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ULTRASTRUCTURAL MORPHOLOGY OF LARVA II OF *TAENIOTHRIPS INCONSEQUENS* (TEREBRANTIA: THRIPIDAE)

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ABSTRACT

Thysanoptera comprises both economically neutral species and economically important pests of crops. The immature stages of many pest species are not well known and, ironically, those are the most harmful stages for crops. *Taeniothrips inconsequens* (Uzel) has been reported on at least 35 different host plant species and it is found almost worldwide, but the knowledge of this species is still incomplete. Herein we present SEM images of the larva II of *T. inconsequens* with comments and remarks on specific features for the accurate identification of this species.

Key Words: almond, instar, pests, Thysanoptera

RESUMEN

Thysanoptera comprende especies neutrales y de importancia económica en cultivos. Dentro de las especies con un impacto negativo, los estadíos inmaduros no son conocidos para la mayoría de ellas, irónicamente son estos estadíos los que suelen causar mayor daño a los cultivos. *Taeniothrips inconsequens* (Uzel) ha sido reportada de al menos 35 hospederos diferentes y se encuentra distribuida casi mundialmente, pero el conocimiento en esta especie es incompleto. En este artículo presentamos imágenes de MEB de la larva II de *T. inconsequens* con comentarios y observaciones de características específicas para la correcta identificación de esta especie.

Palabras Clave: Almendro, instar, las plagas, Thysanoptera

Translation provided by the authors.

Most of the species within Thysanoptera have no great impact on the economy, however, those species associated with commercial crops can cause millions of losses in terms of production. Species such as *Thrips tabaci* Linderman, *Thrips imaginis* Bagnall, *Thrips australis* (Bagnall), *Frankliniella occidentalis* (Pergande), *Frankliniella bispinosa* (Morgan) and *Scirtothrips perseae* Nakahara cause damage in crops of economic importance in the developed countries or are considered quarantine species. They have been extensively studied and in some cases the costs of their damage has been estimated, for example for *S. perseae* by Hoddle et al. (2008). *Scirtothrips perseae* was just described in 1997 by Nakahara but its distribution, life cycle, control measures, as well as estimates of the losses in avocado crops are well known nowadays (Hoddle et al. 2003).

This information is not available for all species of economic importance. *Frankliniella insularis* (Franklin) causes serious problems in tropical crops such as tomatoes but still remains as a little known species complex. The published papers on the biology and taxonomy of this species are scarce and the most cited paper on this species was appeared in the 1930's (Retana-Salazar & Rodríguez-Arrieta 2012).

There has been a even slower progress in studies of other species. There are at least 35 host plant species in 12 botanical families reported as hosts for *Taeniothrips inconsequens* (Uzel) (Teulon et al. 1994), but there are incidental records involving at least 207 species, 138 genera and 54 families. The breeding behaviors of *T. inconsequens* were mainly observed in the Rosaceae on 16 species (5 genera) but also members on other plant families (Teulon et al. 1994) in Europe, Asia and North America, where it is widely distributed (Teulon *et al*. 1994). In South America *T. inconsequens* is recorded mainly from Argentina and Brazil.

Electron microscopy analysis of biological samples is a very powerful tool in taxonomy (Valdecasas 2011). In this paper we present an ultrastructural study of larva II of *Taeniothrips inconsequens* by scanning electron microscopy that presents valuable data for identification of the immature stages as an addition to the classical taxonomic description.

Materials and Methods

Material was collected in 2009 in an organic almond orchard in Murcia, south-eastern Spain.

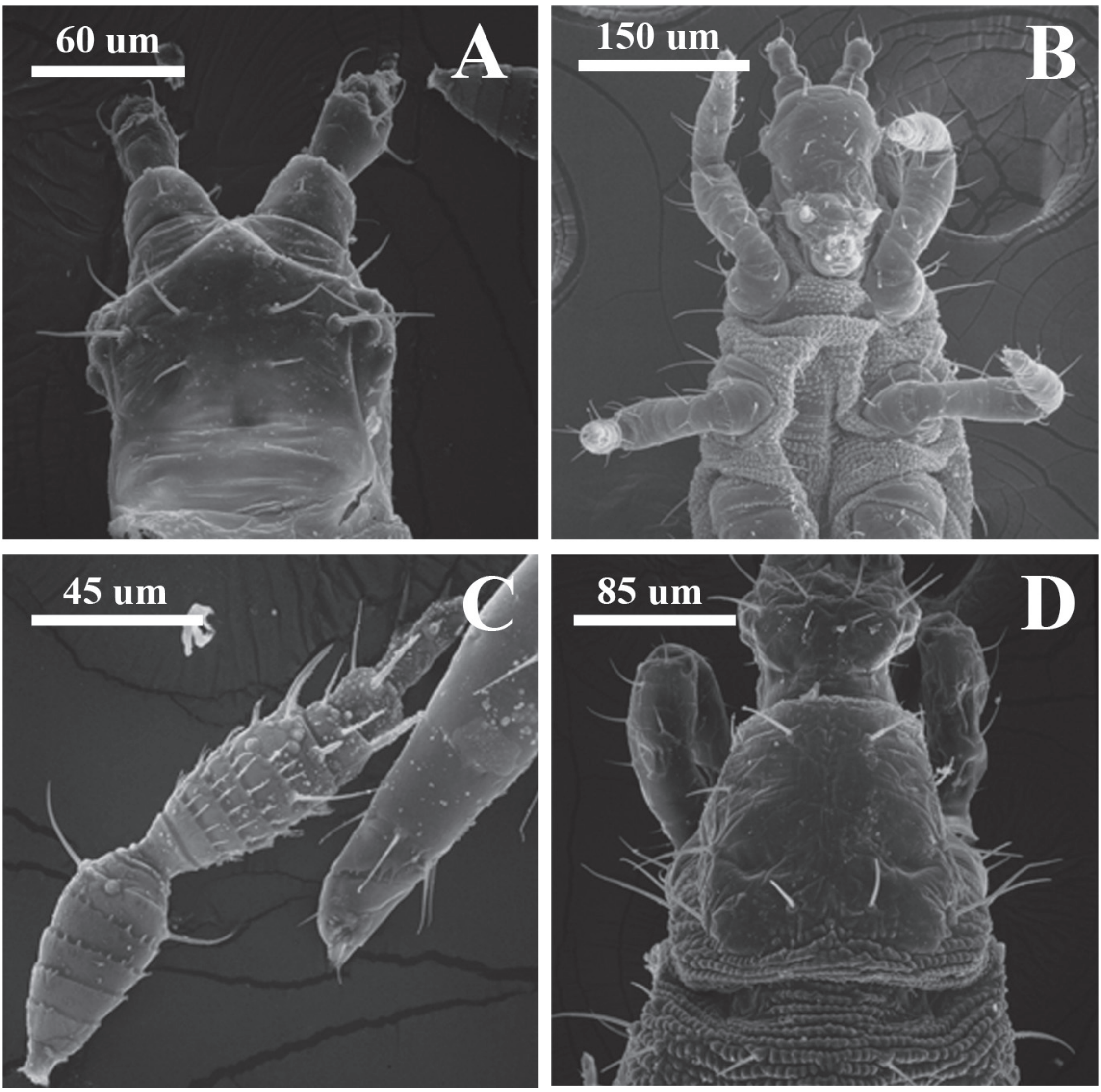

Fig 1. *Taeniothrips inconsequens* instar II, head and thorax details. A) Head and chaetotaxy. B) Head, ventral view. C) Antenna 2. D) Prothorax and chaetotaxy.

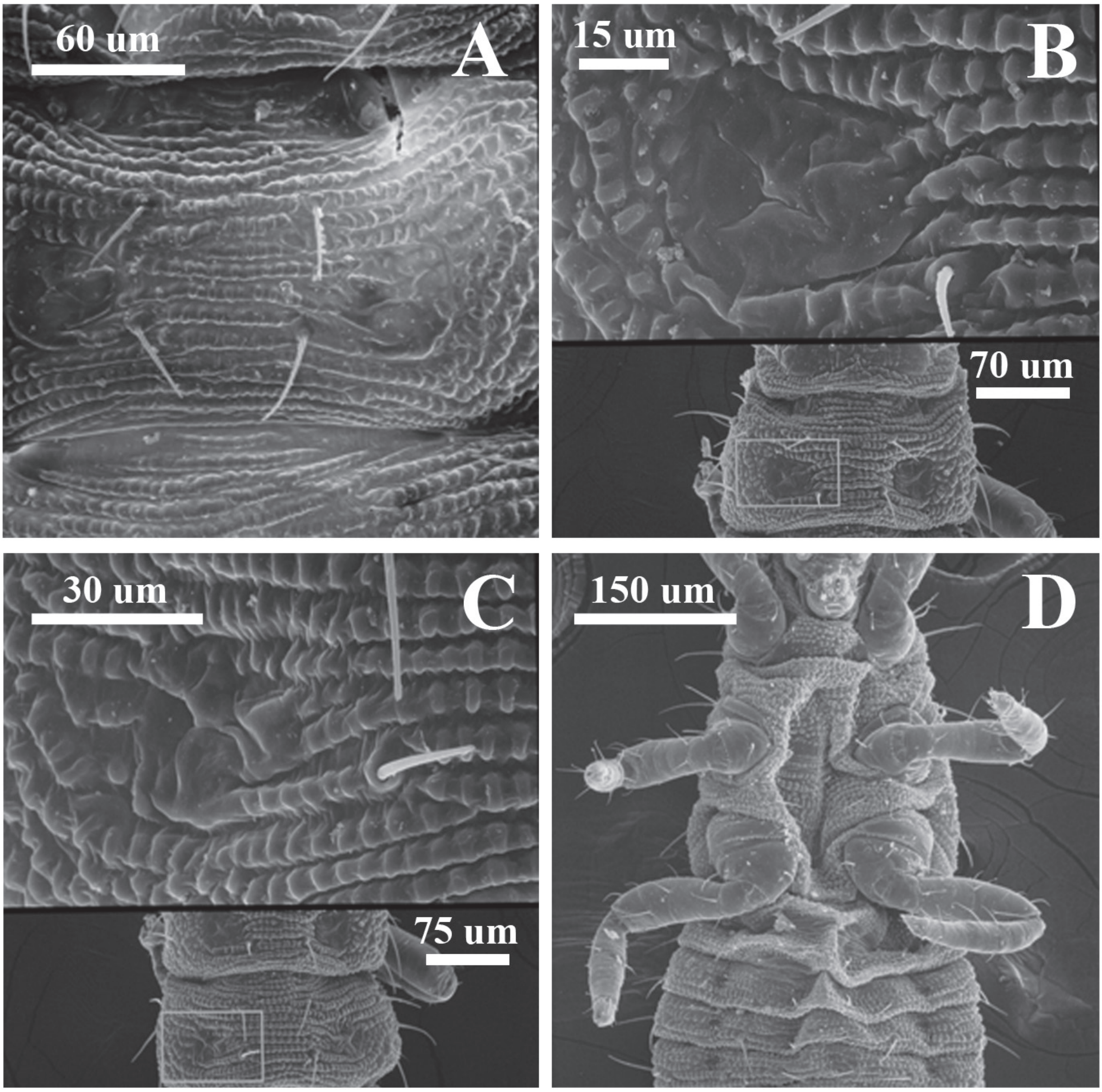

Fig 2. *Taeniothrips inconsequens* instar II, thorax details. A) Mesothorax. B) Mesothorax apodeme. C) Metathorax cuticular structure and chaetotaxy. D) Thorax ventral view and coxal chaetotaxy.

The orchard was placed in the municipal district of Cieza (N 38° 17' 46.2516" W 1° 33' 15.6744", 325 m asl). The arthropod fauna from the canopy of almond trees was sampled using a beating method (see González-Nunez et al. 2008). Beating sampling was carried out monthly in spring and summer, a total of five sampling dates were completed. Samples were translated to the laboratory and kept in a freezer prior to analysis. After thawing and cleaning, the specimens were observed under a stereomicroscope and classified.

We prepared 15 specimens of larva II for scanning electron microscopy (SEM) analysis. The methodology used is described by Sánchez-Monge (2011) for treatment of microarthropod samples for ultrastructural observation at the Microscopic Research Center (CIEMIC), University of Costa Rica.

Results and Discussion

Taeniothrips inconsequens (Uzel), 2nd instar larva

Color. Body pale yellow in life, without dark markings, except in antennal segments VI-VII, eyes with 4-6 red facets, comb on IX abdominal tergum and tip of mouth cone, 3,2-3,6 times as long as wide in mounted specimens.

Head. Without denticles. Cephalic setae I-IV long and pointed, distance I-II 1,5 times as long as II-III, III longer than others, never blunt at tip, IV

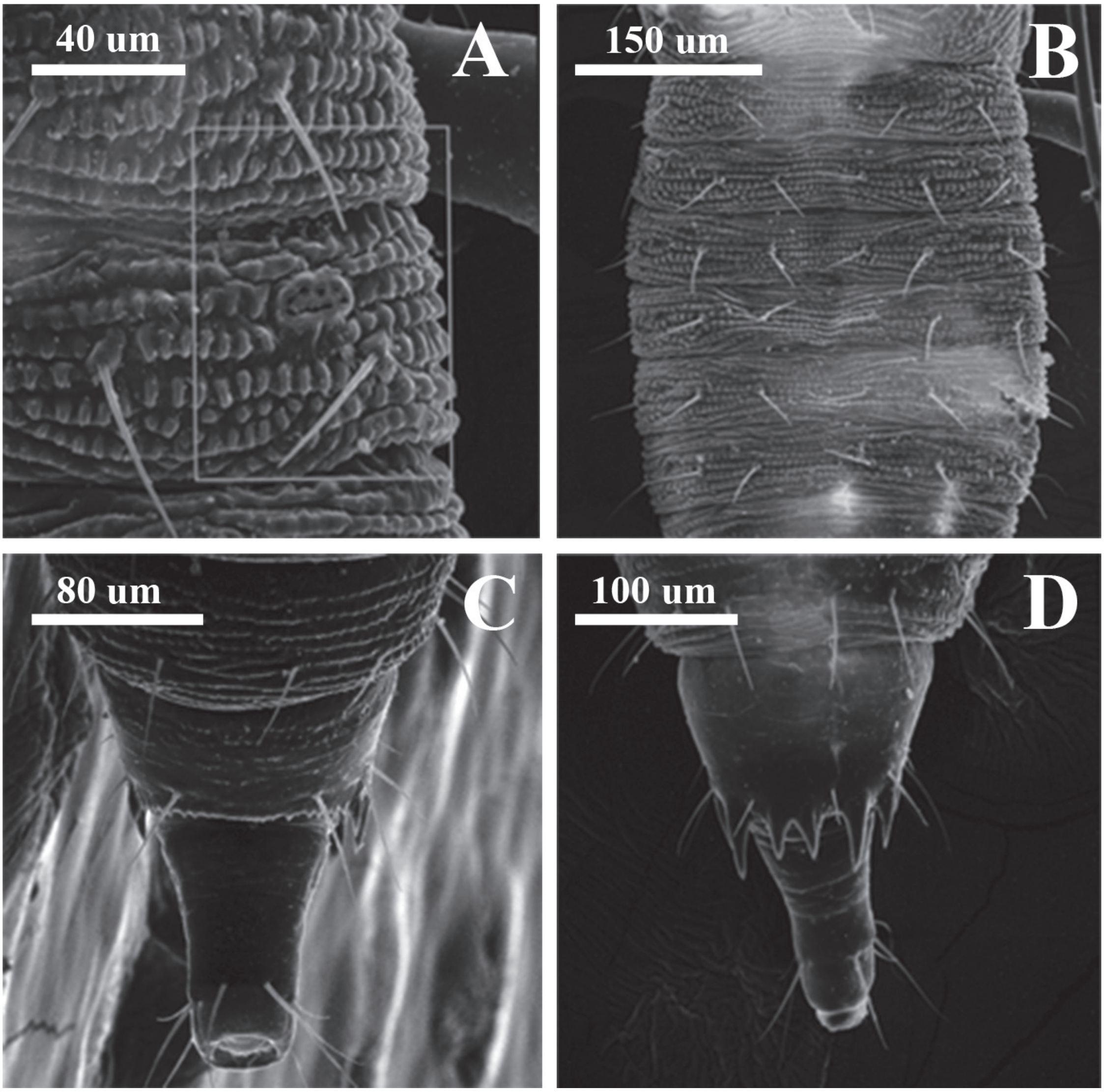

Fig 3. *Taeniothrips inconsequens* instar II, abdominal details. A) Spiracular area. B) Stick-like plaques arrangement. C) Sternites IX-X. D) Terga IX-X.

smaller than others (Fig. 1A). Sternal face with 2 pairs of medial setae, mouth cone long, is projecting between coxae I (Fig. 1B), palpi reduced and 2-segmented.

Antennae. 0,15-0,17 as long as body, with all segments lightly pigmented, III with 5 annulations with microtrichia hardly developed, IV 2,10-2,14 times as long as wide, with 6 annulations bearing minute but distinct microtrichia (Fig. 1C), and with apical ring (apical zone of the segment partitioned by the apical annulation) so that setae and trichomes of the segment located close to each other near the apex, IV very small, VI rounded in profile, 1,12-1,14 times as long as wide, VII long and slender, 3,25 times as long as wide.

Thorax. Prothorax without denticles, 7 pairs of setae well developed, with acute apices (Fig. 1D). Mesothorax bandlike with several rows of denticles close together, with 5 pairs of lateral setae and 2 pairs of medial setae, (Figs. 2A, 3B), mesothoracic apodeme (Fig. 2B). Metathorax bandlike, with several rows of denticles close together, with 3 pairs of lateral setae and 2 pairs of medial seate, (Fig. 2C). Sternal face without setae, except 3 pairs of coxal setae (Fig. 2D).

Abdomen. Abdominal terga of anterior segments with several strong stick-like plaques which are devoid of microtrichia and arranged in transverse rows medially while they are scattered marginally (Fig. 3A, B), IX-X terga with rows of elongate plaques, without microtrichia, and each segment without a pair of sensory domes. Spiracles reduced in lateral third (Fig. 3A). IX sternum with irregular rows of microtrichias, without well-developed teeth but with an irregular comb of microtrichias interrupted medially (Fig. 3C). IX tergum with well-developed and diagnostic posterior comb with teeth (Fig. 3D). Abdominal tergum I with 2 pairs of setae, terga II-VIII with 3 pairs of setae, abdominal segment IX 1,1-1,13 times longer than VIII in medial line, posterior margin of tergum IX with a well-developed comb with 3 pairs of dorsal teeth, two lateral pairs longer than medial pair of teeth, one pair of medial sensillae, with two pairs of setae before the margin, medial pair reduced, tergum X with one pair of lateral sensillae in medial line and a pair of subapical seate (Fig. 3B). Sternal region, abdominal segment I without setae, II with 2 pairs of setae, III-VIII with 3 pairs of setae, abdominal segment IX without strong teeth and a poor and irregular comb in lateral sections, teeth absent medially, X with two pairs of subapical setae (Fig. 3C).

Comments. *Taeniothrips* is a genus with more than 45 described species and more than 20 are known only from fossil record. The definition of this genus is not easy and several characterizations are available in literature (Mound et al. 2012). Few is known about the biology of this genus, some of them are anthophylous as *picipes* Zetterstedt (the type species), *oreophilus* Priesner, *zurstrasseni* Zawirska and *eucharii* (Whetzel). *Taeniothrips inconsequens* is associated with foliage, particularly young leaves and is easy to recognize as adults by the presence of a strongly recurved terminal claw in fore tarsus. Immatures are recognized by the presence of a strong sclerotized marginal comb in abdominal tergum IX. The presence of these very diagnostic characters have caused that no major revisions were made on the morphology of this species, particularly instars. The current descriptions of the 2nd stage are not more than 5 to 10 lines, in some cases with reference only to colour pattern (Nakahara 1991; Hoover 2002), in other cases just some photographs are included in absence of a good taxonomic characterization (Skinner *et al*. 1989). In this case (as in several other Thripines) the abdominal terminal terga lacks of sensorial domes, reported in other groups as Aeolothripidae, Chirothripini and Sericothripini and present also in *Pseudodendothrips mori* (Niwa) 2th instar (Miyazaki & Kudo 1989). The peritreme of the abdominal terga are reduced and with a central tubercle as in *Mycterothrips glycines* Okamoto (Miyazaki & Kudo 1989). The small tubercles in the body surface are absent in the IX-X abdominal terga and in the dorsal lateral margins of the pronotum. Further studies of this type are needed to define which characters of the larval stages are constant to define highly specific taxa. Isolated descriptions of some species contribute to the knowledge of the taxonomic characters present in the immature stages, but it is necessary to have more samples to define the characters present in the immature which allow the generic and family classification.

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