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## DESCRIPTION OF THIRD INSTAR LARVAE OF *TERELLIA COLON* AND *T. VIRENS* (DIPTERA, TEPHRITIDAE)

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**Description of Third Instar Larvae of *Terellia colon* and *T. virens* (Diptera, Tephritidae).** Korneyev S. V. — Third instar larvae of *T. colon* (Meigen, 1826) and *T. virens* (Loew, 1846) are described and figured for the first time based on material from Kyiv Region (Ukraine).

Key words: Diptera, Tephritidae, *Terellia*, larva.

**Описание личинок 3-го возраста *Terellia colon* и *T. virens* (Diptera, Tephritidae).** Корнеев С. В. — Впервые даны иллюстрированные описания личинок 3-го возраста *T. colon* (Meigen, 1826) и *T. virens* (Loew, 1846) на основании материалов из Украины.

Ключевые слова: Diptera, Tephritidae, *Terellia*, личинка.

### Introduction

The genus *Terellia* Robineau-Desvoidy, 1830 is represented by ca. 45 species (Norrbon et al., 1999) 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. As far as known, their larvae feed in flower heads and stems of various asteraceous plants.

Larvae of some *Terellia* have been described by P. I. Persson (1963): *T. (Cerajocera) ceratocera* (Hendel, 1913) and *T. (C.) plagiata* (Dahlbom, 1850); M. N. Kandybina (1970): *T. (s. str.) ruficauda* (Fabricius, 1794); K. Dirlbek and J. Dirlbek (1962) and A. Belcari (1991): *T. (s. str.) longicauda* (Meigen, 1830). The descriptions of these species are rather incomplete and also in need of redescription. Larvae of two common species of *Terellia* have remained undescribed until now.

In 2006, numerous larvae of Tephritidae were collected by the author in northern Ukraine. Some of them belong to several species of *Terellia*, and for many of them larvae were not described, or existing descriptions are incomplete. This article starts a series of publications about larvae of the fruit flies of the tribe Terelliini.

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

### Material and Methods

Larvae of fruit flies were taken from samples of knapweeds *Centaurea scabiosa* L. and *C. stoebe* L. in the vicinity of Kyiv, 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 segment 7 and 8 as depicted by M. N. Kandybina (1977: fig. 61). Tissues were macerated by boiling in 10% sodium hydroxide in a water bath. All structures were measured under a dissecting binocular microscope MBS—10 and examined under a compound microscope Wild M-11 (at x10, x20 and x40 magnification).

Series of photos were taken directly from a dissecting or compound microscope with a Nikon 5200 digital camera and then montaged with the use of CombineZM software (Hadley, 2007).

Morphological terminology generally follows that of D. Headrick and R. Goeden (1990). They have proposed so far the most detailed terminology; alternative terms used by M. N. Kandybina (1977) or other authors are given in parentheses; names of the areas of the last segment, are given according to Phillips (1946), as cited by M. N. Kandybina (1977); the terms «medial sensory organ» (for the sensillar structure

lying on the medial groove between anterior sensillar lobes) and «sclerotized plaques» for oval or polygonal thickenings in the cuticle, are proposed here for the first time.

***Terellia colon*** (Meigen, 1826) (fig. 1—2)

Material examined. Ukraine, Kyiv Region, Khodosievka, in flower heads of *Centaurea scabiosa* L. 22.08.2005, 16 third instar larvae (S. Korneyev leg.).

**Description.** 3<sup>rd</sup> instar larva. Body short oval; 4.9—6.1 mm long (mean 5.54 mm); 1.85—2.55 mm wide (mean 2.17 mm); 2.2—2.81 times as long as wide (mean 2.56 mm). Coloration. Pale yellow to pale orange, abdominal segments 6—8 with reddish-brown area on dorsal surface. Posterior surface of segment 8 orange to reddish brown. Thoracic and abdominal segments covered with particles of wax-like substance, looking like grey dust on all examined live specimens, non-soluble in sodium hydroxide or small particles on temporary glycerol slides (fig. 1, 4, 2; 2: wp)

Gnathocephalon (fig. 1, 3) mostly smooth, inverted into thoracic segment 1 at rest. Anterior sensory lobes short, partly separated at anterior margin. Dorsal sensory organ (antenna) (fig. 1, 3: dso) with short, rounded terminal joint. Terminal sensory organ (palpus) (fig. 1, 3: tso) with 3 sensilla. Lateral sensory organ (fig. 1, 3: lso) small. Supralateral sensory organ indistinct or absent. Medial sensory organ (fig. 1, 3: mso) distinct. Anterior portion of sensory lobe with network of grooves; its anterior margin with one long integumental petal (fig. 1, 3: ip) and several plates. Stomal sensory organ (fig. 1, 3: sso) small, round, without teeth or lobes. Antero-lateral portion of gnathocephalon with 12—14 oral ridges (fig. 1, 3: or). Lateral surface of anterior sensory lobe and gnathocephalon posterior of oral ridges with net of shallow, anastomosing grooves. Dorsal surface of gnathocephalon with rather small supradorsal sensillum and additional sensilla posterior of oral ridge. Labial lobe not examined; one pair of sensilla postero-ventrally of it. Postero-lateral portion of gnathocephalon with rather numerous small and acute denticles and one row of 7—8 elongate oval sclerotised plaques (fig. 1, 5).

Cephalopharyngeal skeleton (fig. 1, 7). Mandibular sclerite (fig. 1, 7: msc) almost as long as high, with single blunt mouthhook (fig. 1, 7: mhk) and without additional lobes or teeth. Hypostomal (= hypopharyngeal) sclerite (fig. 1, 7: hps) moderately long, ca. two times as long as high, parastomal sclerite fused to it, indistinct. Dental sclerite not expressed. Labial (= subhypostomal) sclerite (fig. 1, 7: las; 1, 8) elongate, V-shaped.

Thoracic segments 1—3 moderately sclerotised. Segment 1 short, forming a shield-like «mask» (fig. 1, 4) with T-shaped aperture when gnathocephalon retracted and numerous elongate oval and sinuous plaques; antero-dorsal surface with denticles. Anterior spiracle (fig. 1, 6) with 7—8 lobes. Segments 2—3 almost smooth, with row of plaques at anterior margins.

Abdominal segments 1—7 with tiny papillae and one row of plaques at anterior margin; with two rows of verruciform sensilla (dorso-lateral and ventro-lateral). Postero-lateral part of each segment with vertical row of elongate plaques. Creeping welts not expressed.

Segment 8 (fig. 2, 1) with one row of plaques at anterodorsal margin (fig. 2, 1: adr) and with 26 elongate-oval or subrectangular plaques forming arcuate ridge (fig. 2, 1: arr) between stigmal and dorsal areas. Stigmal area (fig. 2, 1: sta) with slightly sunken spiracular plates (fig. 2, 1: stp) separated by a rather wide area 0.6 times as wide as spiracular plate and bearing 6—7 subrectangular plaques (fig. 2, 2). Medial area separated from stigmal area by transverse ridge (fig. 2, 1: trr; 2, 2) formed by plaques; one pair of sensilla below ridge (fig. 2, 2: s) and 6—7 plaques in ventral part (fig. 2, 1: pma). Submedial area with 8—9 oval plaque (fig. 2, 1: psma) forming two irregular rows.

Posterior spiracle (fig. 2, 3) with three spiracular slits (fig. 2, 3: ss). Dorsal slit horizontal, two times as long as wide. Medial and ventral slits 2.4—2.7 as long as wide;

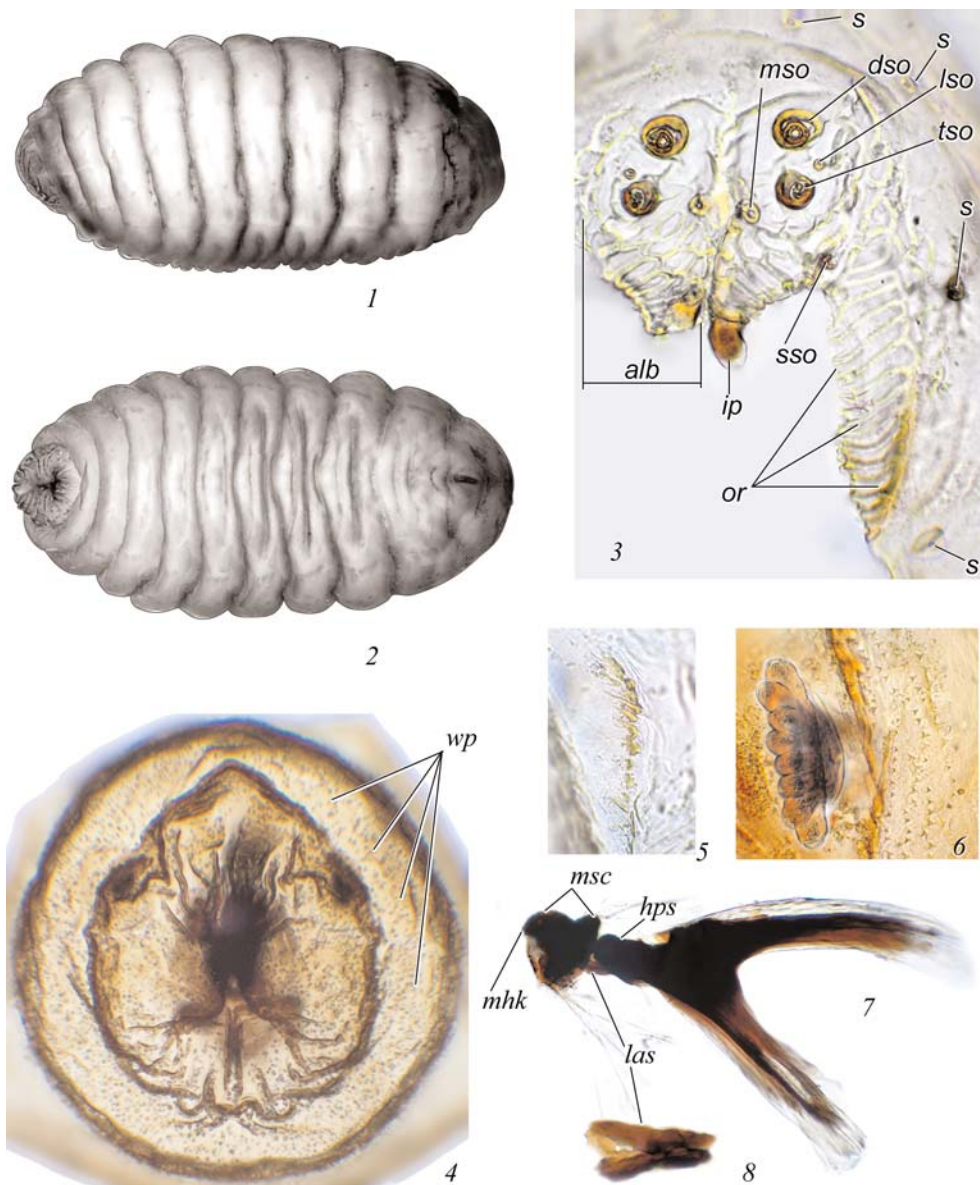


Fig. 1. *Terellia colon*, larva. 1 – habitus, left; 2 – same, ventral; 3 – gnathocephalon, anterior view (cephalopharyngeal skeleton, right and ventral parts removed); 4 – thoracic segments 1 and 2, anterior view; 5 – row of sclerotised plaques on lateral surface of gnathocephalon; 6 – anterior spiracle; 7 – cephalopharyngeal skeleton, left; 8 – labial sclerite.

alb – anterior sensory lobe; dso – dorsal sensory organ; ip – integumental petal; las – labial (subhypostomal) sclerite; lso – lateral sensory organ; mhk – mouthhook; msc – mandibular sclerite; mso – medial sensory organ; s – sensillum; sso – stomal sensory organ; tso – terminal sensory organ; wp – wax particles.

Рис. 1. *Terellia colon*, личинка. 1 – общий вид, слева; 2 – то же, вентрально; 3 – гнатоцефал, вид спереди (цефалофарингеальный скелет, правая и вентральная части удалены); 4 – 1–2-й грудные сегменты, вид спереди; 5 – ряд склеротизированных бляшек на боковой поверхности гнатоцефала; 6 – переднее дыхальце; 7 – цефалофарингеальный скелет, слева; 8 – лабиальный склерит.

alb – передняя сенсорная доля; dso – дорзальный сенсорный орган; ip – покровный вырост; las – нижнегубной (субгипостомальный) склерит; lso – латеральный сенсорный орган; mhk – ротовой крюк; msc – мандибулярный склерит; mso – медиальный сенсорный орган; s – сенсилла; sso – ротовой сенсорный орган; tso – терминальный сенсорный орган; wp – частички воска.

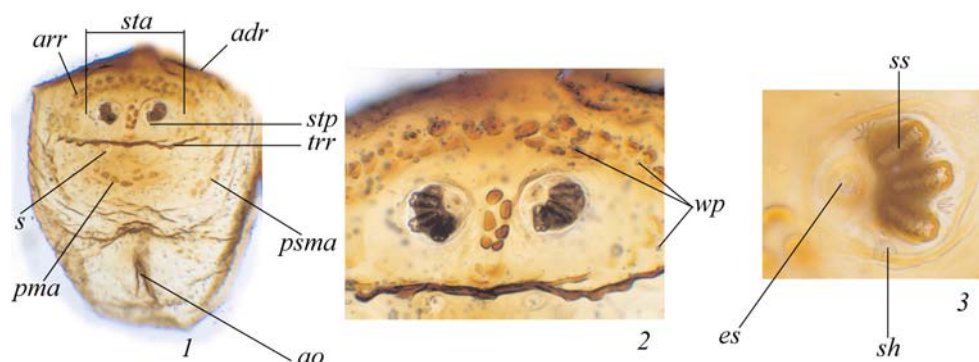


Fig. 2. *Terellia colon*, larva. 1 – segment 8, posterior view; 2 – stigmal area, enlarged; 3 – posterior spiracle (spiracular hairs retouched).

adr – anterodorsal ridge of plaques; arr – arcuate row of plaques; pma – plaques of medial area; psma – plaques of submedial area; s – sensillum; sh – spiracular hair; sta – stigmal area; stp – stigmal plate; trr – transverse ridge of plaques.

Рис. 2. *Terellia colon*, личинка. 1 – 8-й сегмент, вид сзади; 2 – стигмальная область, увеличено; 3 – заднее дыхальце (дыхальцевые волоски прорисованы).

adr – переднедорзальный гребень бляшек; arr – дуговидный ряд бляшек; pma – бляшки медиальной области; psma – бляшки субмедиальной области; s – сенсилла; sh – дыхальцевый волосок; sta – стигмальная область; stp – стигмальная пластинка; trr – поперечный гребень бляшек.

ventral slit almost vertical, forming angle 75–80° to dorsal slit. Bundles (from dorsal to medioventral) with 4–5 – 2–3 – 3 – 3–4 spiracular hairs (fig. 2, 3: sh).

**Diagnosis.** Third instar larva of *T. colon* differs from all known larvae of terelliine flies except *T. virens* by the short oval, reddish yellow body and sclerotised, mask-like thoracic segment 1 (most terelliines have elongate, maggot-like larvae with poorly sclerotized thoracic segment 1). From *T. virens*, which has similar shape of body and thoracic segment 1, it differs by the presence of rows of sclerotized plaques at anterior margin of thoracic and abdominal segments and by more numerous plaques on abdominal segment 8, as well as by more numerous spiracular hairs (3–4 in each bunch rather than one). The network of grooves lateral of oral ridges is less expressed than in *T. virens*.

**Notes.** This species is widespread in Europe and in some regions of Middle Asia. Larvae develop in flower heads of *Centaurea scabiosa* L., *C. adpressa* Ledeb. and some other species of the subgenus *Lopholoma* (Korneyev, Kameneva, 1992, 1993). Superficially similar *T. luteola* (Wiedemann) infests flower heads of the safflower (*Carthamus*) in the Mediterranean region, Near East, and Middle Asia (White et al., 1990), and an unnamed species is associated with *Centaurea* (s. str.) *ruthenica* Lam. in the Volga Region and Middle Asia (V. A. Korneyev, pers. comm.), but larvae have not been collected or described yet.

#### *Terellia virens* (Loew, 1846) (fig. 3–4)

**Material examined.** Ukraine, Kyiv Region, Kruglik, in flower heads of *Centaurea stoebe* L. 18.08.2006, 9 third instar larvae (S. Korneyev leg.).

**Description.** 3<sup>rd</sup> instar larva. Body short oval; 3.2–4.35 mm long (mean 3.73); 1.5–1.85 mm wide (mean 1.67); 1.88–2.57 times as long as wide (mean 2.24). **Coloration.** Yellow to pale orange, abdominal segments with reddish-brown area on dorsal surface. Posterior surface of segment 8 orange to reddish brown.

**Gnathocephalon** (fig. 3, 5, 7) rather smooth, inverted into thoracic segment 1 at rest. Anterior sensory lobes short, partly separated at anterior margin. Dorsal sensory organ (antenna) (fig. 3, 5: dso) with short, rounded terminal joint. Terminal sensory organ (palpus) (fig. 3, 5: tso) with 3 sensilla. Lateral sensory organ small. Medial sen-

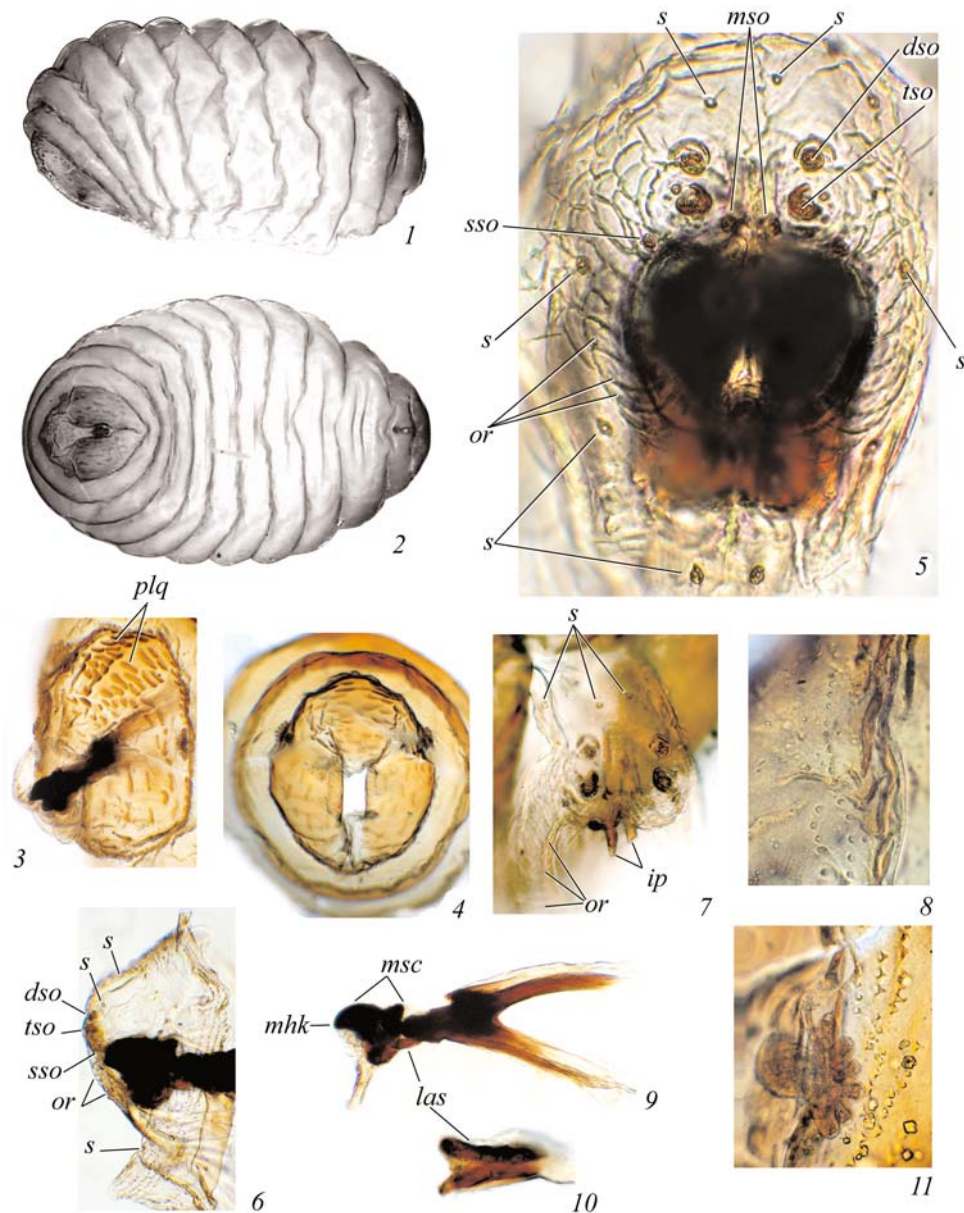


Fig. 3. *Terellia virens*, larva. 1 – habitus, left; 2 – same, ventral; 3 – gnathocephalon and thoracic segment 1, laterodorsal view; 4 – thoracic segments 1 and 2, anterior view (gnathocephalon and cephalopharyngeal skeleton removed); 5 – gnathocephalon, anterior view; 7 – same (cephalopharyngeal skeleton, left and ventral parts removed); 8 – denticles and plaques on thoracic segment 1; 6 – gnathocephalon lateral view; 9 – cephalopharyngeal skeleton, left view; 10 – labial sclerite; 11 – anterior spiracle.

Legend as on fig. 1.

Рис. 3. *Terellia virens*, личинка. 1 – общий вид, слева; 2 – то же, вентрально; 3 – гнатоцефалон и 1-й грудной сегмент, вид сбоку и сверху; 4 – 1–2-й грудные сегменты, вид спереди (гнатоцефалон и цефалофарингеальный скелет удалены); 5 – гнатоцефалон, вид спереди; 6 – то же (цефалофарингеальный скелет, левая и вентральная части удалены); 7 – зубчики и бляшки на 1-м грудном сегменте; 8 – гнатоцефалон, вид сбоку; 9 – цефалофарингеальный скелет, вид слева; 10 – лиабальный склерит; 11 – переднее дыхальце.

Условные обозначения как на рис. 1.

sory organs (fig. 3, 5: mso) hidden in median groove, but rather distinct. Anterior portion of sensory lobe with network of grooves; its anterior margin with two long finger-like, apically bifurcate integumental petal (fig. 3, 7: ip) and several short accessory plates.

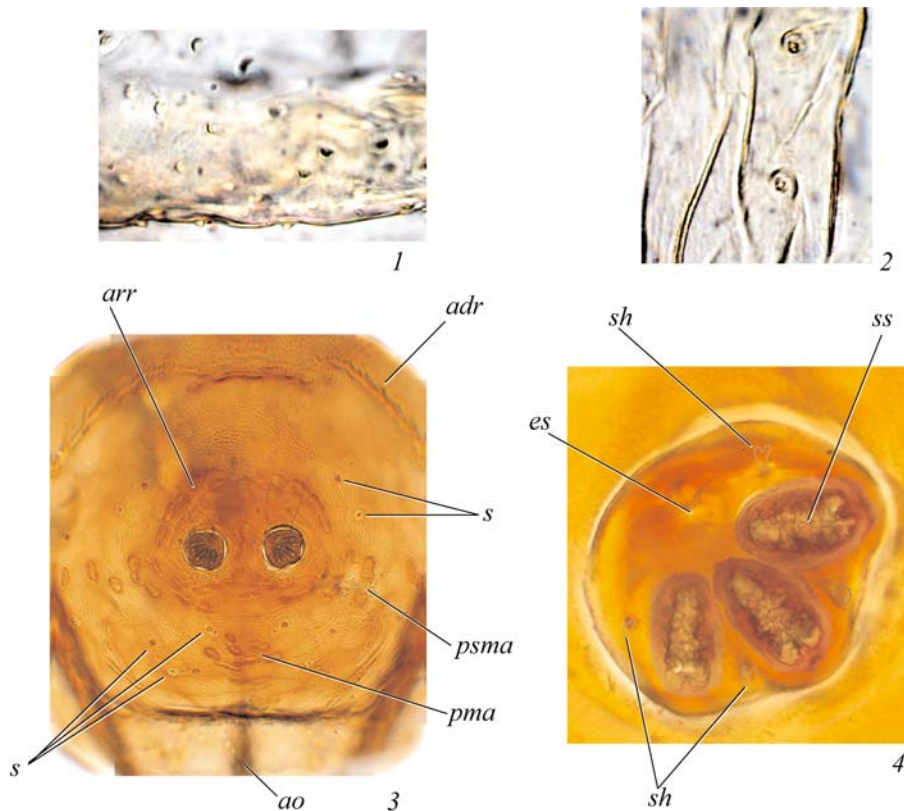


Fig. 4. *Terellia virens*, larva. 1 – papillae on ventral side of abdominal segment; 2 – verruciform sensilla on lateral surface of abdominal segment 4; 3 – segment 8, posterior view; 4 – posterior spiracle (spiracular hairs retouched).

Рис. 4. *Terellia virens*, личинка. 1 – папиллы на вентральной стороне брюшного сегмента; 2 – бородавковидные сенсиллы на боковой стороне 4-го брюшного сегмента; 3 – 8-й сегмент, вид сзади; 4 – заднее дыхальце (дыхальцевые волоски прорисованы).

Условные обозначения как на рис. 2.

Stomal sensory organ (fig. 3, 5: sso) small, round, without lobes or teeth. At sides of oral cavity, 12–14 oral ridges (fig. 3, 5, 7: or). Lateral surface of anterior sensory lobe and gnathocephalon posterior of oral ridges with network of anastomosing grooves, more expressed than in *T. colon*. Dorsal surface of gnathocephalon with rather small supradorsal sensillum and additional sensilla postero-dorsal and another one postero-ventral of oral ridges. Labial lobe smooth, with one pair of sensilla postero-ventrally.

Cephalopharyngeal skeleton (fig. 3, 9). Mandibular sclerite (fig. 3, 9: msc) almost as long as high, with simple blunt mouthhook (fig. 3, 9: mhk) and without additional lobes or teeth, at most with inconspicuous tubercle at base. Hypostomal (= hypopharyngeal) sclerite (fig. 3, 9: hps) moderately long, ca. two times as long as high, parastomal sclerite fused to it, indistinct. Dental sclerite not expressed. Labial (= subhypostomal) sclerite (fig. 3, 9: las; 3, 10) elongate, V-shaped.

Thoracic segments 1–3 moderately sclerotised. Segment 1 short, forming a shield-like «mask» (fig. 3, 3, 4) with T-shaped aperture and numerous elongate oval and sinuous plaques (fig. 3, 3: plq); antero-dorsal surface without spinules. Anterior spiracle (fig. 3, 11) with 5–6 lobes. Segments 2–3 almost smooth, with 2 rows of denticles at anterior margins (fig. 3, 11: den).

Abdominal segments 1–7 with sparse, inconspicuous papillae on lateral and ventro-lateral surfaces (fig. 4, 1), and neither denticles nor plaques at anterior margin; each with

several (at least 4) rows of verruciform sensilla (fig. 4, 2). Creeping welts not expressed.

Segment 8 (fig. 4, 3) with one row of plaques at anterodorsal margin (fig. 4, 3: adr) and additional short row posterior of it in the dorsalmost part; with 10–11 long subrectangular plaques forming arcuate ridge (fig. 4, 3: arr) between stigmal and dorsal areas. Stigmal area with slightly elevated stigmal plates separated with rather wide area 0.85 times as wide as spiracular plate and bearing 4–5 polygonal or oval plaques. Medial area separated from stigmal area with row of 8–9 sparse subrectangular or oval plaques, not forming ridge. Medial area with two pairs of sensilla (fig. 4, 3: s) in dorsolaterally and 6–8 plaques (fig. 4, 3: pma) in ventral part. Submedial area with 6–7 oval or polygonal plaques (fig. 4, 3: psma) dispersed towards antero-ventral margin.

Posterior spiracle (fig. 4, 4) with three spiracular slits (fig. 4, 4: ss) 1.9–2.1 times as long as wide. Dorsal slit horizontal. Ventral slit almost vertical, forming angle 80–90° to dorsal slit. Bundles (from dorsal to medioventral) with 1–1–1–1 lanceolate, flattened, sometimes two- or three-tipped spiracular hairs (fig. 4, 4: sh).

**Diagnosis.** Third instar larva of *T. virens* differs from all known larvae of terelliini except *T. colon* by the short oval, reddish yellow body and sclerotised, mask-like thoracic segment 1. From *T. colon*, which has a similar body shape and thoracic segment 1, it differs by the absence of rows of sclerotized plaques at the anterior margin of thoracic (except segment 1) and abdominal segments and by less numerous plaques on abdominal segment 8, as well as by having single spiracular hairs. A network of grooves lateral to the oral ridges is well expressed, including 2–3 rows of accessory plates.

**Notes.** *T. virens* is widespread in Central and Eastern Europe and has been introduced to North America. Larvae develop in flower heads of *Centaurea stoebe* L., *C. diffusa* Lam. and some other species of the subgenus *Acrolophus* (V. Korneyev, Kameneva, 1992, 1993). The superficially similar *T. zerovae* V. Korneyev and *T. uncinata* White infest flower heads of starthistles (*Centaurea (Solstitialis)* and *C. (Calcitrapa)* spp.) in the Mediterranean (V. Korneyev, pers. comm.), but their larvae have not been described.

The species of the *virens* and *colon* groups of the genus *Terellia* differ from other Terelliini by the peculiarities of larval morphology, which are believed to be synapomorphies of some larger group of taxa (Korneyev, 1999). There is a need to study larvae of the other related species such as *T. vectensis* (Collin), *T. dubia* V. Korneyev, *T. megalopyge* (Hering), *T. popovi* V. Korneyev, *T. luteola*, *T. uncinata* and *T. zerovae* to clarify whether the structure of thoracic segment 1 is common for all these species.

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