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Revision of the Central European *Trioza rotundata* FLOR complex (Hemiptera, Psylloidea): taxonomy and bionomy

DANIEL BURCKHARDT[1] & PAVEL LAUTERER[2]

The allegedly polyphagous species *Trioza rotundata* s.l. is revised to contain three species, viz. *Trioza rotundata* FLOR developing mainly on *Cardamine amara* (Brassicaceae), *T. caesaris* sp. n. on *Cardamine hirsuta* (Brassicaceae) and, under special conditions, *Stellaria nemorum* (Caryophyllaceae), as well as *T. remaudierei* sp. n. on *Saxifraga aizoides* (Saxifragaceae). Adults and last instar larvae of the three species are diagnosed, and illustrations are provided of taxonomically relevant structures. The synonymies of *T. coriacea* and *T. greisigeri* with *T. rotundata* are confirmed, and a lectotype is designated for *T. coriacea*. Information is given on the bionomy.

Key-words: Psylloidea, *Trioza*, taxonomy, new taxa, Central Europe, Brassicaceae, Caryophyllaceae, Saxifragaceae.

INTRODUCTION

Jumping plant-lice or psylloids are generally highly host specific developing on a single or a few closely related plant species. Polyphagy has been convincingly demonstrated for only a very few species, e. g. *Bactericera nigricornis* (FOERSTER) (HODKINSON 1981). Allegedly polyphagous species usually desintegrate after thorough taxonomic work into complexes of closely related species with narrow host ranges. The West Palaearctic *Trioza rotundata* is such an example which is discussed here.

CONCI & TAMANINI (1987) suggested that *T. rotundata* is a morphologically variable species and reported hosts from the Brassicaceae, Caryophyllaceae and Saxifragaceae. They listed *T. coriacea* and *T. greisigeri* as juniour synonyms, which is in contrast to VONDRÁČEK (1957) and KLIMASZEWSKI (1967) who treated the former as variation of *T. rotundata* or as good species respectively. Here we present evidence that *Trioza rotundata* sensu CONCI & TAMANINI (1987) consists of three morphologically and biologically distinct species.

MATERIAL AND METHODS

The bulk of the material comes from the collections of the Moravské Muzeum, Brno (MMBC), Muséum d'histoire naturelle, Geneva (MHNG) and Naturhistorisches Museum, Basel (NHMB). Additional specimens were examined or are recorded from the Hungarian Natural History Museum, Budapest (HNHM), Museo Civico di Storia Naturale, Milano (MSNM), Muséum national d'Histoire naturelle, Paris (MNHN) and the Silesian University, Katovice (SUKC). Specimens are dry or slide mounted, or are preserved in alcohol.

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The morphological terminology follows mostly OSSIANNILSSON (1992). For preparing the drawings and taking the measurements specimens were permanently mounted in Canada balsam or temporarely in glycerine.

RESULTS

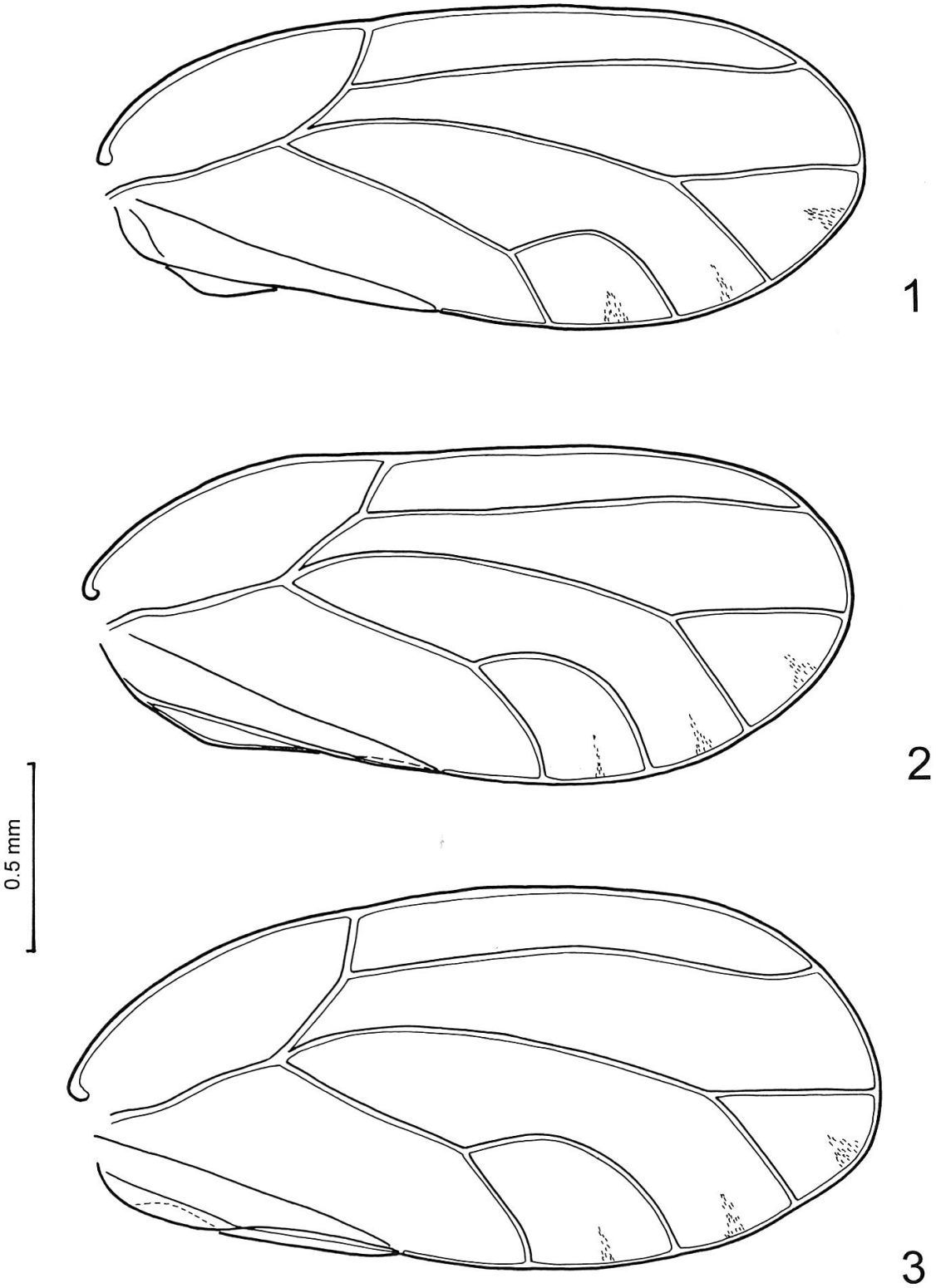
The three species of the *Trioza rotundata* complex (*T. rotundata* s. str., *T. caesaris* sp. n. and *T. remaudierei* sp. n.) differ morphologically in details of the antenna, forewing, and male and female terminalia in the adult, and the size and shape of the humeral lobe, body length/width ratio and, to a lesser extent, proportions of the marginal sectasetae in the last instar larva. Other characters such as coloration, head shape and number of tibial spurs are homogenous and were described by CONCI & TAMANINI (1987) and OSSIANNILSSON (1992). The last instar larva which is strongly flattened, lacks dorsal sectasetae, has 6-7 antennal segments and is characteristically truncated caudally in all three species (Figs 22-24). The tarsal arolium is large fan-shaped quite unlike Fig. 31 of CONCI & TAMANINI (1987: 273).

In the Central European fauna there are two other *Trioza* species sharing with *T. rotundata* s. l. 1+3 apical metatibial spurs and densely spaced surface spinules on the forewing membrane reaching the veins: *Trioza flavipennis* FOERSTER and *T. tripteridis* BURCKHARDT *et al.* The former resembles *T. caesaris* in the long Cu_1 vein of the forewing, the latter is, in this respect, closer to *T. rotundata* and *T. remaudierei* with a short Cu_1 vein. Both species are clearly distinct in the morphology of their terminalia and their host plant ranges. Densely spaced surface spinules on the forewing and 1+3 apical metatibial spurs occur also in some species of the *Trioza dispar* LÖW group which is characterised by the converging axes of the genal processes and the terminal setae on the antennal segment 10 which are highly unequal in length, one being very short. The species of the *T. rotundata* group have parallel axes of the genal processes, and terminal setae of which the shorter is at least half as long as the longer.

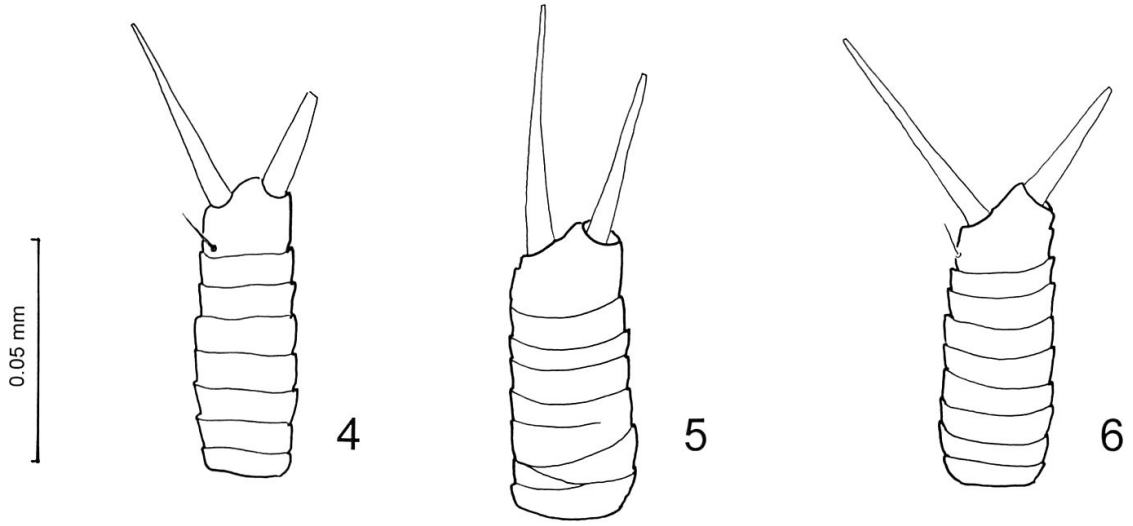
Trioza caesaris sp. n. (Figs 1, 4, 7-9, 16, 19, 22)

? *Trioza coriacea* sensu KLIMASZEWSKI 1964, 1967, 1969, 1975, nec HORVÁTH 1895.
Trioza rotundata FLOR p.p.; CONCI & TAMANINI 1987.

Material examined. Holotype ♂, **Czech Republic**, Moravia borealis, Hrubý Jeseník Mountains, SW face of Pradéd (Altvater) Mountain, S slope of Česnekový Důl ravine, 1000 m, 8.vii.1984, *Stellaria nemorum* ssp. *montana*, P. Lauterer (NHMB).
Paratypes. **Austria**: Niederrösterreich, Bezirk Scheibbs, 1984, F. Ressl (2 ♂, MHNG); same but Garning, Neuhaus, 6.x.1991, Rausch (1 ♀, NHMB). - **Czech Republic**: same as holotype but 900-1100 m, *Stellaria nemorum* ssp. *montana* and *Cardamine hirsuta* (7 ♂ + ca 50 specimens, MMBC, 1 ♂, 2 ♀, NHMB); same data but reared specimens, 1-15.viii.1984, *Stellaria nemorum* (last instar larval skins, MMBC); same data but reared, 3.ix.1984 (1 adult, MMBC); same data but reared, 10.ix.1984 (2 adults, MMBC); same data but reared, 8.viii.1984, *Cardamine hirsuta* (1 adult, MMBC); same data but S facing slope between Kouty nad Desnou and Červenohorské sedlo saddle, 610-740 m, 29.viii.1984, *Cardamine hirsuta* growing in wooded bog with springs with *Cardamine amara* and *Stellaria nemorum* (1 ♂, MMBC). - **France**: Haut-Rhin, D 27, Sondernach to Col de Plazerwasel, 875 m, 3.v.1986, D. Burckhardt (1 ♂, MHNG). - **Italy**: Aosta Valley, above St. Rémy, 1500 m, 23.ix.1980, *Picea abies*, D. Burckhardt (1 ♂, MHNG); Trentino, Province Trento, Folgaria, Malga II Posta, 1420 m, 14.viii.1987, reared from *Stellaria nemorum* ssp. *nemorum*, Conci & Tamanini (6 ♂, 22 larvae and larval skins, MSNM); Lombardia, SO, Chiesa Valmalenco, Chiareggio, 1600 m, 9.v.1988, *Cardamine amara*, Conci & Tamanini (1 ♀, 2 adults without abdomen, MSNM); same data but San Giuseppe, 1400 m (2 ♂, MSNM). - **Switzerland**: GR, Val Calanca, Val di Passit, 1500 m, 5.ix.1979, *Picea abies* (D. Burckhardt) (dry and slide mounted 5 ♀, MHNG); Valle Mesolcina, Alpe d'Albiniasco, 1500-1600 m, 4.ix.1979, *Picea abies*, D. Burckhardt (3 ♂, 1 ♀, MHNG); Val Bregaglia, Val da Pila, 1600-1650 m, 31.v.1981, *Picea abies*, D. Burckhardt (4 ♂, 4 ♀, MHNG); Engadine, above Ftan, 1900 m,



Figs 1-3: Forewing (scale bar = 0.5 mm). - 1. *Trioza caesaris*. - 2. *Trioza remaudierei*. - 3. *Trioza rotundata*.



Figs 4-6: Last antennal segment (scale bar = 0.05 mm). - 4. *Trioza caesaris*. - 5. *Trioza remaudierei*. - 6. *Trioza rotundata*.

27.v.1980, *Picea abies*, D. Burckhardt (1 ♀, MHNG). - SZ, Rigi North face, Rigiwald, 1300-1400 m, 6.v.1989, conifers, Burckhardt & Önuçar (2 ♀, MHNG). - VS, Simplon, South face, 1680 m, 13.ix.1979, *Larix decidua* (D. Burckhardt) (dry and slide mounted 4 ♂, 4 ♀, MHNG, NHMB).

Distribution. Austria, Czech Republic, France, Italy and Switzerland. The species reported as *T. coriacea* from Poland (KLIMASZEWSKI 1964, 1967, 1969, 1975) is, based on Klimaszewski's description, referrable to *T. caesaris*. Some of the records of *T. rotundata* from Italy (CONCI & TAMANINI 1987) concern *T. caesaris*. Most of the known localities of *T. caesaris* are in the Southern Alps. North of the Alps the species is apparently rare and localised, known only from each a single locality in the Czech Republic, France and Poland respectively.

Diagnosis. Adult. Forewing (Fig. 1) broadly rounded apically, foremargin relatively straight, vein Cu_1 about 3 times as long as Cu_{1b}, hence cell cu_1 small. Antennal segment 10 (Fig. 4) with longer terminal seta about twice as long as shorter one. Paramere (Figs 7-9) with relatively inconspicuous anterior lobe, sclerotised apical tooth large, curved posteriad. Distal portion of aedeagus (Fig. 16) relatively small. Female terminalia (Fig. 19) short, dorsal margin of proctiger more or less straight, subgenital plate pointed apically. Measurements and ratios in Tabs 1, 2.

Fifth instar larva (Fig. 22). Body relatively narrow. Humeral lobes ending well beyond anterior eye margin, relatively narrow and pointed. Marginal sectasetae relatively long.

Host plants. *Cardamine hirsuta* (Brassicaceae) and, under special conditions, *Stellaria nemorum* (Caryophyllaceae).

Bionomy. In the Czech Republic the species is, as far as known, restricted to one valley in the Jeseníky Mountains at an altitude of 990-1100 m. There it lives in the herbaceous layer of a 50-70 years old spruce forest with wetter and dryer portions containing *Cardamine hirsuta* and *Stellaria nemorum* spp. *montana* respectively. On the latter host many galls were also observed at 610-740 m altitude. The locality which is difficult to reach was visited only once. The field observations are, therefore, restricted to a single date, 8.vii.1984, which was probably the peak of the oviposition period. All *Cardamine* plants in the field which were examined were covered in thousends of eggs. The eggs were spaced in a distance of 1 mm and were on the upper and lower leaf surfaces. Eggs and smaller larval instars induced conspicuous 1.0 x 1.0-1.5 mm sized, flat pit galls. Eggs were also deposited on the lower

leaf surface of *Stellaria nemorum* ssp. *montana*. There the eggs and smaller larval instars induced 1.5 x 1.5 mm sized, flat pit galls. Larger instars induced slightly larger pits of 2 x 2 mm dimensions. The galls on *Cardamine* were smaller but slightly more produced than those on *Stellaria*. Some 50 adults were collected on *Stellaria* which were used for subsequent breeding. In the laboratory the breedings were made on very wet plants. The breedings were started on 9.vii. By 22.vii. most larvae on *Cardamine hirsuta* had hatched out of the eggs, and the larvae developed well, most having reached the fourth instar. On *Stellaria nemorum*, most larvae died immediately after emergence, or even failed to hatch. The leaves were covered in dead larvae of first and second instars, and there were only a very few surviving third and fourth instar larvae. It looks like *Stellaria* is not a regular host. *Stellaria* plant are covered in small trichiae which prevent the larvae to get in close contact with the plant surface which may result in a lethal water loss. In the laboratory the mortality was also very high on *Cardamine hirsuta*. By 3.viii. 15 last instar larvae were left on *C. hirsuta*. The development on *Stellaria* was slower with 8 fourth and 3 fifth instar larvae at that date. Due to high density, the larvae on *C. hirsuta* caused the plants to die. The larvae were mostly on the stalks. The stalks of *Stellaria* are narrower and the larvae, therefore, more enveloping the stalk than in *Cardamine* where the larva rather sits on the stalk. Four adults could be reared on *C. hirsuta* from 8.viii.-4.ix., most of the larvae died in the last instar. On *Stellaria* at least 4 adults imerged from 4.ix.-10.ix., the development was, thus, completed later. In the laboratory the egg and larval mortality was very high probably due to too wet conditions. From parasitised larvae 7 chalcidoid wasps emerged.

Comments. *Trioza caesaris* differs from *T. rotundata*, *T. remaudierei* and *T. tripteridis* in the long Cu_1 vein of the forewing. From *T. flavipennis* it differs in the apically broadly rounded forewing which is angular in *T. flavipennis*, the broad paramere which is narrowly digitiform in *T. flavipennis*, and the pointed female proctiger which is truncate in *T. flavipennis*.

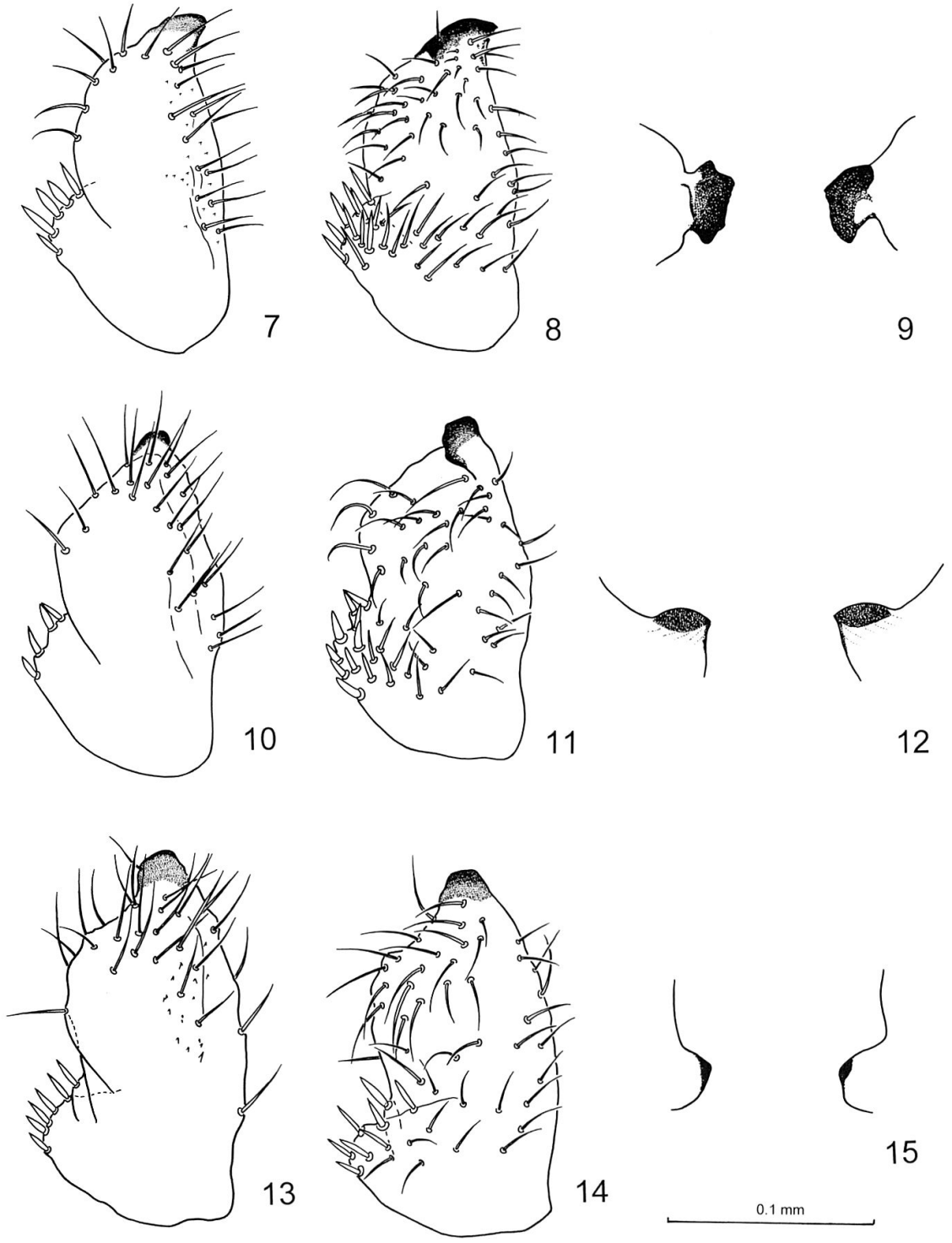
Derivation of name. The species is dedicated to Cesare Conci (Milano).

Table 1. Measurements (in mm) of adult characters: n = number of measured specimens; HW = head width; WL = forewing length; MP = male proctiger length; PL = paramere length; AE = length of distal portion of aedeagus; FP = female proctiger length.

Taxon	n ♂, ♀	HW	WL	MP	PL	AE	FP
T. caesaris	1, 4	0.51-0.56	2.03-2.38	0.16	0.16	0.15	0.33-0.44
T. remaudierei	3, 2	0.53-0.56	2.03-2.13	0.17-0.22	0.17-0.20	0.17-0.20	0.29-0.39
T. rotundata	2, 1	0.52-0.58	2.10-2.32	0.22-0.25	0.17-0.18	0.20	0.38

Table 2. Ratios of adult characters: AL/HW = antenna length / head width; WL/HW = forewing length / head width; WL/B = forewing length / width; Cu_1/Cu_{1b} = lengths of Cu_1/Cu_{1b}; TL/HW = metatibia length / head width; MP/HW = male proctiger length / head width; FP/HW = female proctiger length / head width; FP/SP = female proctiger length / subgenital plate length.

Taxon	AL/HW	WL/HW	WL/B	Cu_1/Cu_{1b}	TL/HW	MP/HW	FP/HW	FP/SP
T. caesaris	1.20-1.27	3.94-4.63	2.22-2.39	2.96-3.14	0.82-0.88	0.31	0.65-0.79	1.95-2.44
T. remaudierei	1.00-1.33	3.69-4.18	2.33-2.47	1.39-2.10	0.75-0.80	0.36-0.39	0.53-0.71	1.21-1.70
T. rotundata	1.17-1.33	3.82-4.08	2.08-2.19	1.62-1.81	0.83-0.91	0.42-0.45	0.66	1.36



Figs 7-15: Paramere (scale bar = 0.1 mm). - 7-9. *Trioza caesaris*. - 10-12. *Trioza remaudierei*. - 13-15. *Trioza rotundata*. - 7, 10, 13. Outer face. - 8, 11, 14. Inner face. - 9, 12, 15. dorsal view, cephalad above, caudad below.

Trioza remaudierei sp. n. (Figs 2, 5, 10-12, 17, 20, 23)

Trioza rotundata FLOR p.p.; CONCI & TAMANINI 1987.

Material examined. Holotype ♂, **Switzerland**: LU, Entlebuch, Wegegg, Grosse Fontannen, 1110 m, 29.iii.1988, conifers, D. Burckhardt (MHNG).
Paratypes. **Austria**: Niederösterreich, Bezirk Scheibbs, Scheibbs, Ginselberg, 16.x.1978, *Picea abies*, F. Ressl (1 ♂, MHNG). - **Italy**: Piemonte, CN, Demonte, Valley NE Arma, 1700 m, 30.viii.1986, *Saxifraga aizoides*, Conci & Tamanini (5 larvae, MSNM). - **Switzerland**: GR, Alp Flix, Cuorts, 1950 m, 15.x.2001, conifers, D. Burckhardt (1 ♀, NHMB); Engadine, above Ftan, 2000 m, 27.v.1980, *Picea abies*, D. Burckhardt (1 ♂, MHNG); same but 2500 m (1 ♀, MHNG); Engadine, Val Ruinains, 1160 m, 26.v.1980, *Picea abies*, D. Burckhardt (1 ♂, 2 ♀, MHNG); Val Calanca, Val di Passit, 1500 m, 5.ix.1979, *Picea abies*, D. Burckhardt (1 ♂, MHNG). - OW, Pilatus, Aemsigen, 1600 m, 15.x.1999, conifers, D. Burckhardt (1 ♀, NHMB). - UR, Gotthard, 1700 m, 4.ix.1962, *Saxifraga aizoides*, G. Remaudière (29 ♂, 30 ♀, 19 fifth instar larvae and skins MNHN, 6 ♂, 4 ♀, 2 larvae, MMBC, 5 ♂, 5 ♀, 6 larvae, NHMB); same but 29.viii.1962 (24 ♂, 19 ♀, 54 fifth instar larvae and skins, MNHN).

Distribution. Austria, Italy and Switzerland. Some of the records of *T. rotundata* from Italy concern this species (CONCI & TAMANINI 1987).

Diagnosis. Adult. Forewing (Fig. 2) broadly rounded apically, foremargin conspicuously straight, vein Cu_1 up to about twice as long as Cu_{1b}, hence cell cu_1 large. Antennal segment 10 (Fig. 5) with shorter terminal seta slightly more than two thirds length of longer one. Paramere (Figs 10-12) with conspicuous angular anterior lobe, small sclerotised apical tooth curved anteriad. Distal portion of aedeagus (Fig. 17) relatively large. Female terminalia (Fig. 20) with relatively long proctiger which is concave dorsally, and short, apically truncate subgenital plate. Measurements and ratios in Tabs 1, 2.

Fifth instar larva (Fig. 22). Body wide. Humeral lobes ending slightly beyond or at anterior eye margin, wide and narrowly rounded. Marginal sectasetae relatively short.

Host plant. *Saxifraga aizoides* (Saxifragaceae).

Bionomy. The larvae sit on the leaves of the host (CONCI & TAMANINI 1987: 273, Fig. 38). The species probably overwinters as adult judging from Swiss specimens collected in spring and autumn on conifers. The species occurs mostly in montane and subalpine altitudes (1000-2000 m).

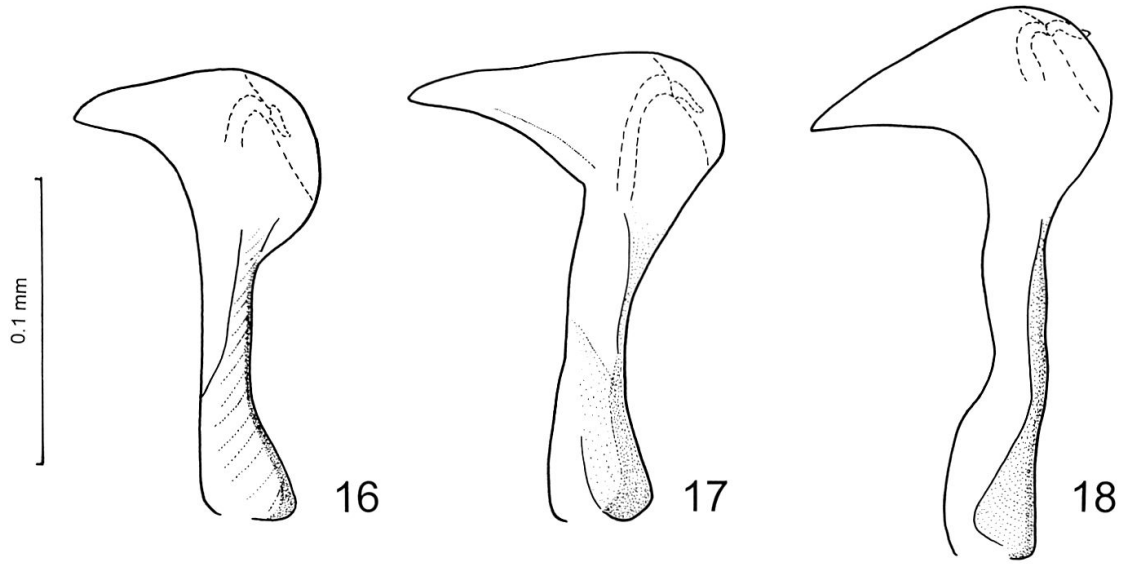
Comments. *Trioza remaudierei* differs from *T. caesaris* and *T. flavipennis* in the short Cu_1 vein of the forewing. From *T. tripteridis* it can be separated by the anteriorly lobed paramere, the large hook on the distal portion of the aedeagus, and the short, apically truncate female proctiger. From *T. rotundata* it differs in the very straight fore margin and the broadly rounded apex of the forewing which is weakly curved and irregularly angular respectively in *T. rotundata*, the larger ratio of the lengths of the longer to the shorter terminal seta on antennal segment 10, the forward rather than inward directed apical tooth on the paramere, and the very short female subgenital plate.

Derivation of name. The species is dedicated to Georges REMAUDIÈRE (Paris).

***Trioza rotundata* FLOR** (Figs 3, 6, 13-15, 18, 21, 24)

Trioza rotundata FLOR, 1861: 406; ŠULC 1912; SCHAEFER 1949; VONDRÁČEK 1957; DOBREANU & MANOLACHE 1962; OSSIANNILSSON 1992.
Trioza coriacea HORVÁTH, 1895: 165; CONCI & TAMANINI 1987, synonymy with *Trioza rotundata*.
Trioza greisigeri HORVÁTH, 1897: 642; VONDRÁČEK 1957, synonymy with *Trioza rotundata*; KLIMASZEWSKI 1962.
Trioza rotundata FLOR p.p.; CONCI & TAMANINI 1987.

Material examined. **Austria** (Niederösterreich), **Bulgaria**, **Czech Republic**, **France** (Haute Savoye, Puy-de-Dôme), **Germany** (Hessen), **Poland**, **Slovakia**, **Sweden, Switzerland** (BE, BL, GR, JU, LU,



Figs 16-18: Distal portion of aedeagus, lateral view (scale bar = 0.1 mm). - 16. *Trioza caesaris*. - 17. *Trioza remaudierei*. - 18. *Trioza rotundata*.

NE, OW, SZ) (MHNG, MMBC, NHMB, SUKC). **Romania**: Lotriaria (lectotype ♂ and 2 paralectotypes ♀ of *Trioza coriacea*, here designated, MMBC). - **Slovakia**: Késmárk, Kressebrunnen, *Nasturtium officinalis*, M. Greisiger (paralectotypes adults and larvae of *Trioza greisigeri*, HNHM).

Distribution. Trioza rotundata was described from Austria (FLOR 1861), *T. coriacea* from Romania (HORVÁTH 1895) and *T. greisigeri* from Slovakia (HORVÁTH 1897). The records by SCHAEFER (1949) from Switzerland, DOBRANU & MANOCLACHE (1962) from Romania, and OSSIANNILSSON (1992) from Sweden and Norway concern *T. rotundata*. The records from Italy (CONCI & TAMANINI 1987) concern all three species, viz. *T. rotundata*, *T. caesaris* and *T. remaudierei*. We have not seen material from the Caucasus from where *T. rotundata* is listed by GEGECHKORI & LOGINOVA (1990).

Diagnosis. Adult. Forewing (Fig. 3) indistinctly angular apically, foremargin weakly curved, vein Cu_1 2.5 times as long as Cu_{1b}, or less, hence cell cu_1 large. Antennal segment 10 (Fig. 6) with shorter terminal seta slightly less than two thirds length of longer one. Paramere (Figs 13-15) with conspicuous angular anterior lobe, small sclerotised apical tooth curved medially. Distal portion of aedeagus (Fig. 18) with large apical hook. Female terminalia (Fig. 20) with relatively long proctiger which is concave dorsally, and long apically truncate subgenital plate. Measurements and ratios in Tabs 1, 2.

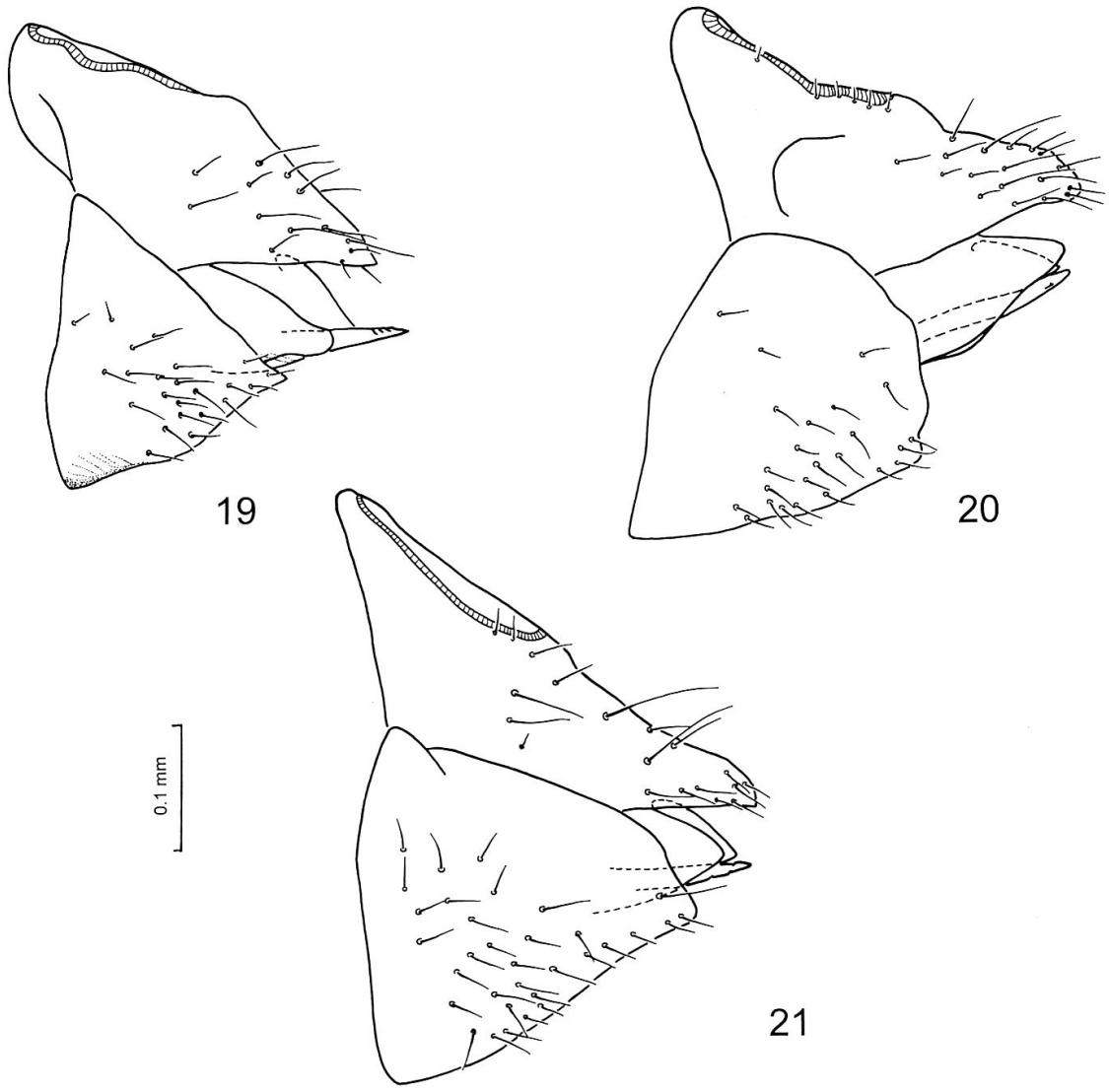
Fifth instar larva (Fig. 22). Body wide. Humeral lobes ending at anterior eye margin, relatively narrow, pointed. Marginal sectasetae short.

Host plant. Cardamine amara, including ssp. *opizii*, maybe also other *Cardamine* species (Brassicaceae). In the Czech Republic and Bulgaria, *T. rotundata* was found exclusively and many times on *Cardamine amara* (PL pers. obs.), suggesting that this is the only host species in Central Europe. The record of *C. impatiens* by LAUTERER (1974) is based only on adult specimens, and the host identity is not absolutely certain. From the Caucasus *Cardamine hirsuta* and *C. uliginosa* are reported as hosts (GEGECHKORI & LOGINOVA 1991). *Nasturtium officinale* has been recorded by HORVÁTH (1897), a host which was often cited by subsequent authors but never confirmed since. CONCI & TAMANINI (1987) questioned the record. In the Jeseníky Mountains (Czech Republic), at 610-740 m altitude many pit galls

were observed on *Stellaria nemorum* (Caryophyllaceae) and adults of *T. rotundata* but only one adult of *T. caesaris* were collected at the same locality.

Bionomy. The oviposition and the sucking of young larval instars produce a small pit-like depression of about 1 x 1 mm dimensions on *C. amara*. *Trioza rotundata* overwinters as adult on conifers. The eggs and first to third larval instars live mostly on the young leaves and stalks, on the upper parts of the plant. About half of the fourth instar larvae migrate to lower portions of the plants. They are light ochreous in colour as instars 1-3. The last larval instar is very hygrophilous and generally dark coloured, which is typical for cold and wet conditions. The last instar larvae are on the lower leaf surface and on the stalks touching the ground. Some larvae have been observed submerged in water. Skins of the last instar were observed at about 5 cm above ground. The first imagoes of the new generation were observed on 25.vii.; on 29.viii. still many larvae, mostly fifth instar, could be found.

The species is widespread in Central Europe where it occurs from colline (250 m) to subalpine (2000 m) altitudes. In the Czech Republic in lower altitudes



Figs 19-21: Female terminalia, lateral view (scale bar = 0.1 mm). - 19. *Trioza caesaris*. - 20. *Trioza remaudierei*. - 21. *Trioza rotundata*.

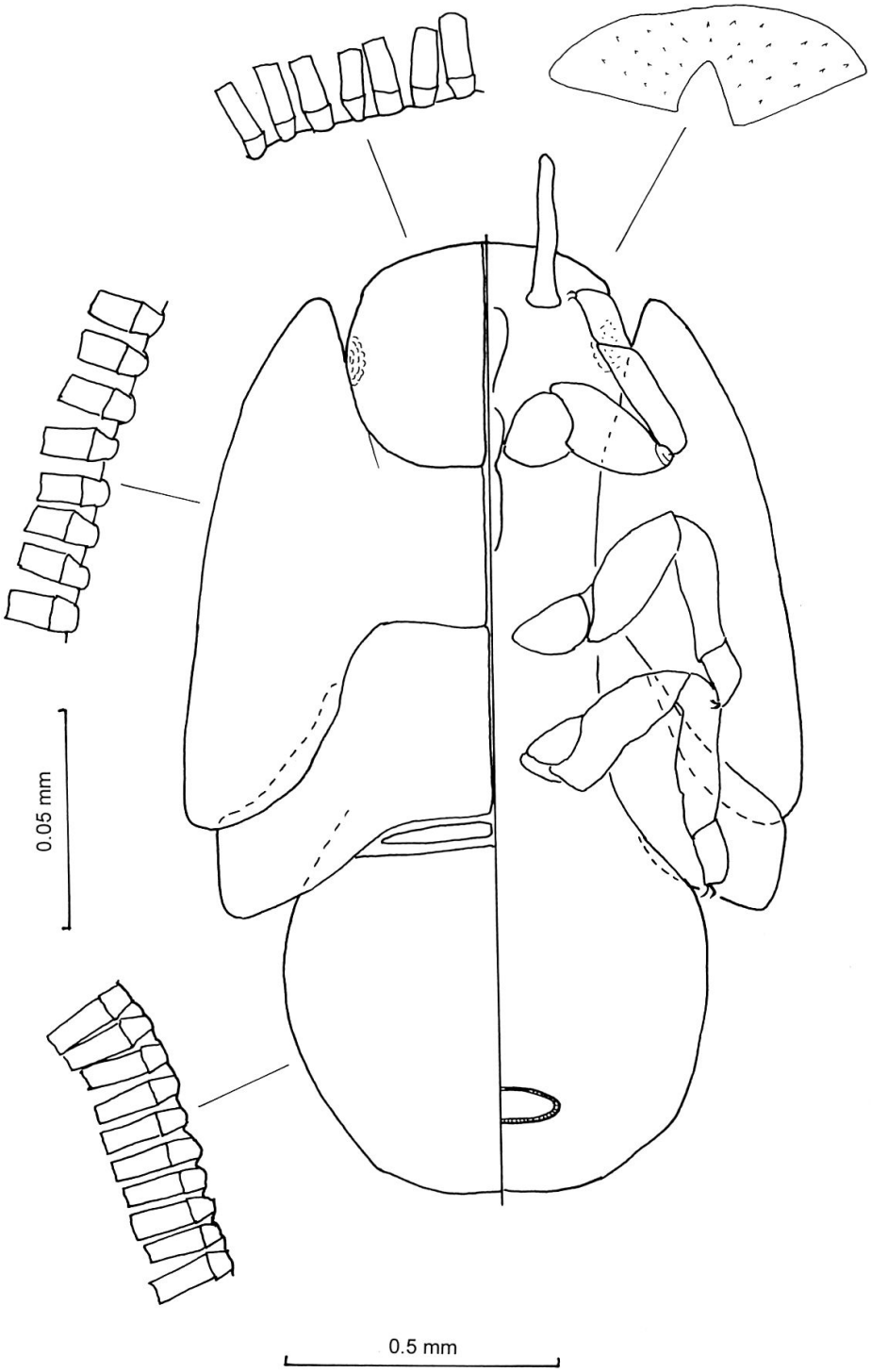


Fig. 22: Last instar larva of *Trioza caesaris*, left dorsal view, right ventral view (scale bar = 0.5 mm) with details of marginal sectasetae and tarsal arolium (scale bar = 0.05 mm).

of 250-650 m the overwintered adults fly on the host *Cardamine amara* at the end of March to beginning of April. The habitats where *T. rotundata* develops are often wet places near springs or small rivers which are wooded, usually with *Alnus* and conifers in the surroundings. The host plants grow in the under growth of these wet woods. In May adults copulate and the female lay eggs. Ripe eggs in ovaries were observed as early as 30.iii. The species has one generation per year. Overwintered imagoes live relatively long. The latest adults were observed on 22.vii. Also the

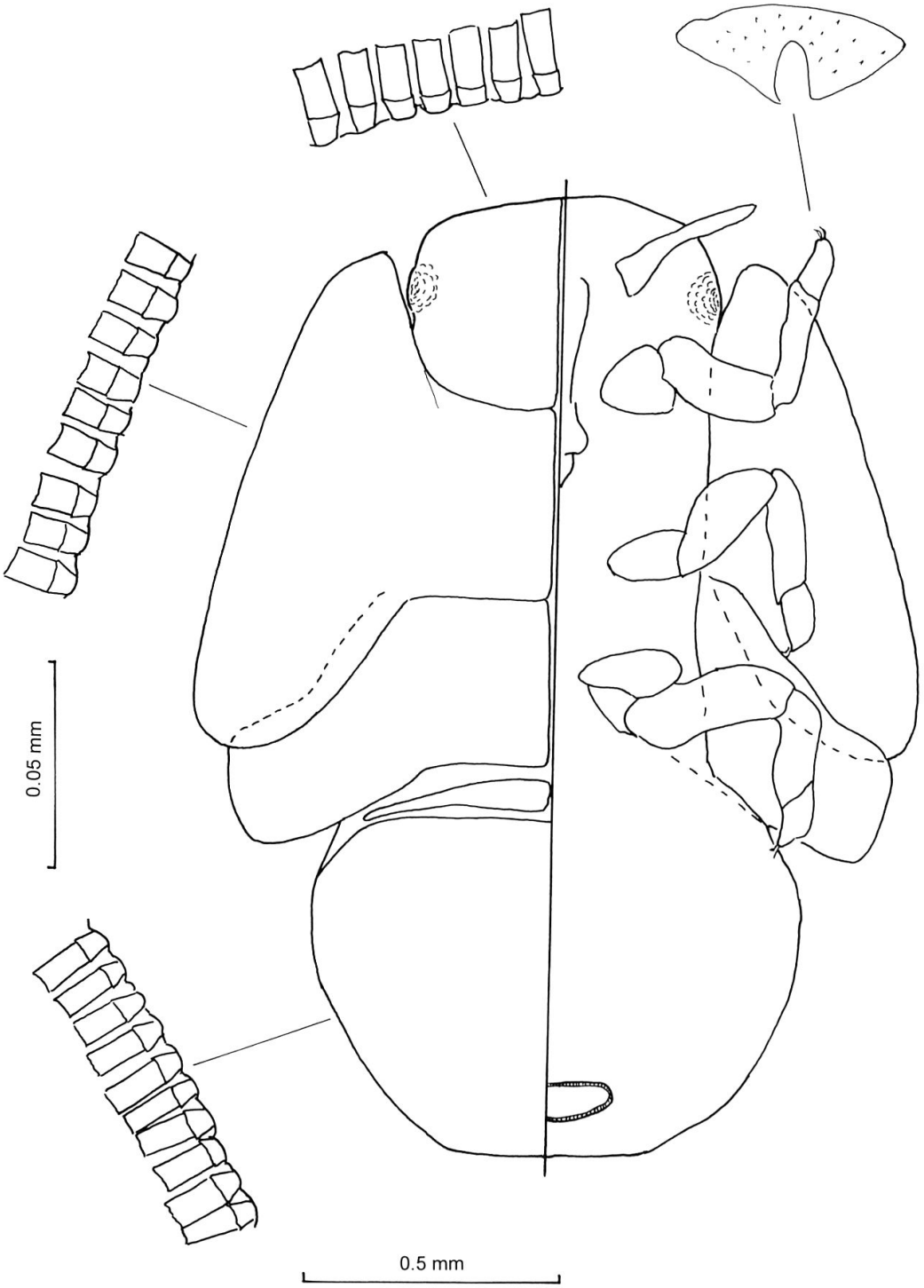


Fig. 23: Last instar larva of *Trioza remaudierei*, left dorsal view, right ventral view (scale bar = 0.5 mm) with details of marginal sectasetae and tarsal arolium (scale bar = 0.05 mm).

period when the eggs are deposited is prolonged. At higher altitudes, the overwintered adults are around until end of June to beginning of July. In Switzerland at 2000 m, adults were common at the end of June; in Bulgaria and Slovakia, in the mountains, a few adults were observed in early July.

Comments. *Trioza rotundata* differs from *T. caesaris*, *T. remaudierei* and *T. flavipennis* as discussed above. From *T. tripteridis* it can be separated by the

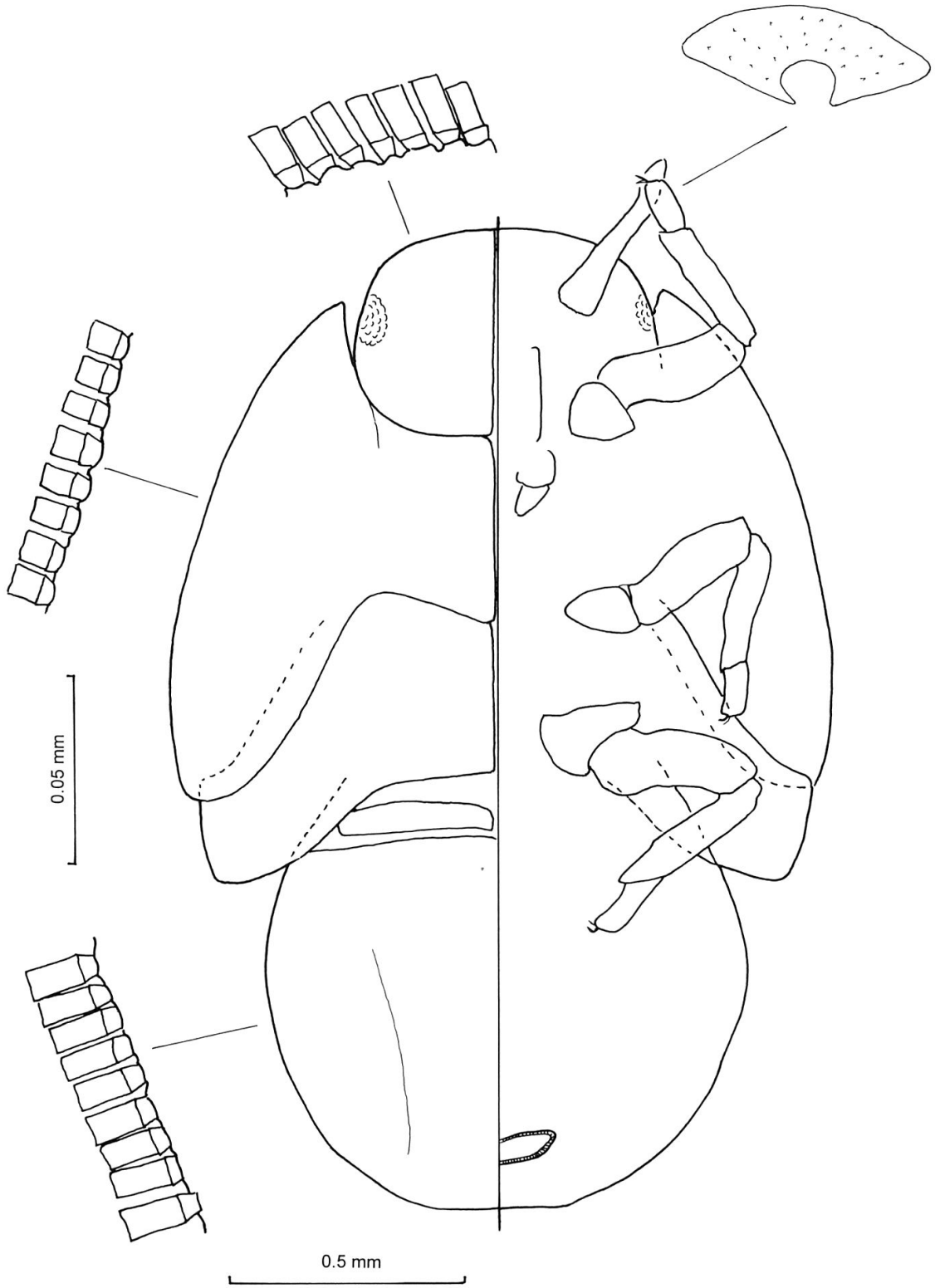


Fig. 24: Last instar larva of *Trioza rotundata*, left dorsal view, right ventral view (scale bar = 0.5 mm) with details of marginal sectasetae and tarsal arolium (scale bar = 0.05 mm).

forewing which has a weakly curved fore margin and is angularly rounded apically, in addition to details in the male and female terminalia.

The synonymy of *T. greisigeri* with *T. rotundata* has been proposed by VONDRÁČEK (1957) and was accepted by subsequent authors. It is confirmed by our

study. *Trioza coriacea*, in contrast, was treated as synonym of *T. rotundata* by CONCI & TAMANINI (1987) but as good species by KLIMASZEWSKI (1964, 1967, 1969, 1975). Part of the type series of *T. coriacea* which should be deposited in the HNHM is apparently lost (CONCI & TAMANINI 1987). There are three slide mounted syntpes (1 male, 2 females) of *T. coriacea* in the ŠULC collection (MMBC) which clearly are *T. rotundata*. To avoid further taxonomic confusion, the male is designated here as lectotype of *T. coriacea*, which is considered a junior subjective synonym of *T. rotundata*. This is in accord with CONCI & TAMANINI (1987) rather than KLIMASZEWSKI (1964, 1967, 1969, 1975) whose concept of *T. coriacea* is a misidentification of *T. caesaris*.

DISCUSSION

Trioza rotundata, *T. caesaris* and *T. remaudierei* form a small, morphologically homogeneous group which is characterised by the shape of the paramere, the distal portion of the aedeagus, and the fifth instar larva with a truncate caudal plate. Of the three species, *T. rotundata* has the widest distribution occurring in Central (including North Italy), North and East Europe and possibly in the Caucasus, the other two species are more restricted in distribution. *Trioza caesaris* occurs mostly in the Southern Alps with isolated records from the Czech Republic, France and Poland. *Trioza remaudierei* is restricted to the Alps including Northern and Southern prealps.

Our study suggests that the host ranges are, as suspected, narrower than estimated by CONCI & TAMANINI (1987). In Central Europe the three species are monophagous: *T. caesaris* on *Cardamine hirsuta*, *T. remaudierei* on *Saxifraga aizoides* and *T. rotundata* on *Cardamine amara*. It is noteworthy that *T. caesaris* can complete the development also on another, unrelated host, viz. *Stellaria nemorum*; the developement takes, however, longer than on *Cardamine*, and the egg and larval mortality is very high. *T. caesaris* induces on both *Cardamine hirsuta* and *Stellaria nemorum* respectively pit galls. The galls on the latter are larger than those on the former.

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TABLE LEGENDS

Tab. 1. Measurements (in mm) of adult characters: n = number of measured specimens; HW = head width; WL = forewing length; MP = male proctiger length; PL = paramere length; AE = length of distal portion of aedeagus; FP = female proctiger length.

Tab. 2. Ratios of adult characters: AL/HW = antenna length / head width; WL/HW = forewing lenth / head width; WL/B = forewing length / width; Cu_1/Cu_{1b} = lengths of Cu_1 / Cu_{1b}; TL/HW = metatibia length / head width; MP/HW = male proctiger length / head width; FP/HW = female proctiger length / head width; FP/SP = female proctiger length / subgenital plate length.