomen without light longitudinal median band, ventral surface pale.

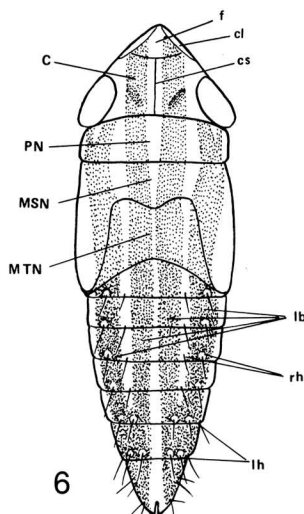


Fig. 6. External features of a cicadellid nymph: C = head, PN = pronotum, MSN = mesonotum, MTN = metanotum, A = abdomen, f = frons, cl = clypeus, cs = coronal suture, lb = longitudinal bands of abdomen, rh = rows of hairs, lh = lateral hairs.

ditional sclerite is divided into two parts by a longitudinal suture. In *Doratura*, *Allygidius* and *Graphocraerus* the frontoclypeus is simply enlarged, appearing as an undivided plate, the anterior part of which extends to the upper part of the head. This character is apparently associated with the concavity of the vertex behind the anterior margin of the head. This type of frontoclypeus occurs also in most representatives of the subfamily Aphrodinae. In most species of Deltocephalinae the frontoclypeus extends to the upper side of the head as arched formations on either side of its anterior margin. Situated between these is usually a small triangular or semicircular additional sclerite. This sclerite is considered to be a remnant of the frons, but this assumption is inconsistent with the fact that such sclerites occur only in more advanced Cicadellidae, and are lacking in more primitive forms (e.g. in *Ulopa*, *Eupelix*). This additional sclerite is recognisable also in adults, forming a triangle which may be of a different texture from the rest of the body surface (shagreened, for example).

The heads of Typhlocybinae are somewhat different; in these the frontoclypeus is situated entirely on the underside of the head. The very weak development of the frontoclypeus in Typhlocybinae is undoubtedly associated with the highly specialised habit of sucking plant cell contents: all but a few typhlocybrids are feeders on mesophyll cell sap; they do not require especially strong suction musculature. This same habit is probably also responsible for the flattened body form of most nymphal Typhlocybinae.

In contrast with the nymphs of most higher Cicadellidae, in which the head is bare, those of lower Cicadellidae have hairs, hair-bearing tubercles or similar structures on the head. In some instances, the hairs may be very long (some *Macropsis* spp.). Long hairs are present also on the heads of many nymphal Typhlocybinae; in several species

the anterior margin of the head is sharpened, provided with long hairs or bears conical lobes.

It is interesting to note that in all nymphs examined so far, the ocelli lie outside the frontal sutures, whereas in adults they usually lie inside (except for Platymetopini and Macrostelini).

Thorax

All three parts of the thorax are clearly distinguishable. In general, the thorax offers very few diagnostic characters, although nymphal instars may be readily identified using the relative development of the wing pads (Vilbaste 1971; Kathirithamby 1973; Walter 1975). The following key is taken from Vilbaste (1971) (Fig. 7):

- 1 (2) Wing pads not obviously present. Posterior margin of mesonotum straight or slightly arched . instar I
- 2 (1) Wing pads obviously present. Posterior margin of mesonotum wavy or lobate.
- 3 (4) Wing pads of mesonotum no longer than median lobe instar II
- 4 (3) Mesonotal wing pads distinctly longer than median lobe.
- 5 (8) Mesonotal wing pads do not extend to posterior margin of metanotum.
- 6 (7) Thorax as long as wide instar III
- 7 (6) Thorax distinctly longer than wide instar IV
- 8 (5) Wing pads extend to posterior margin of metanotum instar V

Thoracic hairs and spines are present only in some lower subfamilies (e.g. in some *Macropsis* spp.), and in nymphs of several Typhlocybinae.

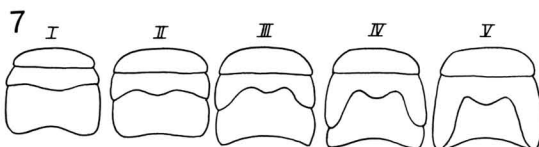


Fig. 7. Development of thorax in *Cicadella viridis*: I—V = nymphal instars (from Vilbaste 1971).

Legs

Legs of Cicadellidae are similar in nymphs and adults. Even the very characteristic femoral chaetotaxy found in higher Deltocephalinae is already established in later nymphal instars.

Abdomen

A dorsal longitudinal keel is present on the abdomen of some lower forms, and this is sometimes provided with strong teeth (e.g. some *Macropsis* spp., Fig. 37). On the other hand, in some strongly dorsoventrally flattened forms (e.g. *Ledra*), the lateral margins of the abdomen are flattened, and may form strong tooth-like structures. Backwardly-directed anal appendages appear to be present only in East-Palaearctic *Japananus* species.

The most useful abdominal character for diagnostic purposes is chaetotaxy. In many of the more primitive species, the abdomen is bare, or covered with different numbers of papillae or tubercles. Further development in chaetotaxy appears to some extent to be an adaptive process. It is interesting to note, for example, that the most strongly hairy nymphs belong to arboricolous forms such as some *Macropsis* spp., and many species of Typhlocybinae. The precise reason for this is not clear. The hair covering would seem to make it more difficult for nymphs to hold themselves against the leaf surface; presumably, this disadvantage is outweighed by some factor such as reduced water loss from the body surface.

The nymphs of lower Cicadellidae have bare abdomens, or at most their abdomens are covered with a few small tubercles. These are distributed all over the abdomen in *Ulopa* and *Eupelicinae*, and already arranged in four longitudinal rows in *Ledra*. There is an evolutionary trend in this arrangement of hairs into four such rows, and there are parallels amongst several taxa. It is possible in the subfamily Macropsinae for example, to trace almost all transitions from practically bare nymphs to those with a dense covering of hairs. In some species, e.g. *Macropsis glandacea*, the abdomen bears, besides uniform hair covering, longitudinal rows of more robust hairs. A similar trend is evident in the subfamilies Aphrodinae and Cicadellinae. Nymphs of the *Aphrodes bicinctus* species complex are bare or covered with tubercles, but in nymphs of *A. albifrons* there are six rows of larger spines, besides uniform hair cover. Nymphs of *Cicadella viridis* have almost bare abdomens, but the nymphs of North American Cicadellinae have hairs in longitudinal rows. The nymphs of Central European *Errhomenellus* are somewhat different; this group apparently should be placed in a separate subfamily.

In higher Cicadellidae, a uniform hair cover is exceptional (e.g. in nymphs of *Coryphaeus*). Nymphs of Typhlocybinae are usually rather hairy; bare or almost bare nymphs are the exception (some Dikraneurini, *Wagneriptyx*, *Eupteryx*, etc.).

Chaetotaxy of the abdomen is also an important diagnostic character in Deltocephalinae. Nymphs in this subfamily usually possess four longitudinal rows of hairs and additional hairs on the hind angles of the seventh and eighth tergites of the abdomen. This type of nymph is found in the tribes Deltocephalini and Paralimnini (if these tribes differ at all) and in some Euscelini. In this last tribe there are both nymphs with complete chaetotaxy and nymphs with a reduced number of abdominal hairs. An evolutionary trend may be observed in the reduction of hairs: some species have hairs confined to medial rows (*Neoliturus* and some species of *Goniognathus* etc.), and others possess just a few hairs on the eighth tergite, four on the posterior margin and two on the hind angles (*Pithyotettix*, *Speudotettix*, *Macustus*, *Scleroracrus*, *Limotettix*). Nymphs of *Grypotes* have an additional two hairs on the hind angles of the seventh tergite. The greatest reduction of hairs occurs in nymphs of *Allygus mixtus*; hairs are present only on the hind angles of the eighth tergite.

Nymphs of Macrostelini also show a reduction in abdominal hairs. *Macrosteles* species for example possess two hairs on the posterior margin of the seventh tergite and four hairs on the eighth tergite. In nymphs of *Sonronius* there are still fewer hairs. In *Sagatus* species the lateral row of hairs is complete, and all that remains of the medial row

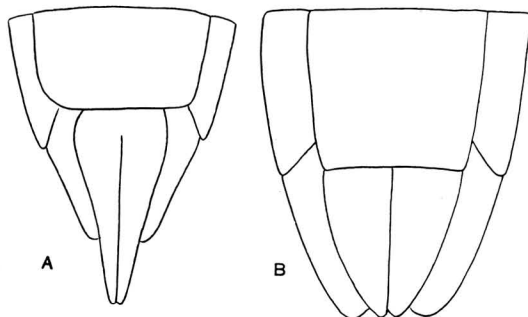


Fig. 8. Hind end of the body of final instar nymph of *Populicerus confinis*: A = male, B = female.

is a single pair of hairs on the eighth tergite. Hairs are also present on the hind angles of the last abdominal tergites.

The almost bare, dorsoventrally flattened nymphs of *Balclutha* are so different from nymphs of Macrostelini that there is reasonable justification for placing *Balclutha* in a separate tribe, Balcluthini (c.f. Baker 1915; Oman 1949).

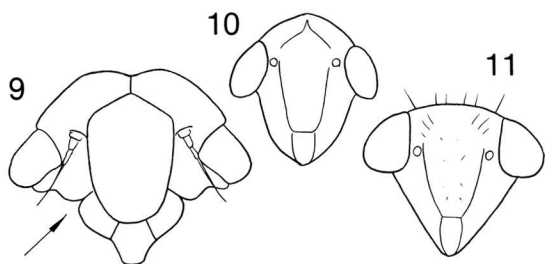
Finally, the sexes are easily recognisable in nymphs of later instars (Fig. 8). In females, the suture between the pygofer lobes extends as far as the pregenital segment; in males it does not extend so far.

I have used the nomenclature adopted by Nast (1972) with a few amendments. *Fagocyba carri* (= *Typhlocyba carri* Edwards 1914) for example, differs so greatly, both as adults and nymphs, from the type species of the genus *Fagocyba* (*Typhlocyba cruenta* H-S), that a new genus is justified: *Dryocyba*. Similarly, I propose a new genus, *Zonocyba*, to contain *Typhlocyba bifasciata* Boheman 1852. I have also recalled the genus *Wagneriptyx* Dlabola 1958, since nymphs of *Aguriahana germari* are so different from those of *Aguriahana* species.

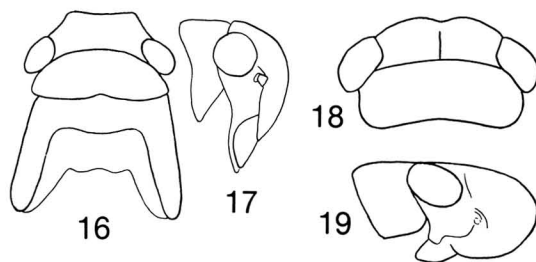
Studies on nymphs have also confirmed my previous assumptions (Vilbaste 1980) concerning the validity of the genera *Verdanus* Om., *Errastunus* Rb., *Ederranus* Rb. and also concerning *Metidiocerus* Oss. 1981.

5.2. Key to the subfamilies of Cicadellidae

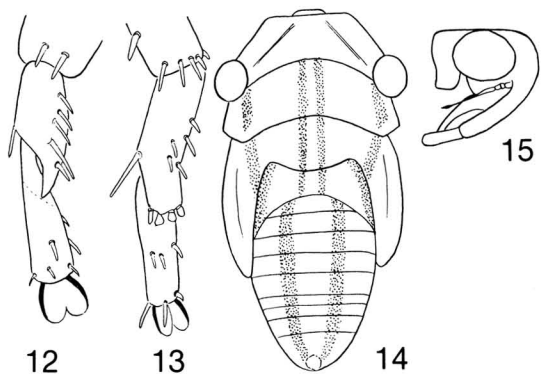
- 1 (2) Subgenal sutures present; genae form separate plates beneath antennae (Fig. 9); hind tibiae only slightly longer than middle ones, without macrochaetae Ulopinae (p. 6)
- 2 (1) Subgenal sutures absent; genae fused with maxillary plates; hind tibiae usually much longer than middle ones, provided with numerous macrochaetae.
- 3 (14) Ocelli lying on ventral surface of head or are absent.
- 4 (5) Frontal sutures meet at sharp angle beneath anterior margin of head (Fig. 10) or narrow before their ends (Fig. 11); ocelli usually absent, first joint of hind tibia (at least in later instars) sharp-tipped (Fig. 12). Mostly strongly flattened forms, bare or covered with rows of strong spines or hairs Typhlocybinae (p. 9)



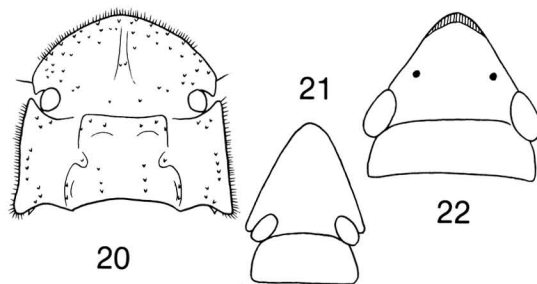
Figs. 9—11. Faces of cicadellid nymphs: — 9. *Ulopa reticulata* (F.) — 10. *Notus flavipennis* (Zs.) — 11. *Kybos smaragdulus* (Fn.).



Figs. 16—19. — 16, 17. *Anaceratagallia ribauti* (Oss.), anterior body and head and pronotum, side view. — 18. *Populicerus populi* (L.), head and pronotum, dorsal view. — 19. *Iassus lanio* (L.), head and pronotum, lateral view.



Figs. 12—15. — 12. *Notus flavipennis* (Zs.), hind tarsus. — 13. *Deltocephalus pulicaris* (Fn.), hind tarsus. — 14. *Megophthalmus scanicus* (Fn.), N₅. — 15. *Populicerus populi* (L.), head and pronotum, lateral view.



Figs. 20—22. Anterior bodies. — 20. *Ledra aurita* (L.). — 21. *Eupelix cuspidata* (F.). — 22. *Aphrodes bicinctus* (Schr.).

- 5 (4) Frontal sutures, when united, extend as coronal suture to upper side of head; first joint of hind tibia obtuse-tipped, usually with cross-rows of spines (Fig. 13).
- 6 (7) Head with elevated, keel-like sutures (Fig. 14); hind tibia with few macrochaetae (less than 5) Megophthalminae (p. 6)
- 7 (6) Head without elevated sutures; hind tibiae usually with more than 10 macrochaetae.
- 8 (11) Head, in side view, broadly rounded, planes of frons and vertex form sharp angle (Fig. 15); head usually much wider than pronotum (at least 1.1 ×)
- 9 (10) Small (N₅ shorter than 2.5 mm); anterior margin of head smoothly angular; head at lateral margins distinctly shorter than in middle (Fig. 16); planes of frons and vertex form almost a right angle; abdomen short and high, almost as high as long Agallinae (p. 8)
- 10 (9) Large (N₅ longer than 3 mm.): anterior margin of head broadly rounded; head at level of eyes same length as at middle (Fig. 18); acute angle between planes of frons and vertex; abdomen flattened, much broader than high Idiocerinae (p. 8)
- 11 (8) Head, in side view, narrowly arched; planes of frons and vertex roughly parallel (Fig. 19); head no wider, or only slightly wider than pronotum (less than 1.1 ×).
- 12 (13) Region between frons and anteclypeus clearly concave (Fig. 19); abdomen flattened, always without longitudinal median keel; body, especially abdomen, bears blunt-tipped or scale-like hairs Iassinae (p. 8)
- 13 (12) Region between frons and anteclypeus usually smooth, rarely concave; a clear longitudinal median keel present on dorsal surface of abdomen; body hairs, when present, ordinary sharp-tipped: Macropsinae (p. 6)
- 14 (3) Ocelli present on upper side of head or on its anterior margin, usually visible from above (cicadellids).
- 15 (18) Upper margin of frons situated on under surface of head, far from its anterior margin.
- 16 (17) Lateral margins of head and body compressed and foliaceous (Fig. 20); frons concave, without keel; hind tibiae broad, foliaceous with stout spines on their outer margins .. Ledrinae (p. 6)
- 17 (16) Lateral margins of head and body not foliaceous although sharp; frons with strong median keel;

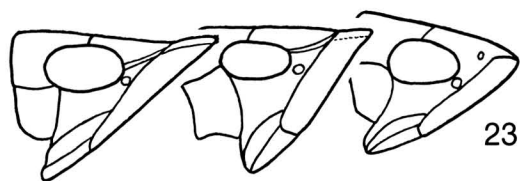
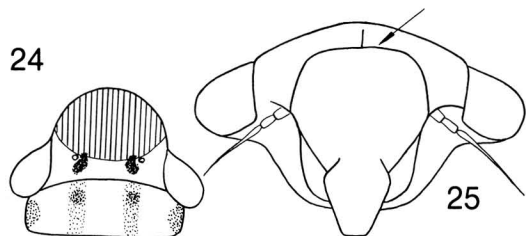
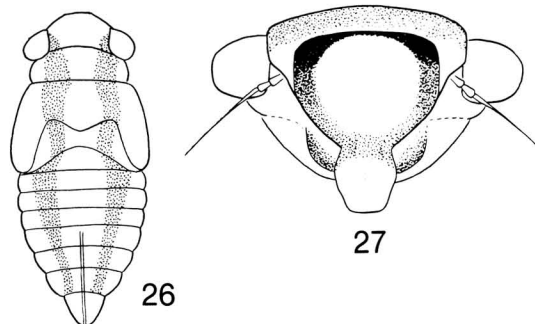


Fig. 23. Heads of Aphrodinae genera, lateral views; from left to right: *Stroggylocephalus*, *Aphrodes*, *Anoscopus*.



Figs. 24—25. — 24. *Cicadella viridis* (L.), head and pronotum, dorsal view. — 25. *Oncopsis alni* (Schr.), face.



Figs. 26—27. — 26. *Oncopsis subangulata* (J.Sb.), N₅. — 27. *Oncopsis planiscuta* (Ths.), face.

Subfamily Megophthalminae

Only *Megophthalmus scanius* (Fn.) occurred in the study area.

Subfamily Ledrinae

Ledra aurita (L.) was collected from the southern part of the study area.

Subfamily Macropsinae

- 1 (2) Central part of frontal suture (between ocelli) horizontal or with a concavity pointed downwards (Fig. 26); abdomen without a sharp dorsal keel, usually bare or with only very small hairs *Oncopsis* Bm.
 - a (b) Nymph yellow with two longitudinal bands (Fig. 26) (Claridge *et al.* 1977, Fig. 1 have identified these nymphs as *O. flavicollis* (L.)). On *Betula* *O. subangulata* (J. Sb.)
 - b (a) Colouring different from above.
 - c (d) Dorsal surface of nymph uniformly dark (blackish) brown, abdomen sometimes lighter; frons in most cases very pale brownish yellow (usually darkened below) with a dark archline when viewed from the side (sometimes sides also darkened) (Fig. 27). On *Alnus incana* *O. planiscuta* (Ths.)
 - d (c) Dorsal surface of nymph not dark brown, pale patches and lines present; frons more or less same colour as dorsal body surface.
 - e (f) Nymph dark brown or blackish brown (sometimes posterior margins of tergites pale) or pale brown with a marbled pattern; usually a somewhat darker longitudinal median line present on head and thorax; markings on head (spots on sides of frons and on vertex) dark brown or black; early instars and also nymphs bearing marbled pattern richly covered in hairs, of which 6 rows are slightly larger and arise usually from pale spots. On *Alnus* *O. alni* (Schr.)
 - f (e) Nymphs brown or light brown, without dark longitudinal mark along midline; head

hind tibiae more or less quadrangular in section, with short spines; anterior margin of head extends keel-like onto eyes (Fig. 21) . Eupelicinae (p. 8)

- 18 (15) Upper margin of frons extends to anterior margin or to upper side of head.

- 19 (22) Ocelli situated away from anterior margin of head; if on anterior margin, they lie further away from epistomal sutures than their diameter; abdomen usually uniformly covered with small hairs (rarely with additional rows of larger spines) or is almost bare.

- 20 (21) Only very small extension of clypeus present on upper side of head (Fig. 22, striped area), its posterior margin more or less straight; anterior margin of head sharp or narrowly rounded (Fig. 23) Aphrodinae (p. 9).

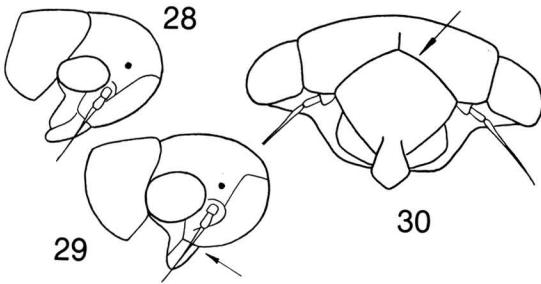
- 21 (20) Large extension of clypeus present on upper side of head, its posterior margins rounded (Fig. 24, striped area); anterior margin of head broadly rounded Cicadellinae (p. 9)

- 22 (19) Ocelli present on anterior margin of head, close to epistomal sutures (not further away than their diameter); abdomen usually with 4 or as many as 8 rows of large hairs, rarely a reduced number of hairs Deltocephalinae (p. 12)

5.3. Subfamilies

Subfamily Ulopinae

Only one representative of this subfamily, *Ulopa reticulata* (F.) was found in the study area.



Figs. 28—30. — 28. *Oncopsis appendiculata* Wg., head and pronotum, lateral view. — 29. *Oncopsis flavicollis* (L.), head and pronotum, lateral view. — 30. *Macropsis impura* (Bh.), face.

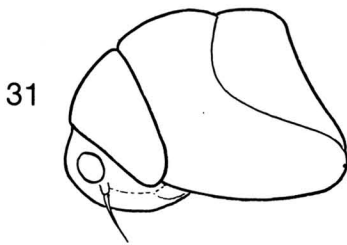
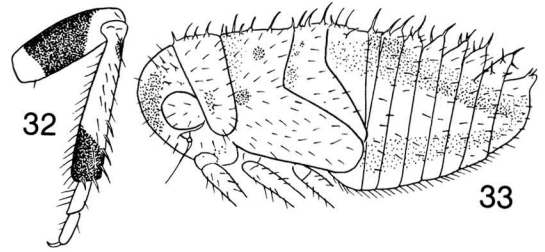
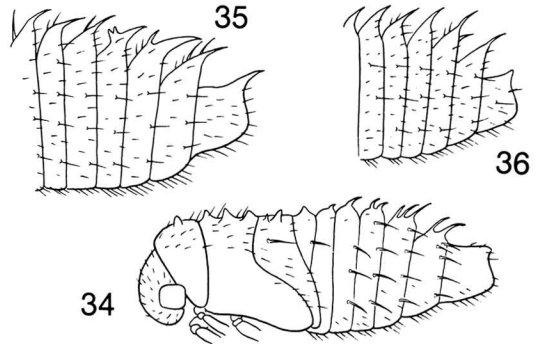


Fig. 31. *Pediopsis tiliae* Gm. Anterior body, lateral view.



Figs. 32—33. *Hephathus nanus* (H.-S.). — 32. Hind leg. — 33. N₅.



Figs. 34—36. *Macropsis* species. — 34. *M. glandacea* Fb., N₅. — 35. *M. scutellata* (Bh.), abdomen. — 36. *M. fuscata* (Zs.), abdomen.

markings no darker or only slightly darker than frons.

- g (h) Face side-view strongly concave ventrally (Fig. 28). On *Betula* ... *O. appendiculata* Wg.
- h (g) Face in side-view even, not concave (Fig. 29).
- i (j) Nymph brown. On *Betula* ... *O. flavicollis* (L.)
- j (i) Nymphs brownish yellow.
- k (l) N₅ longer than 3.5 mm. On *Carpinus*
O. carpi (Edw.)
- l (k) N₅ shorter than 3.3 mm. On *Betula*
O. tristis (Zs.)
- 2 (1) Middle part of frontal sutures rounded or angular (Fig. 30); abdomen with a sharp dorsal keel.
- 3 (4) Mesonotum strongly raised (Fig. 31). On *Tilia*
Pediopsis Bm. *P. tiliae* Gm.
- 4 (3) Mesonotum not raised, more or less horizontal.
- 5 (6) Hind femora (except at base and tip) and apical third of hind tibiae blackish-brown (Fig. 32)
Hephathus Rb. *H. nanus* (H-S) (Fig. 33)
- 6 (5) Legs more or less uniformly coloured
Macropsis Lws.
- a (f) Thorax with large hair-bearing papillae along midline (Fig. 34); middle keel on abdomen with high, upwardly directed lobes.
- b (c) Keel of hind tergites lower than length of tergite; abdomen on each side with 3 rows of stout spines, with only a few smaller hairs in between (Fig. 34) *M. glandacea* Fb.
- c (b) Keel of hind tergites about as high as tergite; numerous hairs or dense spines present between rows of stout spines.
- d (e) In last 3—4 segments of abdomen large lobes of dorsal keel have, in addition to apical teeth, teeth on their anterior margins, (the lobes seem to be trapezoid) (Fig. 35); wing pads very shiny, without hairs (except marginal ones); numerous small hairs present between rows of stout spines ... *M. scutellata* (Bh.)
- e (d) Large lobes of last segments triangular, with several hairs (Fig. 36); wing pads covered with large hairs; spines between rows of large spines almost as stout as those in rows
M. fuscata (Zs.)
- f (a) No large papillae along midline of thorax; if papillae present, then teeth of central keel of abdomen are shorter than width of half tergite.
- g (l) Upper margin of abdominal keel lies more or less on same level; body with few hairs only; ground colour mostly green, often with black punctures.
- h (i) Keels of tergites without hairs; abdomen with a few hairs only, at most only stout hairs on lateral margins of tergites
M. marginata (H-S)
- i (h) Keels of tergites in all segments have 2 short hairs on posterior margins (N.B. since these are fragile and break off easily, careful examination is necessary).
- j (k) Sides of abdomen, apart from marginal hairs, quite bare *M. notata* Prh.
- k (j) Sides of abdomen with very short, thin, fragile

hairs situated along posterior margins of tergites, in 3 longitudinal rows

M. viridinervis Wg.

- l (g) Upper margin of abdominal keel consists of distinct teeth (Figs. 37, 38).

- m (n) Tooth of last abdominal tergite (before anal segment) about as long as half width of tergite (Fig. 37); male nymphs brown, female nymphs partly brown, partly green; pale specimens tend to be more hairy, so they appear to be a different species)

..... *M. infuscata* (J. Sb.)

- n (m) Tooth of last abdominal segment much shorter than half width of tergite (Fig. 38).

- o (p) Whole body covered with long whitish upright hairs; nymph green. *M. prasina* (Bh.)

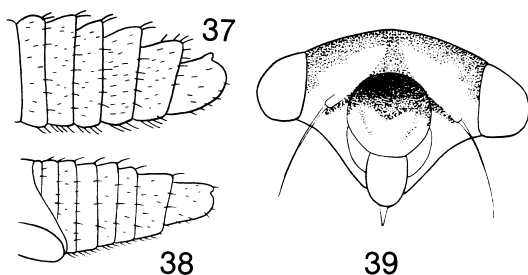
- p (o) Body covered with short lying hairs; nymph brown or green.

- q (r) Body greyish-green or yellowish-green, often with 2 dark longitudinal bands on dorsal surface (Fig. 38) *M. albae* Wg.

- r (q) Dorsal body surface grey or brown, ventral surface whitish; if green patches present on dorsal surface, then abdominal keel is dark brown and frons contrastingly brown.

- s (t) Abdominal keel bears only one pair of (fragile) spines on each segment; frons contrastingly darker, usually with pale transverse band in upper region (Fig. 39) *M. cerea* (Grm.)

- t (s) Abdominal keel bears, in addition to one pair on the posterior margin, 1—2 pairs of smaller spines in each segment; face usually entirely dark, frons rarely contrastingly darker..... *M. impura* (Bh.)



Figs. 37—39. *Macropsis* species. — 37. *M. infuscata* (J.Sb.), abdomen. — 38. *M. albae* Wg., abdomen. — 39. *M. cerea* (Grm.), face.

Subfamily Idiocerinae

- 1 (2) Nymphs entirely pale yellowish, covered with stout upright hairs; 2 small dark spots present on anterior margin of head of some individuals *Sahlbergotettix* Zv. *S. saliciola* (Fl.)
- 2 (1) Nymph either pale orange with thin, lying hairs, or brownish/greyish.
- 3 (4) Nymph covered with stout, obliquely erect hairs *Idiocerus* Lew. & *Tremulicerus* Dl.
 - a (b) A very wide paler region present on middle part of dorsum (about 1/3 width of tergite) *I. lituratus* (Fn.)
 - b (a) Middle line of dorsum of abdomen narrow (about 1/10 width of tergite) *T. poecilus* (H-S)
- 4 (3) Nymph with thin, lying hairs.
- 5 (6) Abdomen greyish with transverse rows of brownish spots *Metidiocerus* Oss. *M. elegans* (Fl.)
- 6 (5) Nymph either uniformly pale orange or with characteristic pattern (Fig. 41) *Populicerus* Dl.
 - a (b) Nymph uniformly pale. On *Salix* *P. confusus* (Fl.)
 - b (a) Nymph with dark pattern; at least 2 dark spots present on frons; in extreme cases, a very characteristic pattern is present (Fig. 41). On *Populus tremula* *P. populi* (L.)

Subfamily Agallinae

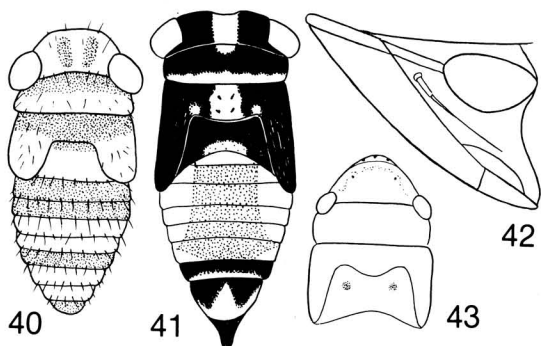
- 1 (2) Abdominal hairs very long, as long as tergite; body usually bears brown transverse striations; posterior pronotum, mesonotum and tergites III, IV and VII are brown; very occasionally, nymphs of later instars are uniformly yellow (Fig. 40) .. *Agallia* Ct. *A. brachyptera* (Bh.)
- 2 (1) Body hairs very short; body mostly mottled brown, but may be uniformly brownish yellow (At least one brownish yellow fifth instar nymph of *A. venosa* Fn. was collected from W. Germany). *Anacertagallia* Zv.
 - a (b) Pale patches on sides of sternites VI and VII; in addition to dark median bands along body is a clear pale longitudinal band (at least in the dorsal part of metanotum); distance between medial rows of spots is approximately 4 × diameter of the spots themselves *A. estonica* Vb.
 - b (a) Nymph usually uniformly dark, pale patches rarely present, no pale bands present along dark median bands; distance between rows of spots usually less than 3 × diameter of the spots. *A. ribauti* Oss.

Subfamily Iassinæ

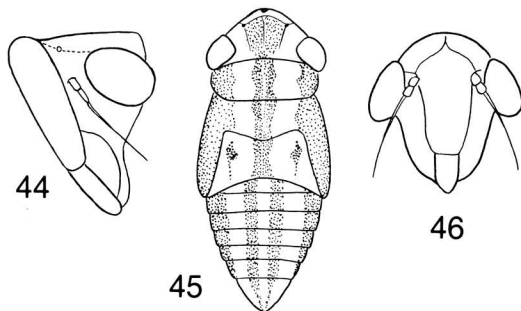
- 1 (2) N_5 longer than 5 mm; colouring varies from green to brown, usually brownish yellow with brown spots; abdomen with blunt, flat, lying scale-like hairs on sides *Iassus* F. *I. lanio* (L.)
- 2 (1) N_5 shorter than 4 mm; uniformly green; abdomen with short, blunt, half erect hairs on sides *Batracomorphus* Lw. *B. irroratus* Lw.

Subfamily Eupelicinae

Only one representative of this subfamily, *Eupelix cuspidata* (F.) was found in the study area.



Figs. 40—43. — 40. *Agallia brachyptera* (Bh.), N_5 . — 41. *Populicerus populi* (L.), N_5 , dark specimen. — 42. *Aphrodes bicinctus* (Schr.), head, lateral view. — 43. *Stroggylocephalus agrestis*, anterior body.



Figs. 44—46. — 44, 45. *Anoscopus serratulae* (F.), head, lateral view and N_5 . — 46. *Notus flavipennis* (Zs.), face.

Subfamily Aphrodinae

- 1 (4) Anterior margin of head, in side view, sharp, flange-like (Fig. 42)
- 2 (3) Anterior margin of head rounded when viewed from above (Fig. 43); surface of vertex even, without either keels or depressions; uniformly shagreened *Stroggylocephalus* Fl.
 - a (b) Anterior margin of head broadly compressed (up to 1/5 of its length), usually alternately dark/pale; colouration of dorsal surface pale, with slightly darker longitudinal bands; metanotum with two contrastingly darker spots, much darker than the remaining pattern on dorsal surface (Fig. 43) *S. agrestis* (Fn.)
 - b (a) Anterior margin of head more narrowly compressed (less than 1/5 of its length) and more or less uniformly coloured; colouration of dorsal surface darker, thorax dark brown to brownish yellow, spots on metanotum no darker or only slightly darker than dark longitudinal bands *S. livens* (Zs.)
- 3 (2) Anterior margin of head angular when viewed from above (Fig. 22); vertex with 3 weak longitudinal keels, with clear depressions between them; vertex usually covered with longitudinally oriented oblong papillae *Aphrodes* Ct.
 - a (b) Larger species, N_5 longer than 5 mm; yellow or brown; if brown, outer margins of wing pads are whitish *A. bicinctus* (Schr.), *A. ochromelas* (Gm.), & *A. makarovi* Zv.
 - b (a) Smaller species, N_5 shorter than 5 mm.
 - c (d) Abdomen covered with clear, whitish spots *A. bifasciatus* (L.)
 - d (c) Pattern of abdomen indistinct.
 - e (f) Abdomen brownish; wing pads pale with indistinct brownish longitudinal stripes *A. trifasciatus* (G.)
 - f (e) Abdomen and wing pads whitish, with only medial edge of wing pads somewhat infuscate *A. nigrilus* (Kb.)

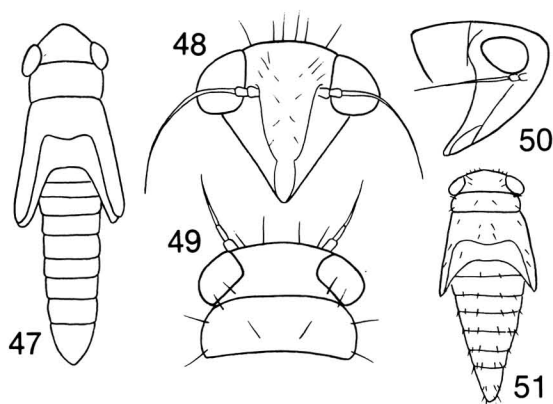
- 4 (1) Anterior margin of head plump, rounded (Fig. 44) *Anoscopus* Kb.
 - a (b) Pattern very faint, often barely visible; dorsal surface of abdomen bare, without hairs *A. flavostriatus* (Dn.) & *A. albifrons* (L.)
 - b (a) Pattern more or less clear, brown (Fig. 45); upper surface of abdomen hairy.
 - c (d) Abdomen covered with tiny hairs, larger spines absent *A. serratulae* (F.)
 - d (c) Abdomen, besides tiny hairs, has two lateral rows of larger, obtuse spines (one in a darker, the other in a lighter band) and 2 rows of smaller spines on medial longitudinal band *A. albiger* (Grm.)

Subfamily Cicadellinae

- 1 (2) Frons with clear medial keel . *Evacanthus* L. & S. *E. interruptus* (L.) & *E. acuminatus* (F.)
- 2 (1) Frons without median keel.
- 3 (4) Two large black spots present close to posterior margin of vertex (Fig. 24); body with 4 brownish longitudinal bands; abdominal hairs very fine, none arise from dark spots *Cicadella* Dm. *C. viridis* (L.)
- 4 (3) Vertex uniformly coloured, or with scattered dark spots; abdomen with stout hairs arising from black or dark-brown spots, largest of these spots often form transverse bands close to posterior margin of tergite .. *Bathysmatophorus* J.Sb. *B. reuteri* J. Sb.

Subfamily Typhlocybinae

- 1 (12) Frontal sutures unite anteriorly, on frons (Fig. 46). Feed mostly on lower plants (Dikraneurini)
- 2 (7) Abdomen bare.
- 3 (4) N_5 about 2 mm in length. In dry places, on *Carex montana* *Wagneriala* An. *W. minima* (J.Sb.)
- 4 (3) N_5 longer than 2.5 mm.



Figs. 47—51. — 47. *Notus flavipennis* (Zs.), N_5 . — 48, 49. *Kybos smaragdulus* (Fn.), face and head and pronotum. — 50, 51. *Alebra wahlbergi* (Bh.), head and pronotum, lateral view and N_5 .

- 5 (6) N_5 usually longer than 3 mm, long and slender, nymph over 3 times as long as wide at eyes (Fig. 47) thorax almost parallel-sided. Inhabits damp meadows and fens *Notus* Fb. *N. flavipennis* (Zs.)
- 6 (5) Length of N_5 2.5—3 mm, approximately $2.5 \times$ as long as width at eyes; lateral margins of wing pads slightly divergent. Inhabits damp meadows and also forests *Forcipata* DL & Cw.
F. citrinella (Zs.) & *F. forcipata* (Fl.)
- 7 (2) Abdomen with hairs in irregular rows
- 8 (9) Frons bears crimson-red patch, bare; whole ventral surface of nymph also reddish; abdomen with very short hairs emerging from whitish tubercles. In sandy places, on *Calluna*
Erythia Fb. *E. aureola* (Fn.)
- 9 (8) Frons without reddish patch, usually with tiny hairs.
- 10 (11) Ground colour brownish yellow; apical joint of abdomen more or less darkened. On *Thalictrum*
Micantulina Kn. *M. micantula* (Zs.)
- 11 (10) Ground colour greyish-yellow, ventral surface often darkened. In open forests and on forest margins. *Dikraneura* Hdy. *D. variata* Hdy.
- 12 (1) Frontal sutures extend only to antennal pits (Fig. 48). Mainly arboreal.
- 13 (22) Vertex extends only slightly beyond eyes and goes no further than basal joints of antennae; vertex medially at most $1.25 \times$ as long as at eyes (Fig. 49).
- 14 (15) Head narrowly rounded between frons and vertex (Fig. 50); nymphs yellowish when alive (Alebrini) *Alebra* Fb.
a (b) Uniformly pale yellowish (Fig. 51).
A. wahlbergi (Bh.)
b (a) With brownish body pattern
A. wahlbergi (Bh.)
- 15 (14) Head more or less angular between frons and vertex (Fig. 52); ground colour mostly greenish when alive (dry and preserved specimens brownish yellow) (Empoascini).

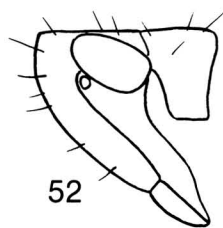
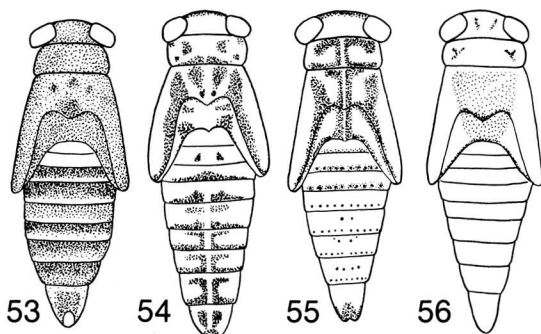
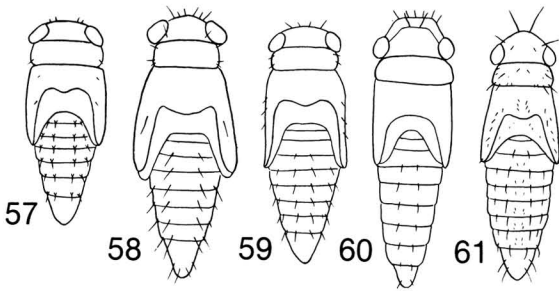


Fig. 52. *Kybos smaragdulus* (Fn.). Head and pronotum, lateral view.

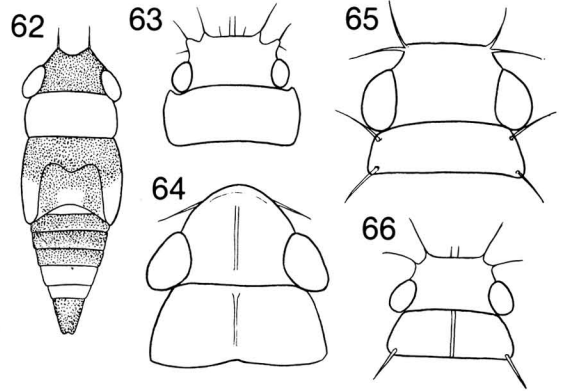
- 16 (17) Each tergite of abdomen with a row of up to 12 long hairs *Kybos* Fb.
- a (d) Abdominal tergites mostly brown with pale midline.
- b (c) Abdominal tergites wholly brown except for first two tergites, which are entirely pale (Fig. 53). On *Alnus* .. *K. smaragdulus* (Fn.)
- c (b) Posterior margins of abdominal tergites and anterior margins of posterior tergites brown; tergite II with 2 small triangular hair-bearing points (Fig. 54). On *Salix*
K. butleri (Edw.)
- d (a) Abdominal tergites pale, dark spots often present at bases of spines, these often coalesce to form a streak on anterior tergites.
- e (f) Dark pattern on anterior region of body distinct, dark bands almost always present along pale midline and also on posterior margins of segments (Fig. 55) — On *Salix*
K. virgator (Rb.)
- f (e) Pattern on anterior region of body faint or indistinct.
- g (h) Faint but distinct pattern on anterior part of body: 2 patches on vertex, 2 oblique patches on lateral margins of pronotum; hind margins of meso- and metanotum darkened (Fig. 56). On *Populus*
K. abstrusus (Lv.)
- h (g) Anterior region of body bears no such pattern. On *Salix*.



Figs. 53—56. Pattern of *Kybos* species. — 53. *Kybos smaragdulus* (Fn.). — 54. *K. butleri* (Edw.). — 55. *K. virgator* (Rb.). — 56. *K. abstrusus*.



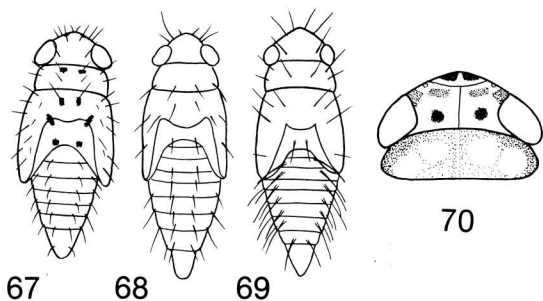
Figs. 57—61. Typhlocybae. — 57. *Chlorita paolii* (Oss.). — 58. *Empoasca solani* (Ct.). — 59. *Austroasca vittata* (Lth.). — 60. *Zygina rubrovittata* (Lth.). — 61. *Alnetoidia alneti* (Db.).



Figs. 62—66. — 62. *Eupterycyba jucunda* (H.-S.). — 63. *Eurhadina pulchella* (Fn.), head and pronotum. — 64. *Typhlocyba quercus* (F.), head and pronotum. — 65. *Zonocymba bifasciata* (Bh.), head and pronotum. — 66. *Eupteryx stachydearum* Hdy., head and pronotum.

- i (j) Anterior region of body more or less same colour as abdomen; abdominal spines dark *K. mucronatus* (Rb.)
- j (i) Anterior body often brownish; abdominal spines pale.
- k (l) Abdominal spines usually arise from dark spots which may fuse to form brownish cross-bands on anterior tergites *K. strigilifera* (Oss.)
- l (k) Abdominal spines arise from darker spots which are relatively pale and do not form dark cross-bands *K. oshanini* Zv.
- 17 (16) Dorsal surface of abdomen with 4 longitudinal rows of hairs.
- 18 (19) Nymph short (N_5 about 2 mm long) and stocky (less than $3 \times$ as long as width at eyes); abdominal hairs arise from whitish tubercles (Fig. 57). On *Artemisia* spp. *Chlorita* Fb. *C. paolii* (Oss.)
- 19 (18) Nymph larger (N_5 longer than 2.5 mm) and more slender (more than $3 \times$ as long as width at eyes); abdominal hairs do not arise from whitish tubercles.
- 20 (21) Ground colour whitish green; numerous hairs on anterior margin of head (Fig. 58) *Empoasca* Wlsh. *E. vitis* (Gth.), *E. solani* (Ct.) & *E. ossianilssonii* Nrt.
- 21 (20) Ground colour greyish green; only 4 hairs on anterior margin of head (Fig. 59) *Austroasca* Lwr. *A. vittata* (Lth.)
- 22 (13) Vertex medially much longer (more than $1.25 \times$) than at eyes and usually extending beyond second joint of antennae (Figs. 60, 61, 64)
- 23 (28) A pair of strongly divergent (almost 90°) hairs present on anterior angle vertex, the bases of which are very close; additional hairs may be present. (Figs. 60—61) (*Erythroneurini*).
- 24 (25) Abdomen with only 2 longitudinal rows of hairs (Fig. 60); dorsal body surface pale yellow, usually with brownish marks on thorax, antennae longer than body. On various trees *Zygina* Fb.
- 25 (24) Abdomen with 4 longitudinal rows of hairs; antennae shorter than body.
- 26 (27) Hairs on anterior margin of head very short; mesonotum with brownish lateral patches *Arboridia* Zv. *A. parvula* (Bh.)
- 27 (26) Hairs on anterior margin of head longer than half length of vertex (Fig. 61); uniformly pale. On *Alnus* and several other deciduous trees *Alnetoidia* Dl. *A. alneti* Db.
- 28 (23) Anterior angle of vertex without strongly divergent hairs: either lobes present or several or no hairs (Fig. 62) (Typhlocybini).
- 29 (32) Anterior margin of head with hair-bearing lobes (Figs. 62, 63).
- 30 (31) Anterior margin of head with 2 lobes (Fig. 62); body bare, except for tiny hairs on hind angles of tergites V—VIII; nymph bicoloured brown and yellow. On *Alnus* *Eupterycyba* Dl. *E. jucunda* (H-S)
- 31 (30) Anterior margin of head with 4 lobes (Fig. 63); abdomen with long hairs. On various deciduous trees, mainly *Quercus* species ... *Eurhadina* Hpt.¹
 - a (d) Median spines of abdominal tergite VIII widely separated from each other (more than $1/2$ their length).
 - b (c) Laterally directed spine in front of eyes more than $1/2$ length of adjacent anterior spine; hairs present also on thoracic segments and on wing pads. On *Quercus* spp. *E. kirschbaumi* (Wg.)
 - c (b) Laterally directed spine in front of eyes less than half length of adjacent anterior spine; hairs present only on lateral margins of wing pads. On *Quercus* spp. *E. pulchella* (Fn.)
 - d (a) Median spines of abdominal tergite VIII lie close together or are touching.
 - e (f) Laterally directed spine in front of eyes less than $1/2$ length of adjacent anterior spine. On *Quercus* spp. *E. ribauti* (Wg.)
 - f (e) Laterally directed spine in front of eye more than $1/2$ length of adjacent anterior spine.

¹ (The above key is taken mainly from Wilson (1978); his figures should be consulted).



Figs. 67—70. — 67. *Linnavuoriana sexpunctata* (Fn.). — 68. *Edwardsiana soror* (Lv.). — 69. *Ribautiana ulmi* (L.). — 70. *Macrosteles sexnotatus* (Fn.), head and pronotum.

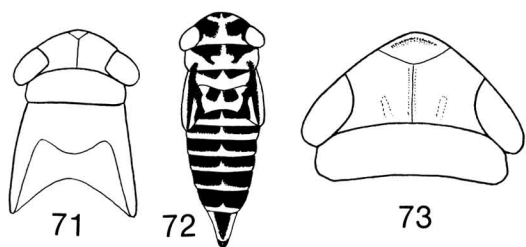
- g (h) Dark pattern on dorsal body surface usually very distinct. On *Acer* spp. *E. loewi* (Th.)
- h (g) If pattern present on dorsal body surface, it is less prominent; head usually without markings. On *Quercus*, *Alnus* and *Fagus* *E. concinna* (Grm.)
- 32 (29) Anterior margin of head rounded, without lobes.
- 33 (36) Dorsal surface of head bare, without hairs.
- 34 (35) Spines on hind angles of tergite V—VIII long, more than 1/2 length of tergite; pale yellowish nymphs. On *Quercus* spp. *Dryocyba* n. gen. *D. carri* (Edw.)
- 35 (34) Spines on hind angles of tergites V—VIII very short, hardly visible; pale, olive-brown nymphs. On *Pinus* *Wagneriptyx* Dl. *W. germari* (Zs.)
- 36 (33) Hairs present on dorsal surface on anterior margin of head.
- 37 (38) Anterior margin of head with only one pair of small laterally directed hairs (Fig. 64); abdomen with only short hairs on hind angles of tergites V—VIII and 2 additional hairs on posterior margin of tergite VIII; reddish markings often present on mesothorax and wing pads. On *Quercus* and other deciduous trees *Typhlocyba* Grm. *T. quercus* (F.)
- 38 (37) Anterior margin of head with at least 2 pairs of hairs: abdomen hairy.
- 39 (40) Thorax bare; entirely yellowish or with reddish underside *Fagocyba* Dl. *F. cruenta* (H-S)
- 40 (39) Thorax hairy.
- 41 (44) Hairs present only on anterior margin of head; margin almost straight medially (Fig. 65, 66); nymphs mainly brown.
- 42 (43) Outer hairs on anterior margin of head directed laterally (Fig. 65); dorsal surface of nymph brown with brownish yellow patches at tips and bases of wing pads. On deciduous trees *Zonocyba* n. gen. *Z. bifasciata* (Bh.)
- 43 (42) Outer hairs on anterior margin of head are directed obliquely forwards (Fig. 66); tips of wing pads usually dark. On herbaceous plants *Eupteryx* Ct.
- a (b) Nymph with 2 pale cross-bands; pale patches present also on head and pronotum *E. stachydearum* Hdy.
- b (a) Uniformly brown or with a single pale cross-

- band *E. atropunctata* (Gz.) & *E. cyclops* Mm.
- 44 (41) Head with hairs also on posterior part of vertex; anterior margin of head more or less rounded.
- 45 (46) Nymph almost totally covered with hairs of varying lengths: abdominal hairs not arranged in longitudinal rows. On *Ulmus* *Aguriahana* Dt.
- 46 (45) Abdominal hairs arranged in 4 longitudinal rows.
- 47 (48) Body with characteristic dark markings (Fig. 67); small hairs present between longer hairs on abdomen; 2 hairs present on posterior angle of pronotum *Linnavuoriana* Dl.
- a (b) On *Salix* *L. sexpunctata* (Fn.)
- b (a) On *Betula* *L. decempunctata* (Fn.)
- 48 (47) Body without such markings; all hairs more or less of uniform length; only one hair present on posterior angle of pronotum.
- 49 (50) Median hairs on anterior margin of head shorter than lateral hairs (about 1/2); median hairs of abdomen directed backwards (Fig. 68) *Edwardsiana* Zv.
- a (d) Hairs on head and thorax emerge from dark spots.
- b (c) Pronotum with 4 central hairs; distances between median and lateral hairs of tergite VIII are more or less equal. On *Rosa*, *Malus* *E. rosae* (L.)
- c (b) Pronotum with 2 central hairs; distance between median hairs of tergite VIII less than between median and lateral hairs. On *Salix* *E. saliciola* (Edw.)
- d (a) Hairs on head and thorax do not emerge from dark spots.
- e (f) Abdominal hairs shorter, do not reach over adjacent tergite. On *Betula* and *Salix* *E. bergmani* (Tg.)
- f (e) Abdominal hairs very long, extend over adjacent tergite, to next tergite *E. soror* (Lv.) *E. plebeja* (Edw.) *E. menzbieri* Zv.
- 50 (49) Median hairs on anterior margin of head only slightly shorter than lateral ones; median abdominal hairs usually directed obliquely and often extend beyond margin of abdomen (Fig. 69); nymphs vary from pale yellowish to brown. On *Ulmus* *Ribautiana* Zv. *R. ulmi* (L.)

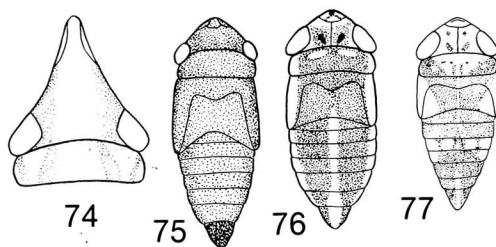
Subfamily Deltocephalinae

Key to tribes:

- 1 (8) Upper margin of frons lies below anterior margin of head; a paired or unpaired additional sclerite extends to upper side of head and lies above frons.
- 2 (3) Abdomen bare; nymph strongly dorsoventrally flattened *Balcluthini* (p. 19)
- 3 (2) Abdomen hairy; nymph not flattened.
- 4 (5) Nymphs short and stocky; head not much wider than pronotum (Fig. 70); vertex clearly longer medially than laterally; hairs present only on tergites VII and VIII, or may be confined to 2 complete rows and two hairs in middle of VIII



Figs. 71—73. — 71. *Grypotes puncticollis* (H.-S.), anterior body. — 72. *Coryphaeus gyllenhalii* (Fn.). — 73. *Doratura stylata* (Bh.), head and pronotum.



Figs. 74—77. — 74. *Platymetopius undatus* (DG.), head and pronotum. — 75. *Deltocephalus pulicaris* (Fn.). — 76. *Doratura exilis* Hv. — 77. *Doratura stylata* (Bh.).

- *Macrostelini* (p. 19)
- 5 (4) Nymph elongate; head considerably wider than pronotum; vertex medially as long as, or only slightly longer than laterally (Fig. 71, 72).
- 6 (7) Abdomen with larger hairs only on tergites VII and VIII (see also couplet 4), additionally tiny hairs are present on sides; additional sclerite unpaired, becoming narrower towards tip; nymphs uniformly brownish (Fig. 71) . *Grypotini* (p. 19)
- 7(6) Abdomen with hairs on all segments, hairs not obviously arranged in rows; occasionally, longitudinal rows of hairs may be present on last three tergites, amongst irregularly distributed hairs; additional sclerite paired; body with characteristic pattern (Fig. 72) *Coryphaeini* (p. 13)
- 8 (1) Frons clearly extends to upper side of head.
- 9 (12) Frons extends to upper side of head as an undivided plate; additional sclerite absent; upper surface of head with concavity before apex (Fig. 73).
- 10 (11) Abdomen with 4 complete rows of short stiff hairs *Doraturini* (p. 13)
- 11 (10) Abdomen with 4 or 8 incomplete rows of hairs *Euscelini* part (*Allygus*, *Graphocraerus*, p. 16)
- 12 (9) Frons extends to upper side of head as 2 narrow sickle-shaped areas, between which lies a triangular additional sclerite.
- 13 (14) Lateral margins of head concave (Fig. 74); abdomen broad, dorsoventrally flattened *Platymetopini* (p. 16)
- 14 (13) Lateral margins of head not concave.
- 15 (16) Whole nymph uniformly pale brown to black-brown, except for anal segment, which is clearly darker (Fig. 75) *Deltocephalini* (p. 16)
- 16 (15) Colouration not as above.
- 17 (18) Vertex, at least medially, clearly horizontal; nymphs unicoloured or with a characteristic banding pattern (bands are rarely irregular); pattern of vertex often divided into 3 pairs of spots separated by a broad pale longitudinal band; no dark bands present beside eyes; vertex usually as long or longer than wide between eyes; abdomen always with 4 complete rows of hairs, together with hairs on posterior angles of tergites VII and VIII *Paralimnini* (p. 13)
- 18 (17) Vertex not horizontal; bands, if present, have pattern consisting of a dark band along a very narrow pale median line, or bands along the inner

side of eyes; vertex often much wider than long; abdomen with 4 complete or more or less reduced rows of hairs *Euscelini* (p. 16)

Tribe Coryphaeini

In the tribe only one representative, *Coryphaeus gyllenhalii* (Fn.).

Tribe Doraturini

Represented by the genus *Doratura* J. Sb.

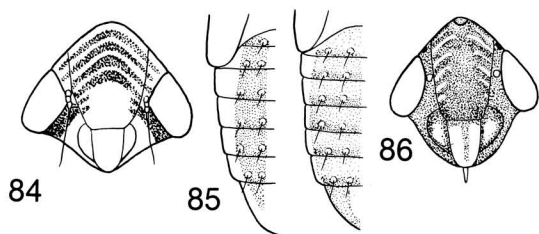
- a (b) Dorsal surface of abdomen pale, speckled dark; large spots present around bases of spines *D. impudica* Hv.
- b (a) Dorsal surface of abdomen mostly dark, either uniformly so, or with dark longitudinal bands.
- c (d) Dorsal surface of abdomen with 2 wide, sharply delimited dark longitudinal bands, separated by a broad (1/4 — 1/5 width of dark bands) whitish longitudinal band; lateral margins of body narrowly whitish (Fig. 76) *D. exilis* Hv.
- d (c) Dorsal surface of abdomen without dark brown longitudinal bands; pale median longitudinal band is narrower.
- e (f) Abdomen usually wholly unicoloured, sometimes with a narrow pale median longitudinal band; lateral margins much paler than central areas, the limits of these parts being continuous *D. homophyla* (Fl.)
- f (e) Abdomen often with whitish patches on tergites IV and V (Fig. 77); if unicoloured, then dark pigment extends almost to the lateral margin, or margin is only slightly paler *D. stylata* (Bh.)

Tribe Paralimnini

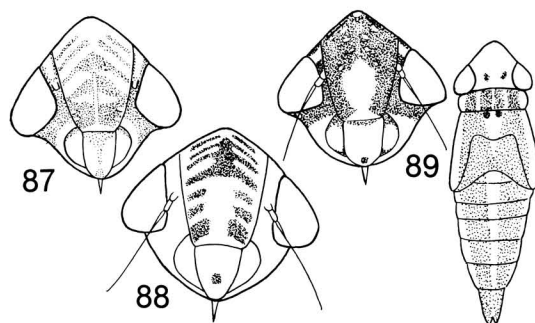
- 1 (4) Frons, immediately beneath vertex, with one broad orange or brown cross-band (Fig. 78).
- 2 (3) Cross-band of frons orange, together with longi-

width of frons beneath; often pale irregularly shaped spot in the middle. Inhabits fens, moist meadows and parks

J. sursumflexus (Th.)

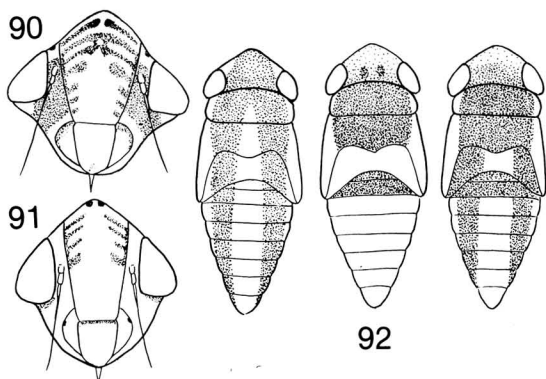


Figs. 84—86. — 84. *Turrutus socialis* (Fl.), face. — 85. *Sorhoanus assimilis* (Fn.), pattern of abdominal tergites. — 86. *Sorhoanus xanthoneurus* (Fb.), pattern of abdominal tergites, face.

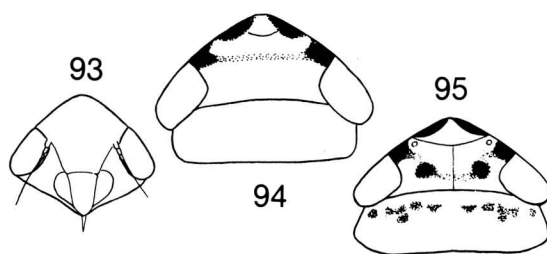


Figs. 87—89. *Jassargus* species. — 87. *J. distinguendus* (Fl.), face. — 88. *J. neglectus* (Th.), face. — 89. *J. flori* (Fb.), face and N₅.

- d (a) Pale brownish yellow species with darker brownish yellow pattern; ventral surface often darker than dorsal surface.
- e (f) Frons with broad pale middle band or large pale patch which extends up to clypeal suture (i.e. the whole ventral part of the frons is pale) (Fig. 88). Inhabits dark coniferous forests. *J. neglectus* (Th.)
- f (e) Frons with pale irregularly-shaped patch not extending up to clypeal suture, but sometimes connected with it by a narrow longitudinal line.
- g (h) Middle bands of mesonotum broader posteriorly; abdominal sternites usually dark with pale middle line and lateral margins (Fig. 89). Inhabits dry meadows *J. flori* (Fb.)
- h (g) Middle bands of mesonotum roughly parallel; abdomen mostly pale: genital segment and preceding segment darker, sometimes only laterally; more rarely, the sides of the remaining sternites are to a certain extent also darkened. Inhabits dry pine forests *J. allobrogicus* (Kb.)
- 23 (22) Meso- and especially metanotum uniformly dark, longitudinal bands indistinct.
- 24 (25) Pattern of anterior body region brownish yellow *Mocuellus* Rb. *M. collinus* (Bh.)
- 25 (24) Body pattern brown *Psammotettix* Hpt.
 - a (l) Vertex distinctly longer than wide.
 - b (e) Entirely pale.
 - c (d) Ground colour brownish yellow; usually with a slightly paler middle line which may have darker margins; eyes grey or greenish-yellow; body stocky. Inhabits fens, meadows and forest edges *P. cephalotes* (H-S)
 - d (c) Ground colour, including eyes, yellowish-white; body elongate. Inhabits sandy places (dunes), where it lives on *Calamagrostis* *P. makarovi* Mr.
 - e (b) Abdomen dark, with rows of pale spots; ventrally also dark.
 - f (g) Anterior body with dark brown longitudinal bands *P. poecilus* (Fl.)
 - g (f) Anterior body without longitudinal bands.
 - h (i) Almost uniformly brown *P. nodosus* (Rb.)
- i (h) Thorax distinctly paler than abdomen.
- j (k) Frons with distinct arch-lines; legs pale with darker rings and spots *P. excisus* (Mm.)
- k (j) Arch-lines of frons usually indistinct; legs almost entirely blackish brown *P. pallidinervis* (Db.)
- l (a) Vertex shorter than wide; anterior body with longitudinal bands.
- m (n) Abdomen approximately the same colour as thorax *P. confinis* (Db.)
- n (m) Abdomen distinctly darker than thorax *P. alienus* (Db.)
- 26 (7) Vertex whitish, greenish, whitish-greenish-yellow or greyish with indistinct longitudinal bands.
- 27 (28) Whole dorsal surface of anterior body more or less uniformly pale whitish green; frons without longitudinal band; ventral surface mainly black. Inhabits dry meadows *Verdanus* Om. *V. abdominalis* (F.)
- 28 (27) Thorax dorsally with longitudinal bands or uniformly brown; frons with white or whitish wedge-shaped spot at least in lower region, or pattern is indistinct; vertex with distinct broad whitish middle line.
- 29 (30) Frons with blackish brown arch-lines and distinct wedge-shaped longitudinal spot in lower region; vertex greenish yellow with broad whitish middle band *Arthaldeus* Rb.
 - a (b) Wedge-shaped whitish spot lying below level of 4th—5th arch-lines (Fig. 90); anterior margin of head forms a right angle *A. pascuellus* (Fn.)
 - b (a) Wedge-shaped whitish spot extends to the transition of vertex and extends over (after narrowing) to the longitudinal band of vertex (Fig. 91); anterior margin of head forms a sharp angle ... *A. striifrons* (Kb.)
- 30 (29) Pattern of frons brownish or indistinct; vertex either greyish with olive green longitudinal band or greenish-yellow with pale narrow middle line *Arocephalus* Rb.



Figs. 90—92. — 90. *Arthaldeus pascuellus* (Fn.), face. — 91. *Arthaldeus striifrons* (Kb.), face. — 92. *Allygus mixtus* (F.), variation of pattern.



Figs. 93—95. — 93. *Macustus grisescens* (Zs.), face. — 94. *Limotettix striola* (Fn.), head and pronotum. — 95. *Scleroracrus decumanus* (Knt.), head and pronotum.

- a (b) Pale grey (brownish yellow in alcohol) with pale olive pattern; thorax longitudinally banded; abdomen speckled dark *A. languidus* (Fl.)
b (a) Vertex yellowish-green, thorax brownish; abdomen more or less uniformly brown, not speckled *A. punctum* (Fl.)

Tribe Platymetopini

Only *Platymetopius undatus* (DG.) was found in this investigation.

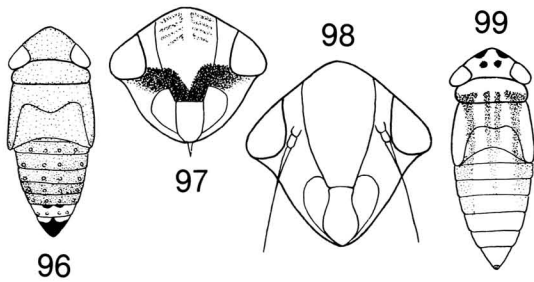
Tribe Deltocephalini

Only two species of the genus *Deltocephalus* Bm. were found in the study area; of these, *D. pulicaris* (Fn.) was the more common (Fig. 75).

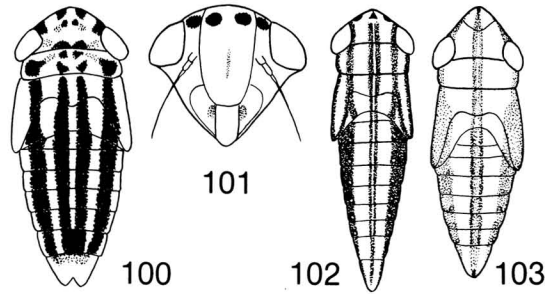
Tribe Euscelini

- 1 (2) Abdomen with 8 (often incomplete) rows of hairs *Allygidius* Rb. *A. commutatus* (Sc.)
- 2 (1) No more than 4 rows of hairs on dorsal surface of abdomen; these may be reduced in extent, or even absent.
- 3 (14) Hairs present only on tergite VIII.
- 4 (5) Hairs present only on hind angles of tergite VIII; pattern of body rather variable (Fig. 92) *Allygus* Fb. *A. mixtus* (F.)
- 5 (4) Hairs present both on hind angles and on hind margin of tergite VIII.
- 6 (7) 4 hairs (2 on hind margin and 2 on hind angles) *Speudotettix* Rb. *S. subfuscus* (Fn.)
- 7 (6) 6 hairs (4 on hind margin, 2 on hind angles).
- 8 (9) Whole insect speckled brown or red; if no speckling, a dark double longitudinal band is present along the whole body *Pithytettix* Rb. *P. abietinus* (Fn.)

- 9 (8) Colouration not as above.
- 10 (11) Abdomen with numerous more or less rounded pale dots; frons with clear arch-lines, separate in upper region; tip or anteclypeus narrows abruptly (Fig. 93) *Macustus* Rb. *M. grisescens* (Zs.)
- 11 (10) Abdomen uniformly dark or with cross-rows of dark spots; upper arch-lines of frons usually fused; anteclypeus parallel-sided.
- 12 (13) Larger forms (N_5 longer than 4 mm); head considerably wider than pronotum (Fig. 94); distinct arch-lines present on frons *Limotettix* J. Sb. *L. striola* (Fn.) & *L. ochrifrons* Vb.
- 13 (12) Smaller forms (N_5 shorter than 3—5 mm); head no wider than pronotum (Fig. 95); frons dark with pale patches or pale with dark patches *Scleroracrus* V.D.
a (b) Anterior body orange-yellow; abdomen uniformly brownish yellow or with cross-rows of brownish dots .. *S. russeolus* (Fn.)
b (a) Abdomen dark or blackish-brown with pale narrow longitudinal middle line.
c (d) Almost entirely dark brown, including front and middle femora *S. transversus* (Fn.)
d (c) Abdomen variegated dark/pale; front and middle femora usually ringed *S. decumanus* (Knt.)
- 14 (3) Hairs also present on preceding tergites; always 4 rows of hairs, sometimes incomplete.
- 15 (16) Median row of hairs incomplete (hairs absent on tergites VI—VIII); body wholly brownish yellow to brown, usually with pale preanal segment (Fig. 96); face with black cross-band (Fig. 97) *Neoliturus* Dt. *N. fenestratus* (H-S)
- 16 (15) Longitudinal rows of hairs complete.
- 17 (26) Dorsal body surface uniformly pale.
- 18 (19) Ground colour yellowish-green or pale green; front tibiae with 1:5 spines; large forms, N_5 longer than 5 mm . *Hesius* Rb. *H. domino* (Rt.)
- 19 (18) Ground colour of dorsal surface orange-yellow; front tibiae with 1:4 spines; smaller forms.
- 20 (21) A row of black dots beneath transition from vertex to frons (Fig. 101) *Cicadula* Zs. (pale specimens, see couplet 34)
- 21 (20) No black dots beneath transition from vertex to frons.
- 22 (23) Hind tibiae without dark spots; front and middle

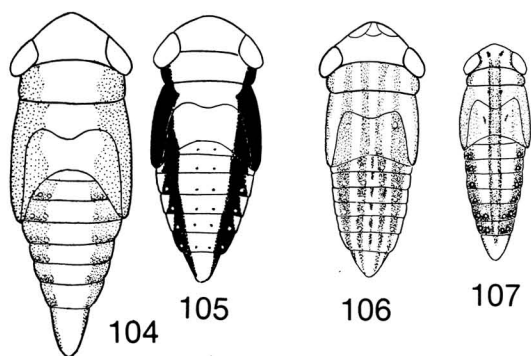


Figs. 96—99. — 96, 97. *Neoliturus fenestratus* (H.-S.), N_5 and face. — 98. *Idionotus cruentatus* (Pz.), face. — 99. *Strictocoris picturatus* (C.Sb.).

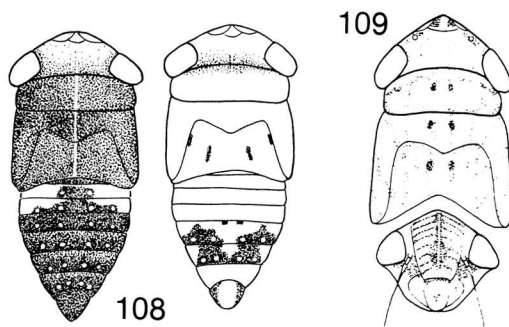


Figs. 100—103. — 100. *Handianus flavovarius* (H.-S.). — 101, 102. *Cicadula quadrinotata* (F.), face and N_5 . — 103. *Cosmotettix preysleri* (H.-S.).

- tarsi sometimes darker towards tip
Cosmotettix Rb. (part, see couplet 36).
- 23 (22) Hind tibiae usually with dark spots around bases of spines.
- 24 (25) Vertex as wide as long; anteclypeus dilates slightly towards tip; greyish longitudinal bands usually present on sides of body; ventral surface not darker *Elymana* DL. (pale specimens, see couplet 37).
- 25 (24) Vertex clearly wider than long; anteclypeus narrows slightly towards tip; upper surface pale brownish, ventral surface clearly darker
Thamnotettix Zs. *T. confinis* Zs.
- 26 (17) Dorsal body surface not uniformly pale.
- 27 (28) Dorsal body surface speckled brownish and red (cf. also couplet 8); 2 paler semicircular patches often present on sides of abdomen; sides of anteclypeus concave (Fig. 98) *Idionotus* Bll.
I. cruentatus (Pz.)
- 28 (27) Dorsal body surface without brownish and red speckling.
- 29 (32) Vertex with sharply delimited black spots.
- 30 (31) Vertex with 2 large black spots and an additional pair of spots on transition to frons (Fig. 99); of the 4 rows of abdominal hairs, 2 are situated in pale, 2 in dark bands *Stictocoris* Ths.
S. picturatus (C. Sb.)
- 31 (30) Vertex with numerous smaller spots (Fig. 100); the longitudinal rows of hairs are confined to dark bands ... *Handianus* Rb. *H. flavovarius* (H.-S.)
- 32 (29) Vertex without sharply delimited black spots.
- 33 (38) Vertex as long as or longer than wide; pattern consists of longitudinal bands, or nymph is brown with pale cross-bands.
- 34 (35) A row of black spots present beneath transition from vertex to frons (Fig. 101); body with 3 brown longitudinal bands, of which the median one is bisected by a narrow pale line (Fig. 102); in some instances, the whole anterior part of the body is uniformly brown *Cicadula* Zs.
a (b) Thorax and abdominal tergite VII—VIII brown, but rarely entirely so
C. nigricornis (J. Sb.) (part).
- b (a) Pattern different, consists of bands.
- c (d) Bands are contrasting; lateral band of vertex (along eye) is distinct along all its length; black spots usually present along sides of anteclypeus *C. quadrinotata* (F.) & *C. quinquenotata* (Bh.)
- d (c) Bands faint or absent.
- e (f) Larger specimens; head width of N_5 greater than 1.1 mm *C. ornata* (Ml.)
- f (e) Smaller nymphs; head width of N_5 less than 1.0 mm.
- g (h) Very pale; bands, if present, are pale brown; band along eyes always absent; face entirely pale. Inhabits dry meadows *C. persimilis* (Edw.)
- h (g) Bands darker; bands along eyes interrupted or absent *C. longiventris* (J. Sb.)
- 35 (34) No black spots present beneath transition from vertex to frons.
- 36 (37) Pattern consists of 3 greyish-brown longitudinal bands (Fig. 103) *Cosmotettix* Rb.
a (b) Pattern distinct; lateral bands extend to lateral margin of abdomen; face with grey or grey-brown band dilating downwards; anteclypeus wholly dark, usually also lorae . *C. preysleri* (H.-S.) & *C. adumbrata* (C. Sb.)
- b (a) Pattern indistinct (bands darker on anterior margin of head); lateral bands of abdomen do not extend to lateral margin; face pale *C. flaveola* (Bh.)
- 37 (36) Pattern consists of 2 pale brownish lateral bands (Fig. 104), sometimes absent (see couplet 24) ..
Elymana DL. *E. sulphurella* (Zs.) & *E. ikumae* (Mm.)
- 38 (33) Vertex distinctly wider than long.
- 39 (40) Body with 2 black longitudinal bands (Fig. 105)
Laburru Rb. *L. impictifrons* (Bh.)
- 40 (39) Body without 2 black lateral longitudinal bands.
- 41 (44) Midline of abdomen dark.
- 42 (43) 3 narrow brownish longitudinal lines present on abdomen, 2 of which continue onto thorax (Fig. 106) *Athysanus* Brm. (part).
A. argentarius Mc.
- 43 (42) Only a single thicker longitudinal line running along abdomen and thorax; this may have a dark border (Fig. 107); N_5 4.5 mm
Ederranus Rb. *E. sachalinensis* (Mm.)
- 44 (41) Abdomen with pale midline.

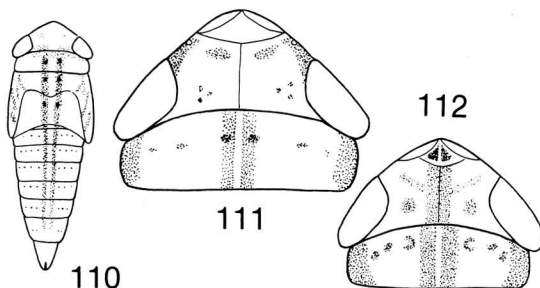


Figs. 104—107. — 104. *Elymana ikumae* (Mm.). — 105. *Laburris impictifrons* (Bh.). — 106. *Athysanus argentarius* Mc. — 107. *Ederranus sachalinensis* (Mm.).

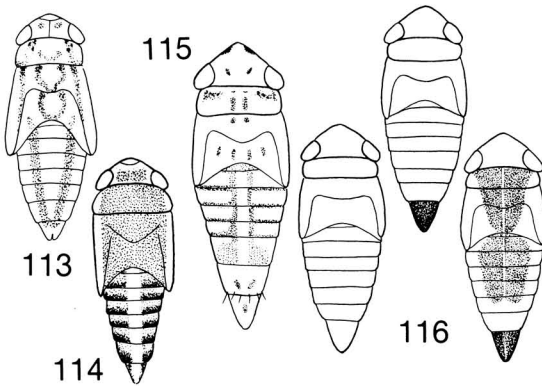


Figs. 108—109. — 108. — *Athysanus quadrum* (Bh.), variation of pattern. — 109. *Doliotettix lunulatus* (Zs.).

- 45 (46) In dark specimens pronotum wholly dark brown, first abdominal tergites pale, tergites IV—VIII dark; in pale specimens darkening present only on tergites VI—VII (Fig. 108) *Athysanus* Brm. (part). *A. quadrum* (Bh.)
- 46 (45) Colouration not as above.
- 47 (54) Dark points on sides of longitudinal bands of meso- and metathorax (Fig. 109).
- 48 (49) Anteclypeus with converging sides; pattern of vertex rather clear and characteristic (Fig. 109) *Doliotettix* Rb. *D. lunulatus* (Zs.)
- 49 (48) Sides of anteclypeus roughly parallel or divergent; pattern faint or absent.
- 50 (51) Abdomen brown, anteriorly with a large pale patch; middle of last tergite and pygofer also pale *Euscelidius* Rb.
- a (b) Pale midline of vertex broadens posteriorly and narrows again on pronotum; pale patch on abdomen usually to the end of tergite V *E. variegatus* (Kb.)
- b (a) Pale midline of vertex of uniform width; pale patch on abdomen usually extends to the end of tergite IV *E. schenki* (Kb.)
- 51 (50) Pattern of abdomen different; 2 longitudinal bands usually present on dorsal surface.
- 52 (53) Distance between dark median longitudinal bands somewhat greater on pro- and mesothorax than on abdomen (Fig. 110) *Conosanus* Ob. & Bil.
- C. convexus* (Kb.)
- 53 (52) Distance between median longitudinal bands more or less equal or pattern is indistinct *Streptanus* Rb.
- a (d) Lateral hairs present on posterior angles of tergites VII and VIII.
- b (c) Large nymphs, N_5 longer than 4.5 mm; distance between median hairs of tergite III more or less equal to that of following tergites; pattern on vertex consists of cross-lines (Fig. 111) *S. aemulans* (Kb.)
- c (b) Small nymphs, N_5 shorter than 4.5 mm; distance between median spines of tergite III clearly shorter than in following tergites; vertex with longitudinal lines (Fig. 112) *S. sordidus* (Zs.)
- d (a) Lateral hairs present only on posterior angles of tergite VIII.
- e (f) Vertex usually without pattern; median hair spots usually distinctly darker than lateral ones; distance between median hairs of tergite III not shorter than in following tergites *S. confinis* (Rt.)
- f (c) Vertex usually with faint pattern; median row of hair spots on abdomen no darker than lateral ones; distance between median hairs of tergite III somewhat shorter than in following tergites . *S. marginatus* (Kb.)
- 54 (47) Margins of longitudinal bands of meso- and metathorax without dark spots *Euscelis* Br.
- a (b) Lateral hairs present only on posterior angles of tergite VIII *E. incisus* (Kb.)
- b (a) Lateral hairs present on posterior angles of tergites VII and VIII.
- c (d) With faint pattern; at least 2 median longitudinal bands usually present *E. distinguendus* (Kb.)
- d (c) Pattern absent; nymph either uniformly pale or dark, with pale narrow midline, pale hair spots, pale forehead and patches on metathorax *E. venosus* (Kb.)



Figs. 110—112. — 110. *Conosanus convexus* (Kb.). — 111. *Streptanus aemulans* (Kb.), head and pronotum. — 112. *Streptanus confinis* (Rt.), head and pronotum.



Figs. 113—116. — 113. *Balclutha calamagrostis* Oss. — 114. *Balclutha lineolata* (Hv.). — 115. *Sagatus punctifrons* (Fn.). — 116. *Macrosteles septemnotatus* (Fn.), variation of pattern.

Tribe Balcluthini

Three species of *Balclutha* Krk were found in the study area.

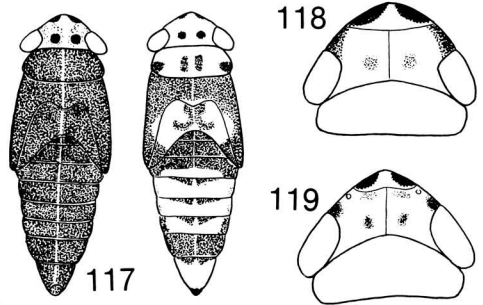
- a (b) Body anteriorly with a very contrasting pattern (Fig. 113); longitudinal bands on abdomen very sharply delimited by brown colouration. Inhabits sandy places on *Calamagrostis* *B. calamagrostis* Oss.
- b (a) Pattern on anterior body indistinct; if longitudinal bands present on abdomen, they are paler and not so sharply delimited.
- c (d) Longitudinal bands, if present on abdomen are unicoloured *B. punctata* (F.)
- d (c) Longitudinal bands of abdomen much darker on hind parts of tergites than on anterior margins (Fig. 114) *B. lineolata* (Hv.)

Tribe Grypotini

Only *Grypotes puncticollis* (H-S) appears to be present in the North European area.

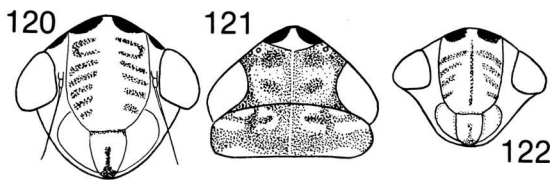
Tribe Macrostelini

- 1 (2) 2 Longitudinal rows of hairs present laterally on abdominal tergites, with 2 median hairs on tergite VIII; hairs on hind angles of tergites V—VIII *Sagatus* Rb. *S. punctifrons* (Fn.) (Fig. 115)
- 2 (1) Hairs present only on tergites VII and VIII.
- 3 (4) 2 hairs present on tergite VII, 4 on tergite VIII *Macrosteles* Fb.
- a (b) Nymph entirely black, with pale narrow longitudinal line and narrow margins of tergites; bluish sheen present when alive. Lives on floating leaves of *Potamogeton* and *Nymphaea* *M. cyane* (Bh.)
- b (a) Nymph not wholly black.

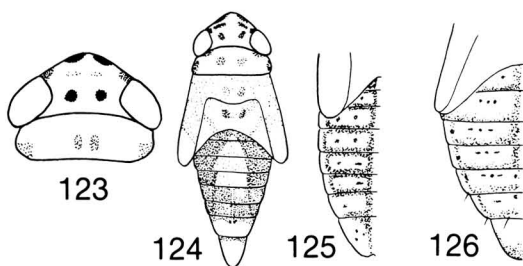


Figs. 117—119. *Macrosteles* species. — 117. *M. variatus* (Fn.), variation of pattern. — 118. *M. viridigriseus* (Edw.), head and pronotum. — 119. *M. fieberi* (Edw.), head and pronotum.

- c (f) Dorsal surface of head uniformly pale or one pair of black spots present; an additional pair of spots usually present on transition to vertex.
- d (e) Nymph either uniformly pale brownish yellow or with 2 black spots on last tergite, or with darkened last tergite and anal segment, or, rarely, black spots on head or crown; if black spots on crown, then the anterior body bears a brown pattern, but the wing pads are always pale (Fig. 116). Lives on *Filipendula ulmaria* *M. septemnotatus* (Fn.)
- e (d) Nymph uniformly brown or with both a pale head and tergites IV—VI; 2 pairs of black spots always present on head. Inhabits undergrowth of forests *M. variatus* (Fn.)
- f (c) More black or brownish spots present on upper surface of head: at least a single small spot on sides of eyes; small brownish cross-spots usually present behind anterior margin.
- g (j) Abdomen either uniformly pale brownish yellow or with darker hind margins of tergites.
- h (i) Large black spots on front of head; these are continuous with brownish spot on ocellular area with at most only a very narrow interruption (Fig. 118); pattern of head rather unclear with exception of small hind spots which may be rather dark *M. viridigriseus* (Edw.)
- i (h) Black spots on front of head smaller; between these and the spots on ocellular area are distinct interruptions (Fig. 119); pattern of head more distinct *M. fieberi* (Edw.)
- j (g) Abdomen darker, anterior margins of tergites usually more darkened; in some cases (*M. laevis*) dark bordering on anterior margins of tergites is absent, but colour is brown or dark brown.
- k (l) Pale stripe below black spots on transition to frons is very narrow (about as wide as



Figs. 120—122. *Macrosteles* species. — 120, 121. *M. horvathi* (Wg.), face, head and pronotum. — 122. *M. laevis* (Rb.), face.



Figs. 123—126. *Macrosteles* species. — 123. *M. laevis* (Rb.), face. — 124. *Macrosteles sexnotatus* (Fn.). — 125. *M. cristatus* (Rb.), pattern of abdominal tergites. — 126. *M. ossianilssoni* Lb., pattern of abdominal tergites.

uppermost arch-line) (Fig. 120); hind pairs of spots on vertex are usually connected with brownish "shadows" (Fig. 121)

- *M. horvathi* (Sg.)
- l (k) Pale stripe below black spots on transition to frons is wider (much wider than uppermost arch-line) (Fig. 122); pattern of vertex not connected with brownish "shadows".
- m (n) Middle spots tend to be absent from vertex (Fig. 123); 3 separate pale spots usually present on lateral margin of wing pads, or wing pads almost entirely brownish-grey *M. laevis* (Rb.)
- n (m) All 3 pairs of spots usually present on vertex (Fig. 124); lateral margin of wing pads usually pale (sometimes with dark "incisions").
- o (p) First abdominal tergites form central white patch which broadens posteriorly (Fig. 124); a double pale patch usually present on the tip of each wing pad ...
..... *M. sexnotatus* (Fn.)
- p (o) Colouration not as above.

- q (r) Pale patches on abdominal tergites each contain 2 brown spots (Fig. 125), between which there are no rows of tiny points *M. cristatus* (Rb.)
- r (q) Rows of tiny spots present, sometimes together with brown spots, within pale patches on abdominal tergites (Fig. 126) *M. ossianilssoni* Lb.
- 4 (3) Only 2 hairs present on tergites VII and VIII; dorsal body surface almost uniformly black *Sonronius* Dt. *S. binotatus* (J. Sb.) & *S. dahlbomi* (Zt.)

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