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DESCRIPTION OF THE THIRD INSTAR LARVAE OF *TERELLIA TUSSILAGINIS* AND *T. GYNAECOCHROMA* (DIPTERA, TEPHRITIDAE)

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Description of the Third Instar Larvae of *Terellia tussilaginis* and *T. gynaecochroma* (Diptera, Tephritidae). Troshyn, A. M. — The third instar larvae of *Terellia* (*Cerajocera*) *tussilaginis* (Fabricius, 1775) and *T. (C.) gynaecochroma* (Hering, 1937) are described and figured for the first time based on material from Kryvyi Rih vicinities (Ukraine).

Key words: *Arctium lappa* L., *Onopordum acanthium* L., Ukraine, host plant, biocontrol, peacock flies, fruit flies, Terelliini.

Introduction

The genus *Terellia* Robineau-Desvoidy, 1830 is represented by *ca.* 62 species (Norrbon et al., 1999; Korneyev, 2003; Kütük et al., 2011; Kütük & Yaran, 2011; Yaran et al., 2018) of medium-sized flies with hyaline or yellow-banded wings occurring predominantly in the Palaearctic Region, and a few species each in the Nearctic and Oriental Regions. Their larvae feed in flower heads and stems of various asteraceous plants inducing no galls (Korneyev et al., 2005; Korneyev, 2021).

Larvae of some *Terellia* were described by Persson (1963): *T. (Cerajocera) ceratocera* (Hendel, 1913) and *T. (C.) plagiata* (Dahlbom, 1850); Kandybina (1970): *T. (s. str.) ruficauda* (Fabricius, 1794); Dirlbek & Dirlbek (1962), Belcari (1991): *T. (s. str.) longicauda* (Meigen, 1830), and S. Korneyev (2008): *T. colon* (Meigen, 1826) and *T. virens* (Loew, 1846). Brief data on the structure of spiracles and the descriptions of some species are rather incomplete and also in need of redescription; furthermore, larvae of most *Terellia* species remain predominantly undescribed. Currently, some species of the Terelliini are used as biocontrol agents of invasive knapweeds and starthistles in the United States and Canada (Coombs, 2004), and successful diagnostics of larvae along with adult flies is important for monitoring distribution and infestation level.

In 2023–2024 the author collected larvae of Tephritidae in Ukraine. Some of them belong to species of *Terellia*, of them larvae of *Terellia tussilaginis* and *T. gynaecochroma* remained undescribed until now, and here we describe the third instar larvae based on optical microscopy study.

Material and Methods

Larvae of fruit flies were taken from samples of burdock flower heads *Arctium lappa* L. and stems *Onopordum acanthium* L. in Kryviy Rih vicinities in the South of Ukraine. Larvae were killed in boiling water and then stored in 70° ethanol.

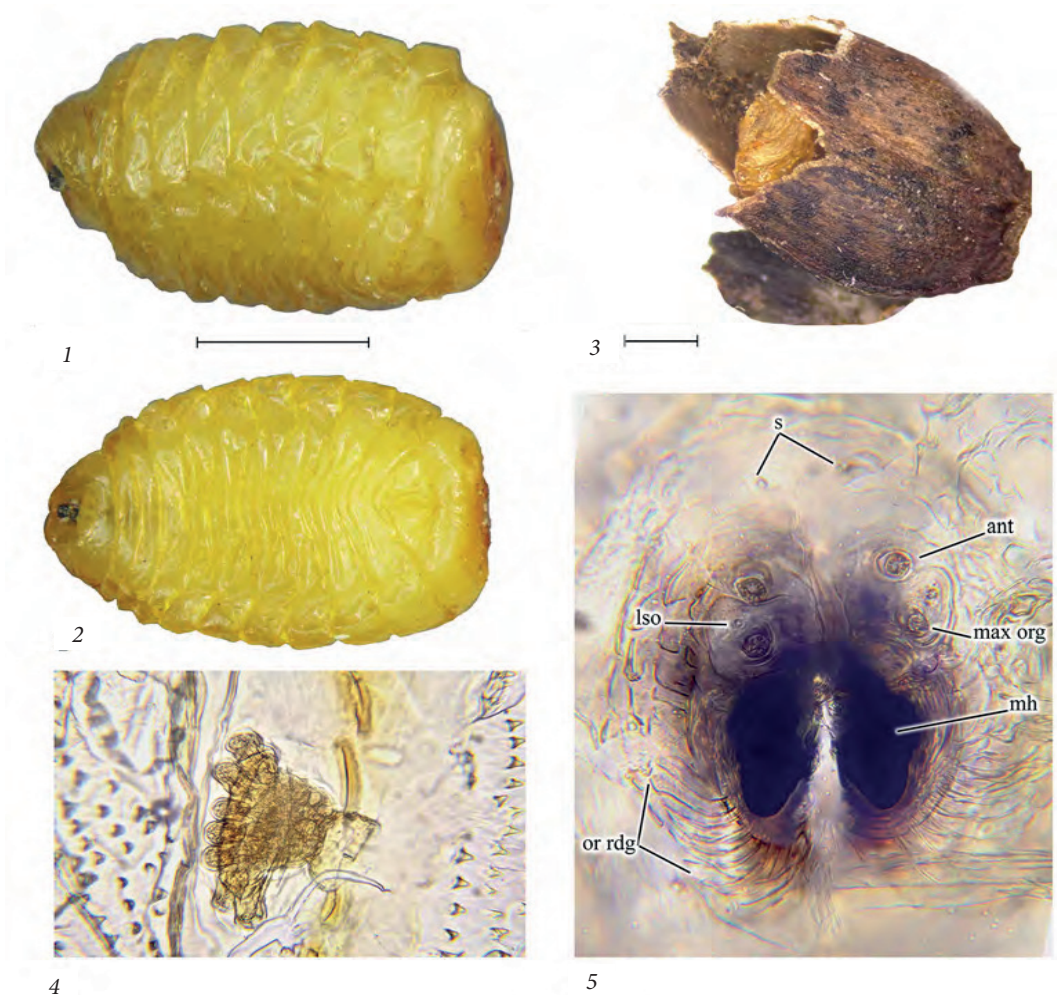
Larvae were dissected obliquely across the anterior part and perpendicularly to the longitudinal axis between abdominal segments 7 and 8 as depicted by Kandybina (1977: fig. 61). Tissues were macerated by boiling in 10% potassium hydroxide on a water bath. All structures were measured under dissecting binocular microscopes MBS-9 and Zeiss Stemi 2000 and examined under a compound microscope Wild M-11 (at 10×, 20× and 40× magnification) equipped with Canon PowerShot A640 and Canon EOS M50 Mark 2 cameras, respectively. Series of photos were focus stacked with the use of Helicon Focus 8.2.0 software (Kozub et al., 2023).

Morphological terminology generally follows that of White et al. (1999), so far the most detailed terminology available; alternative terms used by Kandybina (1977) or other authors are given in parentheses; names of the areas of the caudal segment follow White et al. (1999), Kandybina (1970, 1977); the terms “medial sensory organ” and “sclerotized plaques” for oval or polygonal thickenings in the cuticle, were proposed by S. Korneyev (2008).

Voucher specimens are deposited in the collection of I. I. Schmalhausen Institute of Zoology (Kyiv).

Terellia (Cerajocera) tussilaginis (Fabricius, 1775) (figs 1–2)

Material examined. Ukraine, Kryviy Rih District, Gleyuvatka, in flower heads of *Arctium lappa* L. 25.10.2023, 3 third instar larvae (A. Troshyn leg.).



5 — gnathocephalon, anterior view: ant — antenna; lso — lateral sensory organ; mh — mouthhook; max org — maxillary sensory organ; or rdg — oral ridges; s — sensillum.

Description. Third instar larva. Body short oval; 2.54–3.1 mm long (mean 2.78 mm); 1.74–2.0 mm wide (mean 1.84 mm); 1.45–1.55 times as long as wide (mean 1.51 mm). Coloration. Uniform, pale yellow to pale orange. Posterior surface of segment 8 yellow light.

Gnathocephalon (fig. 1, 5) mostly smooth, inverted into thoracic segment 1 at rest. Anterior sensory lobes short, partly separated at anterior margin. Antenna (dorsal sensory organ) (fig. 1, 5: ant) with short, rounded terminal segment. Maxillary sense organ (fig. 1, 5: max. org) with sensilla. Medial sensory organ indistinct or absent. Anterior portion of sensory lobe with network of grooves. Antero-lateral portion of gnathocephalon with 10–12 oral ridges (fig. 1, 5: or rdg). Lateral sensory organ (fig. 1, 5: lso) distinct. Stomal sensory organ and labial lobe not examined. Dorsal surface of gnathocephalon with additional sensilla (fig. 1, 5: s) posterior of oral ridges. Postero-lateral portion of gnathocephalon with rather numerous small and acute denticles.

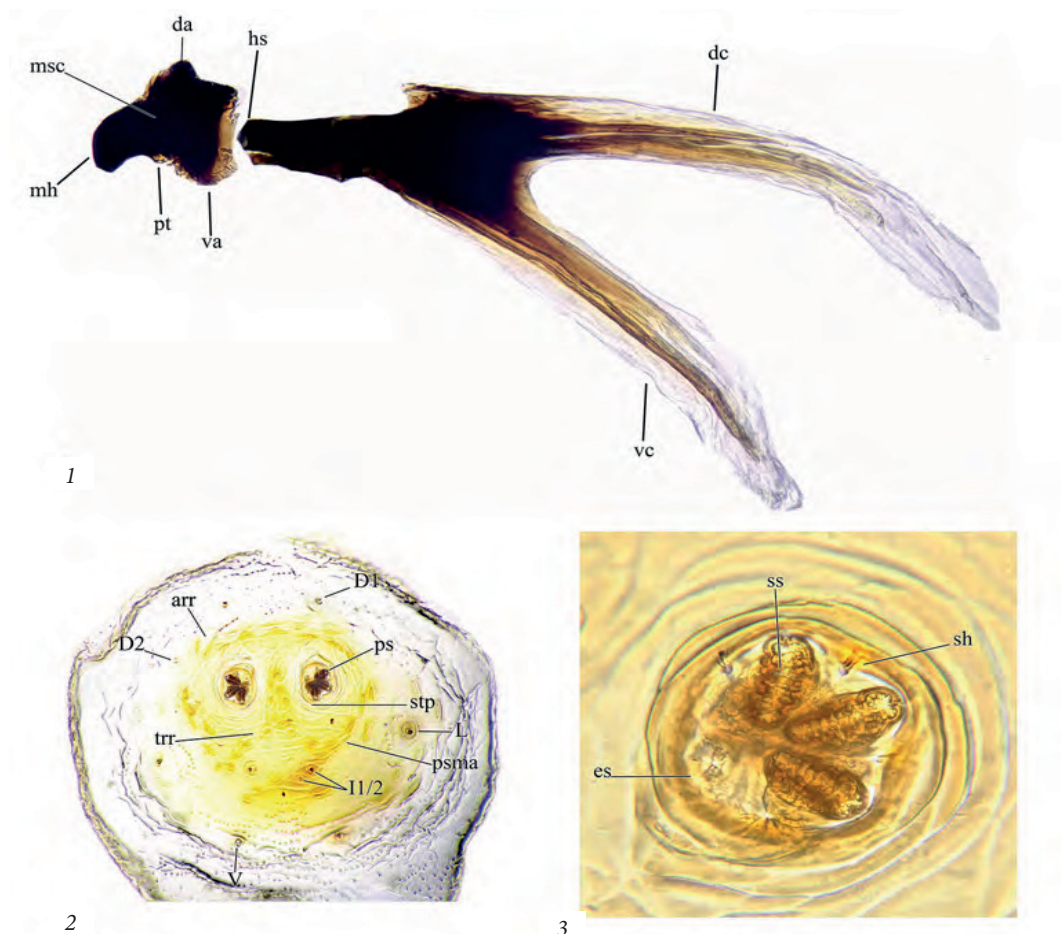


Fig. 2. *Terellia tussilaginis*, larva. 1 — cephalopharyngeal skeleton; left; 2 — segment 8, posterior view; 3 — posterior spiracle: arr — arcuate row of plaques; D1, D2 — dorsal sensilla 1 and 2; da — dorsal apodeme; dc — dorsal cornu; es — ecdysial scar; hs — hypopharyngeal sclerite; I1/2 — intermediate sensilla 1 and 2; L — lateral sensillum; mh — mouthhook; msc — mandibular sclerite; ps — posterior spiracle; psma — plaques of submedial area; pt — praeapical tooth; s — sensillum; ss — spiracular slits; sh — spiracular hair; sta — stigmatal area; stp — stigmatal plate; trr — transverse ridge of plaques; V — ventral sensilla; va — ventral apodeme; vc — ventral cornu.

Cephalopharyngeal skeleton (fig. 2, 1). Mandibular sclerite (fig. 2, 1: msc) almost as long as high, with single blunt mouthhook (fig. 2, 1: mh) and without additional lobes or teeth. Preapical tooth (fig. 2, 1: pt) at most vestigial, barely visible; dorsal and ventral apodemes (fig. 2, 1: da, va) about as high as long. Hypopharyngeal (= hypostomal) sclerite (fig. 2, 1: hs) moderately long, ca. two times as long as high, parastomal sclerite fused to it, indistinct. Dental sclerite not expressed. Pharyngeal sclerite and dorsal and ventral cornu (fig. 2, 1: dc, vc) visible, but details not clear.

Thoracic segments 1–3 moderately sclerotised. Segment 1 short, forming a shield-like “mask” (fig. 1, 5) with T-shaped aperture when gnathocephalon retracted; antero-dorsal surface with denticles. Anterior spiracle (fig. 1, 4) with 7 lobes. Segments 2–3 almost smooth.

Segment 8 (fig. 2, 2) with rows of denticles at anterodorsal margin and with 10–11 elongate-oval or subrectangular plaques forming arcuate ridge (fig. 2, 2: arr) between stigmatal and dorsal areas. Stigmatal area with slightly sunken spiracular plates (fig. 2, 2: stp) separated by a rather wide area 1.2 times as wide as spiracular plate and bearing 6–7 subrectangular plaques (fig. 2, 2). Medial area separated from stigmatal area by transverse arched ridge (fig. 2, 2: trr) formed by plaques. Submedial area with 5 oval plaques (fig. 2, 2: psma) forming two irregular rows. Intermediate sensilla (fig. 4, 2: I1 and I2) present, close to each other. Dorsal sensillum (fig. 2, 2: D1 and D2), lateral sensillum (fig. 2, 2: L) and ventral sensillum (fig. 2, 2: V) seem to be present, but not depicted in fig. 2, 2). Other sensilla to be expected (see White et al., 1999, Fig. 33.7) not visible.

Posterior spiracle (fig. 2, 3) with three spiracular slits (fig. 2, 3: ss). Dorsal slit almost vertical, two times as long as wide. Medial and ventral slits 2.4–2.7 as long as wide; ventral slit almost horizontal, forming angle about 120° to dorsal slit. Bundles (from dorsal to medioventral) with 3–4 — 2–3 — 3 — 2–3 spiracular hairs (fig. 2, 3: sh).

Diagnosis. Third instar larva of *T. tussilaginis* differs from all known larvae of *Terellia* subgenus *Cerajocera* by the absence of a sclerotized prominence on abdominal segment 8. From other known larvae in species of the genus *Terellia*, it differs by the less sclerotized last abdominal segment and the number of plaques on it.

Notes. This species is widespread in Europe and in some regions of the Far East, in particular, on Sakhalin Island. First instar larvae develop in flower heads of *Arctium lappa* L. and the 2–3rd instar larvae develop in the burdock seeds (Korneyev, 1987). Superficially similar *T. (C.) nigronota* (Korneyev, 1985) occurs in Eastern Europe, and the Caucasus (Korneyev, 1985), also in association with burdocks, but larvae have not been collected or described yet.

***Terellia (Cerajocera) gynaecochema* (Hering, 1936) (figs 3–4)**

Orellia lappae, *Terellia (Cerajocera) lappae*: auctt.

Material examined. Ukraine, Kryviy Rih District, in lateral stems of *Onopordum acanthium* L., 4.01.2024, 5 third instar larvae (A. Troshyn leg.).

Description. Third instar larva. Body is elongated oval; 4.71–5.54 mm long (mean 5.2); 1.51–2.0 mm wide (mean 1.8); 2.61–2.9 times as long as wide (mean 2.77). Coloration. The body is light yellow. Posterior surface of segment 8 orange to reddish brown.

Gnathocephalon (fig. 3, 4) mostly smooth, inverted into thoracic segment 1 at rest. Anterior sensory lobes short, partly separated at anterior margin. Antenna (dorsal sensory organ) (fig. 3, 4: ant) with short, rounded terminal segment. Medial sensory organ

(fig. 3, 5: mso) hidden in median groove, but rather distinct. Anterior portion of sensory lobe with network of grooves. Antero-lateral portion of gnathocephalon with 10–12 oral ridges (fig. 3, 4: or rdg). Lateral sensory organ (fig. 3, 5: lso) distinct. Stomal sensory organ (fig. 3, 5: sto org) small, round, without lobes or teeth. Lateral surface of anterior sensory lobe and gnathocephalon posterior of oral ridges with network of anastomosing grooves, more expressed than in *T. (C.) tussilaginis*. Labial lobe not examined. Postero-lateral portion of gnathocephalon with rather numerous small and acute denticles.

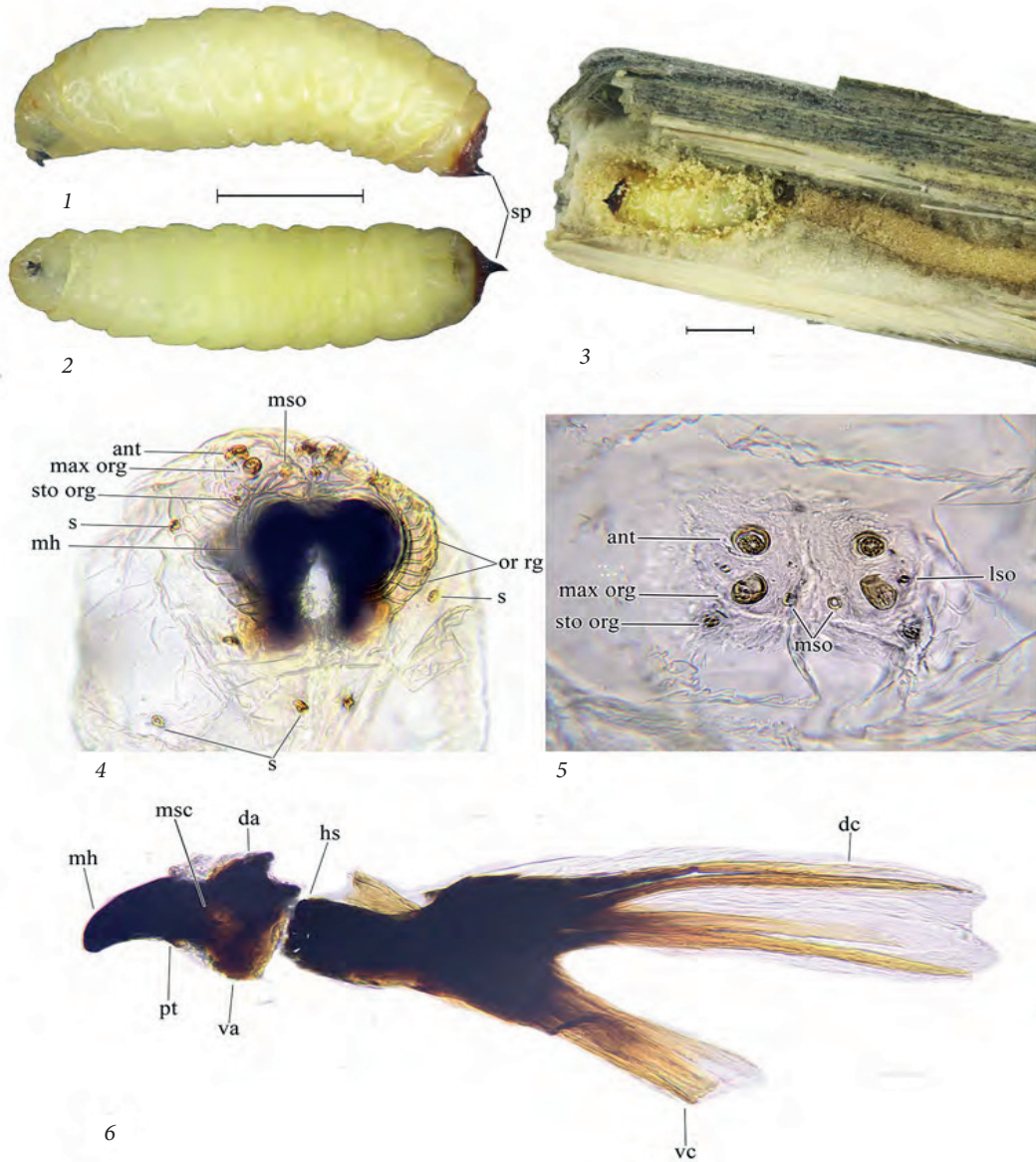


Fig. 3. *Terellia gynaecochroma*, larva. 1 — habitus, left; 2 — same, ventral; 3 — larvae in stems; 4 — gnathocephalon, anterior view; 5 — gnathocephalon, anterior view (cephalopharyngeal skeleton, and ventral parts removed); 6 — cephalopharyngeal skeleton: ant — antenna; da — dorsal apodeme; dc — dorsal cornu; hs — hypopharyngeal sclerite; lso — lateral sensory organ; mh — mouthhook; max org — maxillary sensory organ; msc — mandibular sclerite; mso — medial sensory organ; pt — praeapical tooth; or rdg — oral ridges; s — sensillum sp — sclerotized prominence; sto org — stomal sensory organ; va — ventral apodeme; vc — ventral cornu.

Cephalopharyngeal skeleton (fig. 3, 6). Mandibular sclerite (fig. 3, 6: msc) oblong, with simple blunt mouthhook (fig. 3, 6: mhk) and without additional lobes or teeth. Preapical tooth (fig. 3, 6: pt) at most vestigial, barely visible; dorsal and ventral apodemes (fig. 3, 6: da, va) about as high as long. Hypopharyngeal sclerite (fig. 3, 6: hs) moderately long, ca. two times as long as high, parastomal sclerite fused to it, indistinct. Dental and labial sclerite not expressed. Pharyngeal sclerite and dorsal and ventral cornu (fig. 2, 1: dc, vc) visible, but details not clear.

Thoracic segments 1–3 moderately sclerotised. Segment 1 short, forming a shield-like “mask” (fig. 3, 4, 5) with T-shaped aperture; antero-dorsal surface without spinules. Anterior spiracle (fig. 4, 1) with 8 lobes. Segments 2–3 almost smooth, with rows of denticles at anterior margins.

Abdominal segments 1–7 with papillae on lateral and ventrolateral surfaces. Creeping welts present on abdominal segments, more obvious ventrally, each creeping welt composed of several rows of spinules with truncate apex and rounded perimeter, but sometimes slightly pointed.

Segment 8 (fig. 4, 2) without plaques at anterodorsal margin. Stigmatal area with slightly elevated stigmatal plates separated with area 0.5 times as wide as spiracular plate and bearing 4–5 polygonal or oval plaques. Ventral sensillum (fig. 4, 2: V1) and intermediate sensilla (fig. 4, 2: I1, I2 and I3) present, close to each other. Other sensilla to be expected not visible, maybe due to contaminations. On the ventral side there is a sclerotized prominence (fig. 4, 2: sp).

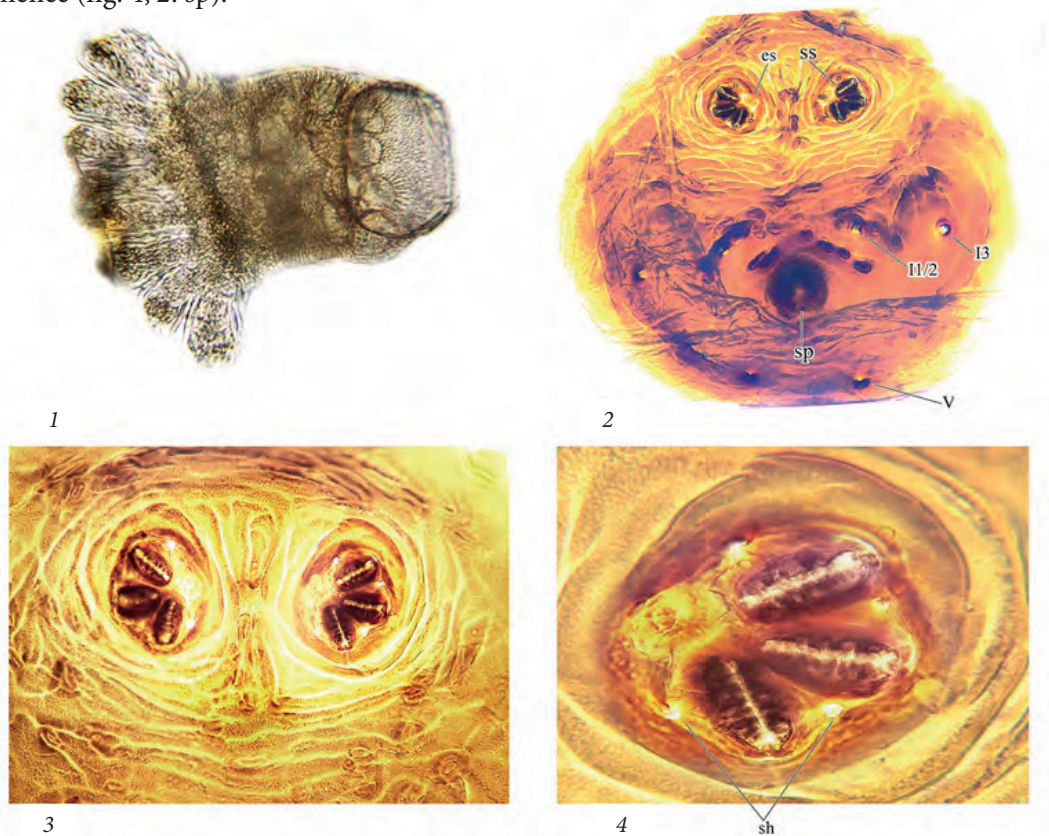


Fig. 4. *Terellia gynaechroma*, larva. 1 — anterior spiracle; 2 — segment 8, posterior view; 3 — stigmatal area, enlarged; 4 — posterior spiracle: es — ecdysial scar; I1/2, I3 — intermediate sensilla 1, 2 and 3; ss — spiracular slits; sh — spiracular hair; sp — sclerotized prominence; V — ventral sensilla.

Posterior spiracle (fig. 4, 4) with three spiracular slits. Dorsal slit almost horizontal. Ventral slit almost vertical, forming angle 95–105° to dorsal slit. Bundles (from dorsal to medioventral) with 2–2–2–1 lanceolate, flattened spiracular hairs (fig. 4, 4: sh).

Diagnosis. Third instar larva of *T. (C.) gynaecochroma* differs from all known larvae of Terelliini except *T. (C.) plagiata* (Dahlbom, 1850), *T. (C.) ceratocera* (Hendel, 1913), *T. (C.) clarissima* Korneyev, 1987 and *T. (C.) cyanooides* Korneyev, 2003 by the presence of a sclerotised prominence of the abdominal segment 8.

Terellia (Cerajocera) gynaecochroma differs by the single simple conical shape of the sclerotised prominence of 8th segment from *T. (C.) plagiata* and *T. (C.) ceratocera*, which are double or simple bifurcated in those species, respectively (Persson, 1963). *Terellia (C.) clarissima* and *T. (C.) cyanooides* also have the prominence single and simple, but there is no detailed description of their larvae.

Notes. *T. (C.) gynaecochroma* is widespread in Central and Eastern Europe, and apparently in Israel (Freidberg & Kugler, 1989), Turkey (Kütük & Yaran, 2011) and Iran (Mohamadzade & Korneyev, 2018). Larvae develop in flower heads, and at the 3rd instar, in the lateral stems of *Onopordum acanthium* (Korneyev, 1987).

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