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The Neotropical genus *Titanochrysa* (Neuroptera, Chrysopidae): larval descriptions, biological notes, a new species, and taxonomic changes

CATHERINE A. TAUBER¹, GILBERTO S. ALBUQUERQUE² & MAURICE J. TAUBER¹

¹Department of Entomology, Comstock Hall, Cornell University, Ithaca, NY 14853-2601 & Department of Entomology, University of California, Davis, CA. E-mail: cat6@cornell.edu

²Laboratório de Entomologia e Fitopatologia, CCTA, Universidade Estadual do Norte Fluminense, Campos dos Goytacazes, Rio de Janeiro, Brazil 28013-602. E-mail: gsa@uenf.br

Abstract

This report provides new information on three facets of a recently described Neotropical genus of chrysopine lacewings, *Titanochrysa* Sosa & Freitas 2012. First, because the current taxonomic understanding of the genus is based entirely on the adult stage, we describe the larvae and aspects of the biology of *Titanochrysa trespuntensis* Sosa & Freitas. We show that although *T. trespuntensis* larvae share many morphological and behavioral characteristics with other Neotropical genera of Chrysopini, they also differ significantly in many generic-level characters. Their unique suite of larval features provides strong support for the designation of this group of lacewings as a genus. Second, *Titanochrysa* is known to contain four species; this report describes the adult of a fifth species—*Titanochrysa simpliciala* **New Species**, from Costa Rica. Third, the report presents new locality records for three of the original four *Titanochrysa* species and deals with several taxonomic issues. Specifically, (a) *Chrysopa annotaria* Banks is transferred to the genus; thus the valid name for the species becomes *Titanochrysa annotaria* (Banks), **New Combination**. (b) *Titanochrysa pseudovaricosa* (Penny) is documented as a **New Synonym** of *T. annotaria*. (c) *Chrysopa nigripalpis* Banks is identified as a **New Synonym** of *Titanochrysa circumfusa* (Burmeister).

Key words: *Chrysopodes*, *Ceraeochrysa*, adults, larvae, distribution records

Resumo

Esse trabalho fornece novas informações sobre três aspectos de um gênero neotropical de crisopídeos recentemente descrito, *Titanochrysa* Sosa & Freitas 2012. Primeiro, como o entendimento taxonômico atual do gênero baseia-se unicamente no estágio adulto, nós descrevemos as larvas e aspectos da biologia de *Titanochrysa trespuntensis* Sosa & Freitas. Nós demonstramos que, embora as larvas de *T. trespuntensis* compartilhem muitas características morfológicas e comportamentais com outros gêneros neotropicais de Chrysopini, elas também diferem significativamente em muitos caracteres ao nível de gênero. Seu conjunto único de características larvais oferece forte sustentação para a designação deste grupo de crisopídeos como um gênero. Segundo, *Titanochrysa* é conhecido por conter quatro espécies; nesse trabalho, descreve-se o adulto de uma quinta espécie—*Titanochrysa simpliciala* **Nova Espécie**, da Costa Rica. Terceiro, o trabalho apresenta novos registros de localidade para três das quatro espécies originais de *Titanochrysa* e trata de diversos problemas taxonômicos. Especificamente, (a) *Chrysopa annotaria* Banks é transferida para o gênero; dessa forma, o nome válido da espécie passa a ser *Titanochrysa annotaria* (Banks), **Combinação Nova**; (b) *Titanochrysa pseudovaricosa* (Penny) é documentada como **Sinônimo Novo** de *T. annotaria*, e (c) *Chrysopa nigripalpis* Banks é identificada como **Sinônimo Novo** de *Titanochrysa circumfusa* (Burmeister).

Introduction

The recent description of the green lacewing genus *Titanochrysa* brought to ten the number of currently valid, Neotropical genera in the tribe Chrysopini (Sosa & Freitas 2012, see Oswald 2007). Each of these genera is characterized by a unique set of adult characteristics. However, it has been well demonstrated that chrysopid larvae, as well as adults, provide valuable taxonomic information, especially at generic and higher levels (e.g., Principi 1956, Tauber 1974, 2006, Díaz-Aranda & Monserrat 1995, Tsukaguchi 1995). In addition to the adult features that distinguish the Neotropical chrysopine genera, unique suites of larval characteristics have been described for five of these genera (*Meleoma*: Tauber 1969; *Chrysoperla*: Tauber 1974; *Ceraeochrysa*: Tauber *et al.* 2000, Tauber & de León 2001; *Plesiochrysa*: Tauber *et al.* 2001; *Chrysopodes*: Tauber 2003). Thus, to help gain an understanding of the larval features that might distinguish *Titanochrysa*, we provide descriptions of the three instars of *Titanochrysa trespuntensis* Sosa & Freitas, and we compare and contrast these features with the well established, generic-level features of the two other Neotropical chrysopine genera, *Ceraeochrysa* and *Chrysopodes*, within which *Titanochrysa* species were included previously.

The second part of the paper describes a new species in the genus. *Titanochrysa* was originally described from four species (Sosa & Freitas 2012): *Titanochrysa circumfusa* (Burmeister) from Brazil and Venezuela, *Titanochrysa ferreirai* Sosa & Freitas and *Titanochrysa trespuntensis* Sosa & Freitas from Brazil, and *Titanochrysa pseudovaricosa* (Penny) from Costa Rica. The fifth species, *Titanochrysa simpliciala* Tauber, **New Species**, is from Costa Rica.

Finally, in the third part of the paper, we identify two new synonymies and a new combination in *Titanochrysa*, and we present previously unpublished distribution records for three of the species.

Material and methods

The procedures and terminology are identical to those used previously (adults: Tauber 2010; larvae: Mantoanelli *et al.* 2006). Readers may refer to the explanatory material and illustrations in those publications (freely available online—<http://www.pensoft.net/journals/zookeys/article/387/abstract>) & <http://esa.publisher.ingentaconnect.com/content/esa/aesa/2006/00000000/00000001/art00003>.

We examined adult specimens from the following institutions: Museum of Comparative Zoology (MCZ, Cambridge), Natural History Museum (NHM, London), University of Minnesota Insect Collection (UMIN, St. Paul), California Academy of Sciences (CAS, San Francisco), Florida State Collection of Arthropods (FSCA, Gainesville), Essig Museum of Entomology (UCB, University of California, Berkeley), Bohart Museum of Entomology (UCD, University of California, Davis), Instituto de Entomologia, Fundación Miguel Lillo (IFML, San Miguel de Tucumán), American Museum of Natural History (AMNH, New York), the United States National Museum of Natural History (USNM, Washington DC), Universidade Estadual do Norte Fluminense (UENF, Campos dos Goytacazes), Museum für Naturkunde der Humboldt-Universität (ZMB, Berlin), Zoologisches Institut der Martin-Luther Universität (HALLE, Halle-Wittenberg), and Institut royal des Sciences naturelles de Belgique (IRSNB, Brussels; images). Adult specimens from our collections and rearings are deposited in the insect collections at UENF and UCB. Larval specimens are in the research collections of MJT & CAT (TRC, in Davis, CA) and GSA (UENF, in Campos dos Goytacazes, RJ).

Larval descriptions

Titanochrysa trespuntensis Sosa & Freitas, 2012

Figs 1–7

All instars. Body cream-colored, with light brown integumental spinules, brown to dark brown dorsal, lateral markings on thorax and abdomen. Shape of body in lateral view: head and thorax relatively flat dorsally, body becoming thicker posteriorly; metathorax not noticeably raised; abdomen raised, dome-like through segment 6; segments 7–10 becoming narrow and tubular distally, not withdrawn. All spiracles brown, sessile, with deep, narrow atrium. Two types of chalazae: (1) small, delicate, unmodified basally or (2) robust, with enlarged base,

often with brown coloration on anterior surface. All setae smooth except some long, robust setae slightly granulate under high power (x200).

Third instar. *Body.* 7.3–7.5 mm long.

Head (Figs 2A–C, 3A, 4, 5A). Cephalic setae smooth, straight, pointed; all primary cephalic setae present: S1, S11 long, S2–10, S12 of medium-length, S5 shortest; large patch of approximately 50 very short secondary setae in transverse row across mid-section of cranium; Vx setae more robust than secondary setae, beneath cervical membrane. Anterior margin of head rounded, with three pairs of medium-length setae, mesal pair longer than two lateral pairs. Mandibles slightly shorter than width of head; head width across eyes, 0.81–0.82 mm; mandible length, 0.73–0.77 mm (ratio, mandible length to head width = ~0.93). Labial palpus: basal segment with one small dorsal seta, two short mesal setae, one long ventral seta; middle segment with six long setae distally, seven to eight shorter setae basally; distal segment without setae, ventral surface with two small, longitudinal sensory organs. Palpiger with two medium-length to long ventral setae. Mentum with two pairs of long setae anteriorly below palpiger, one pair of long setae laterally above stipes, two pairs of medium-length setae posteriorly. Stipes elongate, folded inward on longitudinal axis; cardos elongate, narrow.

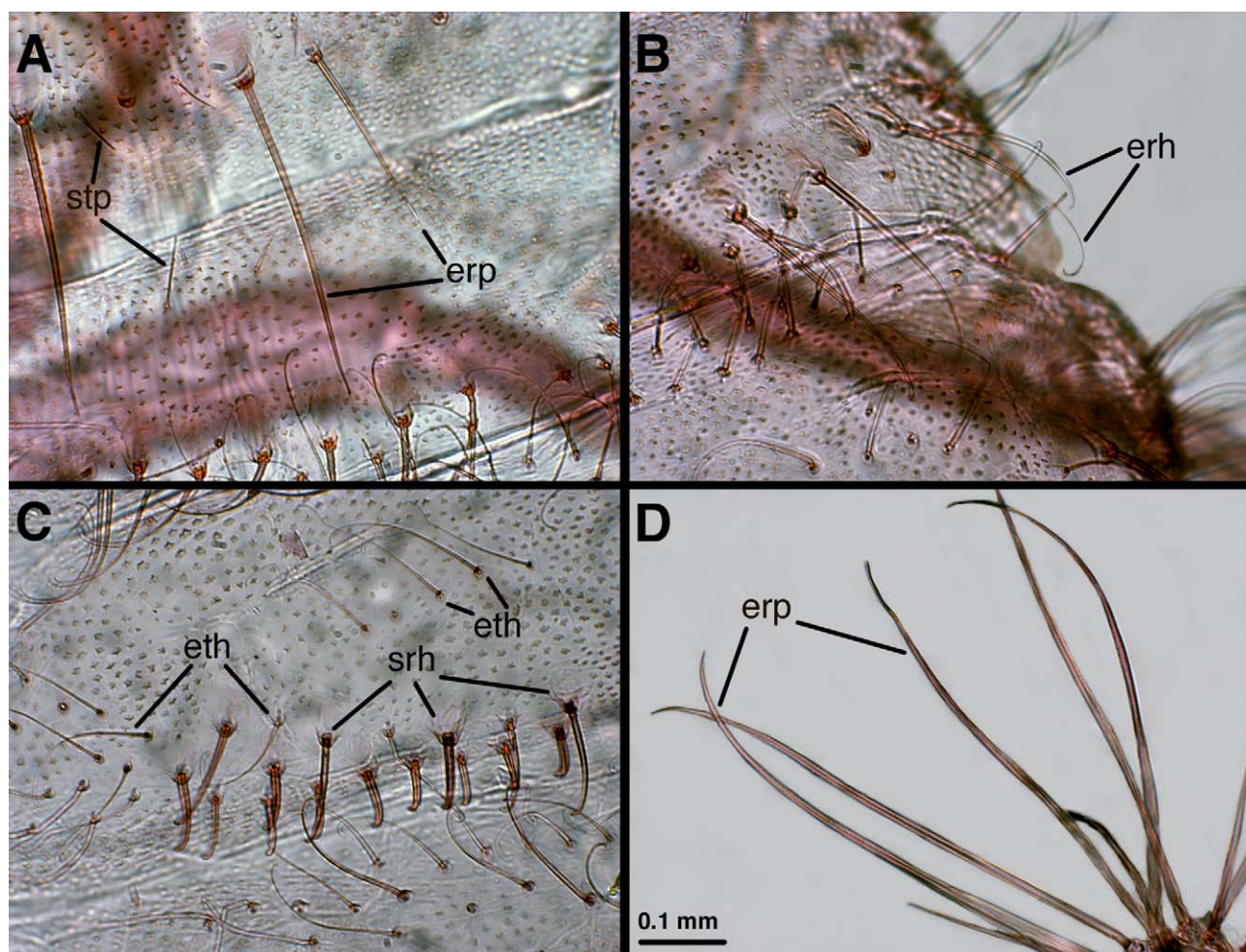


FIGURE 1. *Titanochrysa trespuntensis*, Examples of setae on dorsum (laboratory-reared third instar, from female collected in Rio de Janeiro State, Brazil). A. Two types of dorsal setae on the metathorax (posterior row) and anterior part of abdominal segment 1: elongate, robust, pointed setae (erp); short, thin, pointed setae (stp). B. Elongate, robust, hooked setae (erh) on posterior section of the abdominal segment 1. C. Two types of submedian setae on abdominal segments 2–4: elongate, thin, hooked setae (eth); short, robust, hooked setae (srh). D. Elongate, robust, pointed setae (erp) on the thoracic lateral tubercles.

Head coloration: Dorsum cream-colored, with brown to dark brown markings. Epicranial marking brown, divided into two narrow, elongate sections, both in contact with posterior margin of head; lateral section extending from distal margin of posterior cranial suture, reaching to level of middle of eye; mesal section extending from base of head, becoming confluent with postfrontal marking, which extends to inner base of scape. Postfrontal marking

very dark at confluence with mesal section of epicranial marking, narrow throughout. Frontal marking dark brown, with each arm narrow, separate, extending from midsection of head, beyond tentorial pits to anterior margin of clypeolabral region. Intermandibular marking light brown, narrowly transverse, small, separate from frontal marking. Clypeolabral region cream-colored. Stemmata black; integument surrounding anterior stemmata black, around posterior stemmata white. Gena cream-colored, with elongate, brown marking from base of eye to posterior margin of cranium, bifurcated anteriorly. Mandible, maxilla brown to dark brown. Labial palpus: basal segment light brown; mesal segment mostly brown, with cream mesally and between subsegments; terminal segment dark brown basally, light brown distally, with concentric rings throughout, terminal ring cream-colored. Antenna: scape cream-colored, with tinge of brown; basal section of pedicel brown, with cream mesally and between subsegments, distal section brown throughout; flagellum brown, ringed, with terminus cream-colored. Venter cream-colored, except interior margin of cranium with longitudinal brown mark; center of mentum white to cream-colored, with large light brown patch mesally.

Thorax (Figs 1A, D, 3A, 4, 5B). Cervix cream-colored, with pair of submarginal brown stripes; venter cream-colored; sides with dark brown stripe. Thoracic dorsum white to cream-colored, with pair of light to dark brown, elongate, curved, submesal stripes, small, scattered, brown marks. Lateral tubercles (LTs) white to cream-colored, with setae (LS) golden to light brown. Venter cream-colored to white, unmarked. Legs: coxa white, with brown marking on basolateral surface; femur cream basally, anterior surface becoming brownish distally, ventral surface white; tibia brownish to amber; tarsus, empodium, brown to dark brown.

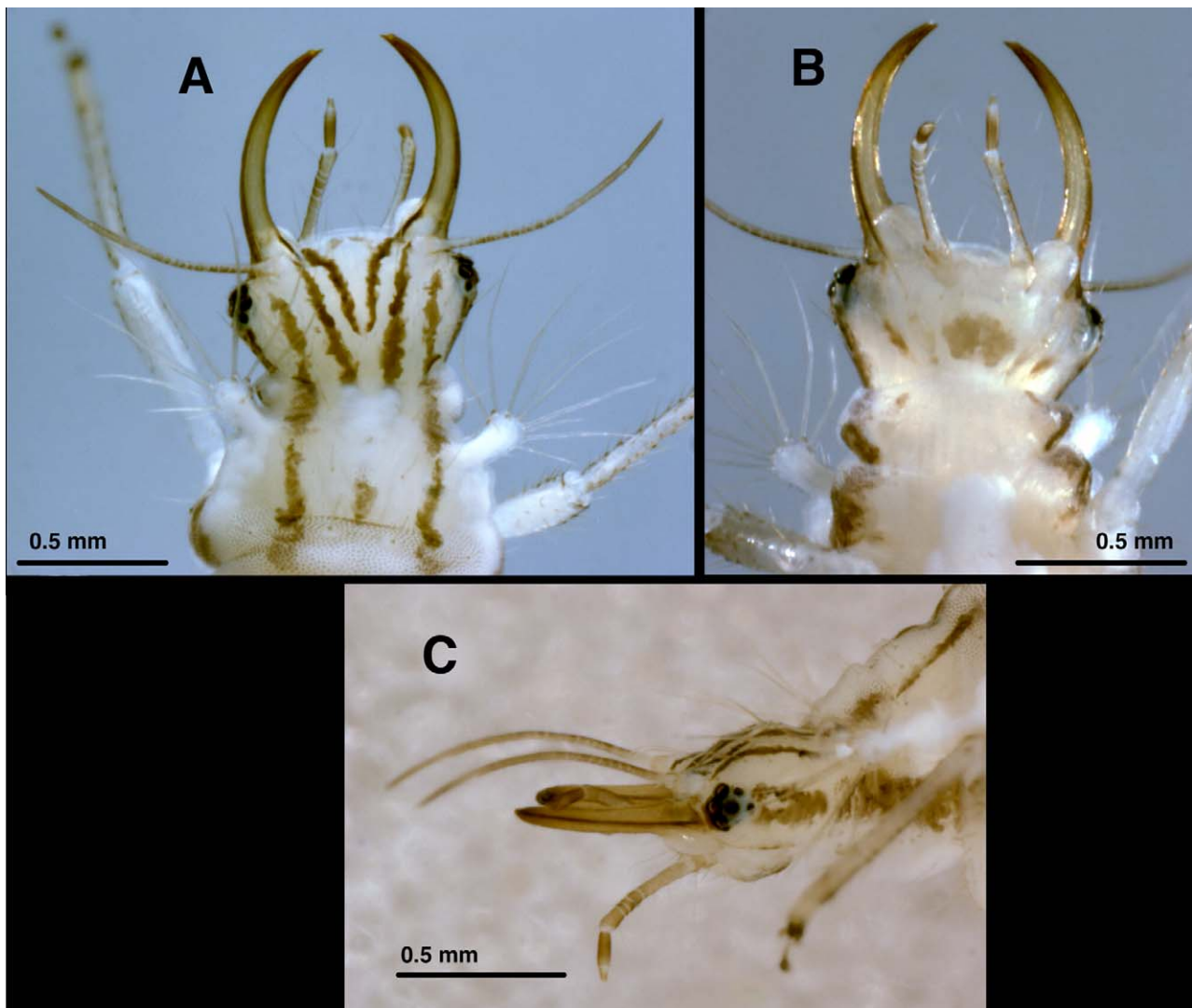


FIGURE 2. *Titanochrysa trespuntensis*, Third instar (Laboratory reared from female collected in Rio de Janeiro State, Brazil). A. Head, dorsal; B. Head, ventral; C. Head, lateral.

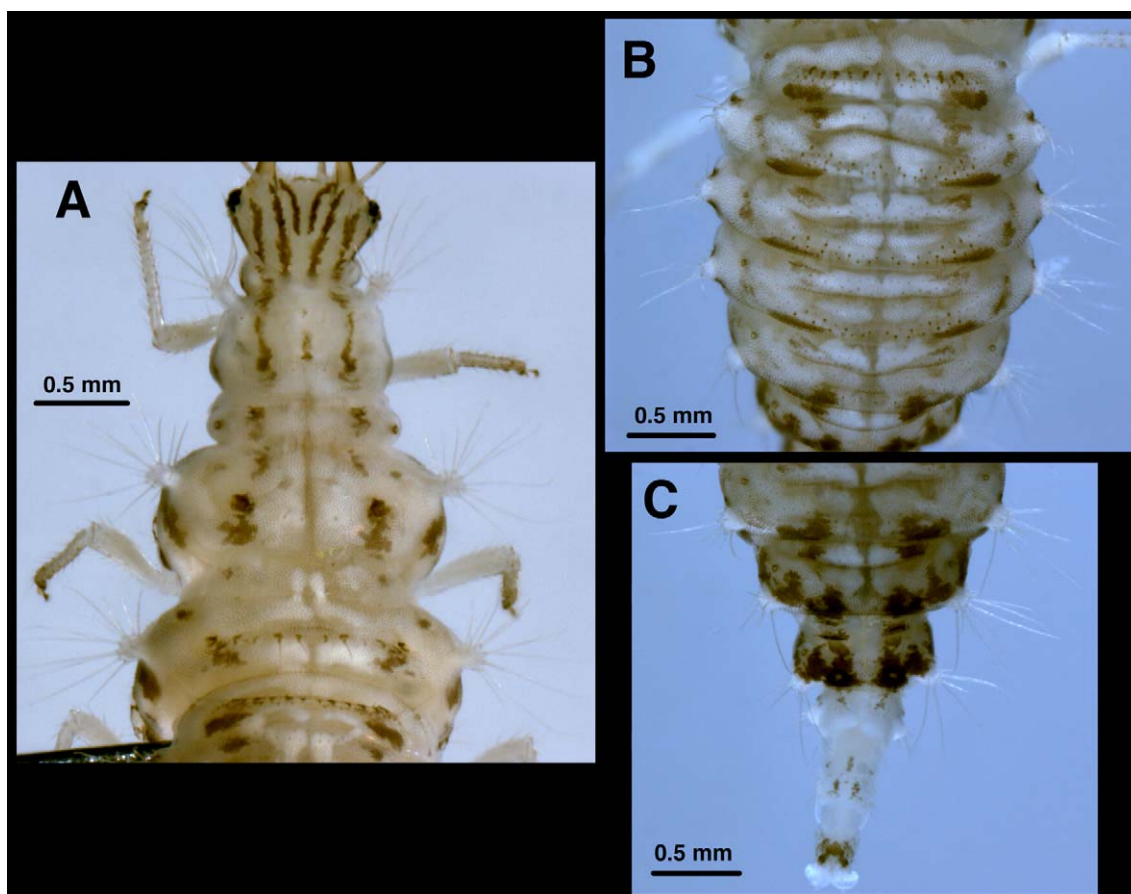


FIGURE 3. *Titanochrysa trespuntensis*, Third instar (Laboratory reared from female collected in Rio de Janeiro State, Brazil). A. Head and thorax, dorsal; B. Abdominal segments 1 to 5, dorsal; C. Abdominal segments 6 to 10.

LTs well sclerotized, rounded, each bearing 12 to 16 LS: six to ten large chalazae located on distal part of LT usually bearing long, slender and tapering, pointed (occasionally hooked) LS, five to six smaller chalazae located dorsally or basally, usually bearing shorter, robust, pointed LS (Fig. 1D). Dorsal setae straight (Fig. 1A).

T1: Notum with pair of narrow, longitudinal, brown stripes submesally, oblong brown mark mesally; pleuron with dark brown band; anterior margin with three short setae (R1), extending from below anterior fold of integument. LT with slightly elongated base, extending to middle of cervix, with ~9–10 long LS apically, ~5–6 shorter LS basally. Paired sclerites (Sc1) large, obtuse, marked with very light brown laterally, with dark brown mesally. S1Sc1 long; S2Sc1 shorter, anterior to S1Sc1; two to three pairs of short, secondary setae mesal to Sc1. Mesal sclerite (Sc2) marked with brown, less than one-half length of Sc1, almost as wide as long. Primary setae S1, S2, S3, S4 long; S5 absent.

T2: Anterior subsegment with pair of brown submesal stripes; spiracles with small spiracular seta (SSp) anteriorly. Anterior sclerite (Sc1) with three associated setae—one mesal (S1Sc1), two lateral (S2Sc1, S3Sc1). Posterior subsegment with broken sections of submesal stripe; anterior mark light brown, posterior mark dark brown anteriorly, lighter brown posteriorly. Sclerite on anterior margin (Sc2) with two, very small, associated, lateral setae (S1Sc2, S2Sc2); mesolateral sclerite (Sc3) with two associated setae—S1Sc3 intermediate-length, on mesal margin, S2Sc3 small, on anteromesal margin. S1 short, mesal to LT; S2 intermediate-length, mesal to S1, with three small, secondary setae nearby; S3 long, mesal to Sc3, with one secondary seta on each side. LT with six to eight long LS, ~six short LS, patch of five to six small setae on anterior surface of base. Pleural region marked with large dark brown mark behind, below LT.

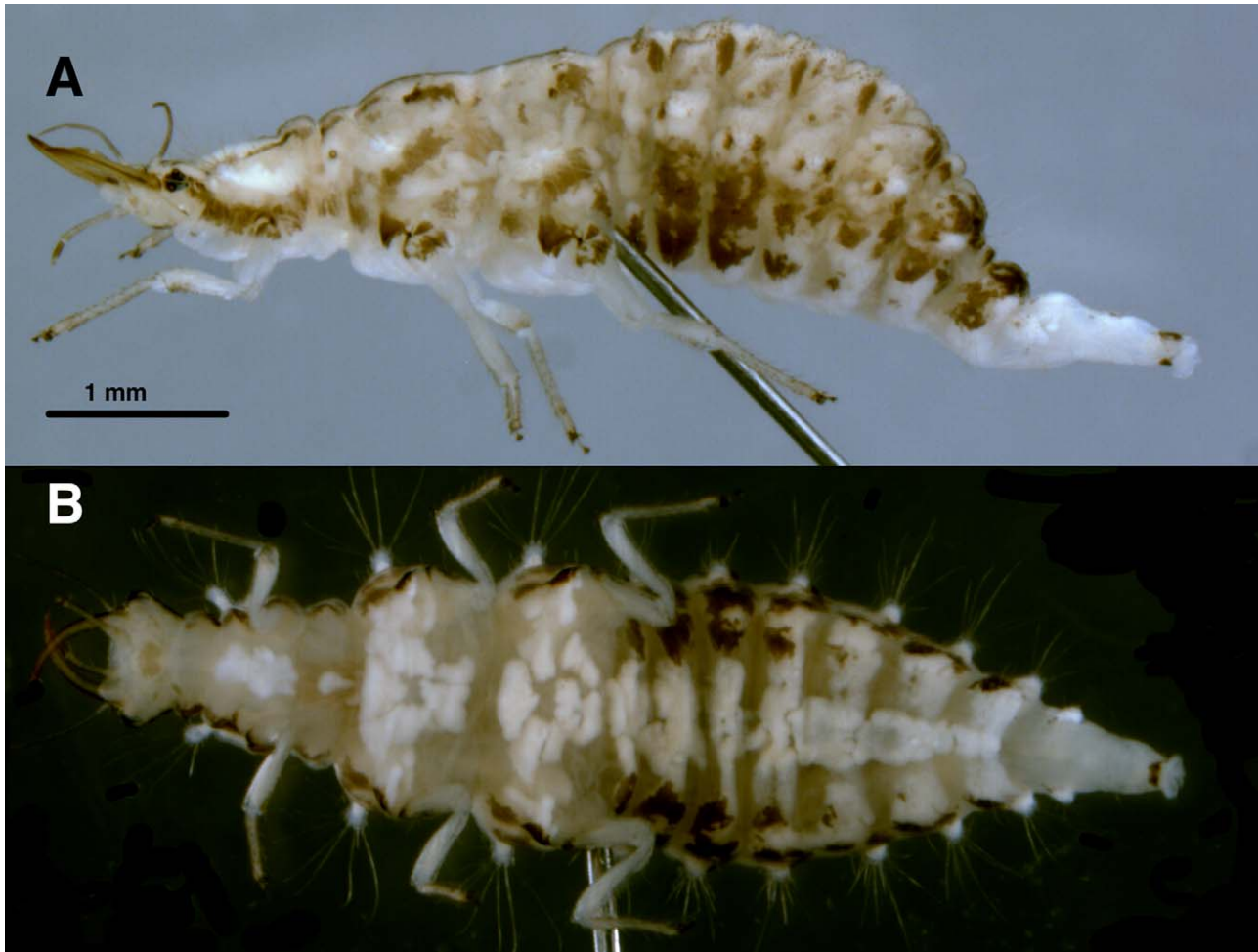


FIGURE 4. *Titanochrysa trespuntensis*, Third instar (Laboratory reared from female collected in Rio de Janeiro State, Brazil). A. Habitus, lateral; B. Habitus, ventral. Scale applies to both images.

T3: Dorsum with dark brown spot anteromesal to LT, pair of large brown marks midway between LT and midline. Small sclerite on anterior margin (Sc1) with one small seta (S1Sc1); mesolateral sclerite (Sc2) with one small associated seta (S1Sc2). S1 intermediate-length, anteromesal to Sc2; S2 very small, lateral to S1; posterior row of five pairs of robust, relatively straight setae, stemming from brown chalazae with pear-shaped brown markings beneath. LT with six to eight long LS, ~six short LS, patch of four to five short setae on anterior base of LT.

Abdomen (Figs 1A–C, 3B, C, 4, 5C, D). Dorsum, venter white to cream-colored, with brown to dark brown markings. Spiracles brown, circular, sessile, with narrow, conical atria. Dorsal markings: A1–A5 each with pair of submesal brown marks near anterior margin, pair of dark brown, transversely elongate marks behind posterior row of setae. A6, A7 each with pair of large, dark brown marks, pair of lighter brown marks extending onto top of LTs. A8 white, with small, elongate, brown spot mesally, pair of smaller spots laterally; A9 white, with pair of dark brown marks anteriorly. A10 white anteriorly, brown distally, with dark brown, inverted U-shaped mesal mark. LTs white, with brown, basal marks anteriorly and posteriorly: A2 with anterior mark dark brown, posterior mark light brown, A3, A4, with both marks dark brown, A5 with anterior mark light brown, posterior one dark brown. A1–A7: area ventral to LTs marked with large, dark brown to brown marks, especially A2, A3. A8, A9 white laterally. Venter white to cream-colored, with large, dark brown lateral marks on A1–A4, small brown marks on A5, very small on A6, tip of A10 with transverse, rectangular, brown, mark.

Abdominal LTs (A2–A7) well sclerotized, with short, straight sides, rounded distally, each with approximately six long LS on large distal chalazae, four medium-length LS slightly basal on LT, four smaller LS further basal on LT. LS mostly straight or with gentle curve, small terminal hook. Dorsal abdominal setae of four main types: (1) short or medium-length, thin, pointed, with small, unmarked chalazae (e.g., A1: anterior two pairs), (2) elongate,

robust, hooked, with large chalazae marked with brown anteriorly [e.g., A1: anterior row of submedian setae (SMS)], (3) elongate, thin, hooked, with small, unmarked chalazae (e.g., A2–A5: first and second rows of SMS), (4) short, robust, hooked, with large chalazae marked with brown anteriorly (A2–A4: posterior rows of SMS) (Fig. 1A–C, stp, erh, eth, srh).

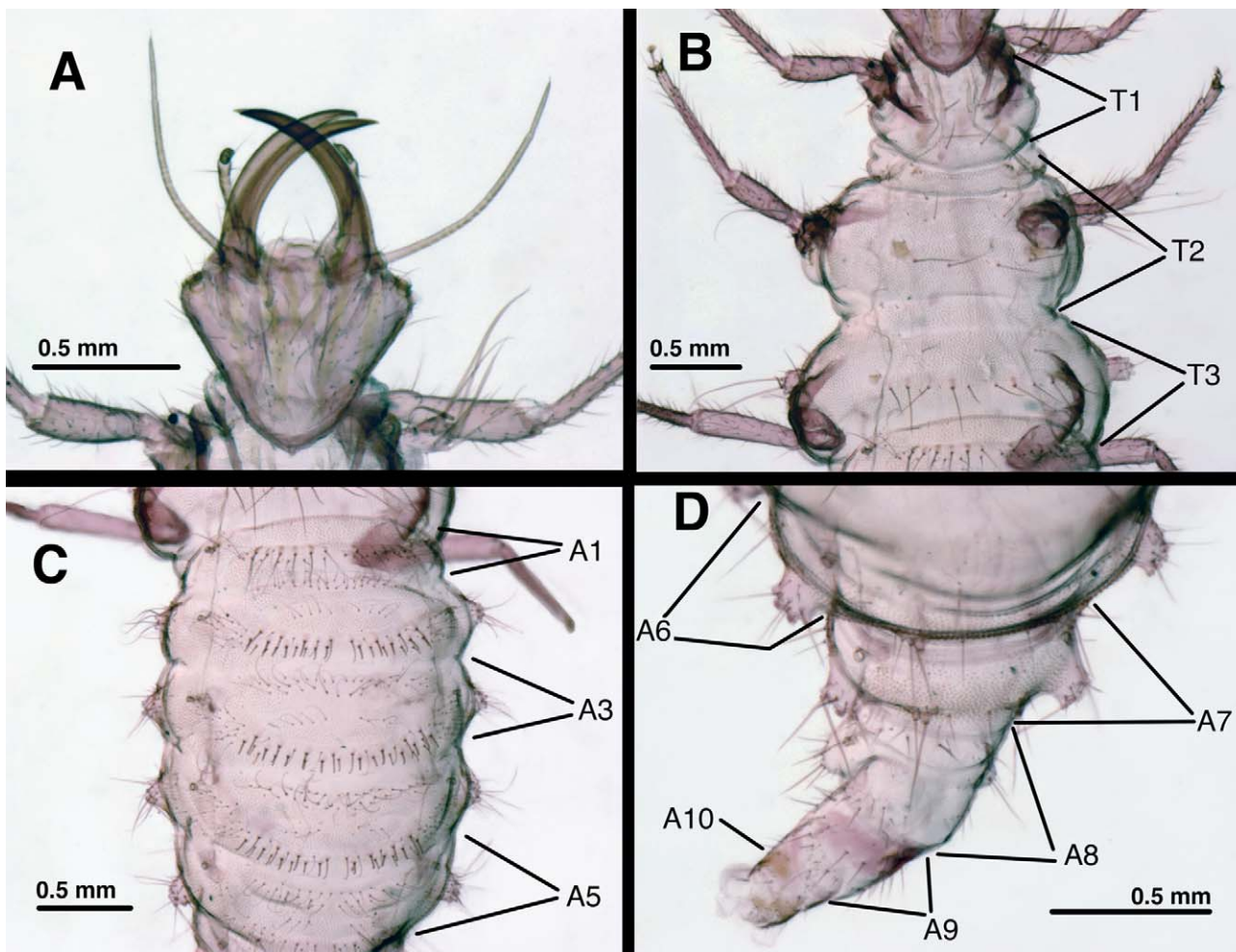


FIGURE 5. *Titanochrysa trespuntensis*, Cleared and stained third instar, dorsum (Laboratory reared from female collected in Rio de Janeiro State, Brazil). A. Head; B. Thorax; C. Abdominal segments 1 to 5; D. Abdominal segments 6 to 10. Abbreviations: A1–A10, first to last (tenth) abdominal segments; T1, T2, T3, first, second and third thoracic segments.

A1: Dorsum (from anterior to posterior) with two pairs of short setae near anterior margin, row of six to seven pairs of elongate, robust, hooked SMS arising from large chalazae with brown, teardrop-shaped marks on anterior surface, patch or three to four pairs of elongate, thin, hooked SMS on small, brown chalazae, lateral to robust chalazae; row of ~nine to ten pairs of elongate, thin, hooked SMS arising from small, brown chalazae without anterior marks. Spiracle with two to three slender, hooked spiracular setae (SSp) mesally.

A2–A4: Dorsum of each segment with three transverse rows of SMS, all hooked. Anterior row with 15 to 20 pairs of elongate, thin SMS arising from small, brown chalazae in double line. Middle row with four to five pairs of elongate, thin SMS arising from small chalazae in single line. Posterior double row with 12 to 14 pairs of short, robust SMS arising from large, brown chalazae in double line (chalazae with brown, teardrop-shaped marks anteriorly) and three to four pairs of elongate, thin SMS on small chalazae in anterior section of row. Patch of 14 to 16 (A2) to 24 to 26 pairs (A4) of elongate, thin SMS on brown chalazae lateral to mesal and posterior rows, extending to spiracle (A2) or beyond to base of LT (A4). No identifiable SSp.

A5: Dorsum with three transverse rows of SMS, all elongate, thin, hooked. Anterior row with four to five pairs of SMS arising from small chalazae in regular, single, anteromesal line, nine to ten pairs of slightly larger SMS on more robust chalazae, in irregular line close behind. Middle row with two pairs of smaller SMS arising from small chalazae mesally. Posterior row with 14 to 16 pairs of elongate, thin to more robust SMS arising from small

chalazae in irregular double line, pair of small laterodorsal tubercles (LDTs) midway in row, each bearing one elongate, robust hooked seta (LDS), one shorter, more slender LDS. Four to five pairs of small setae mesal and posterior to spiracles; no identifiable SSp.

A6: All setae straight, pointed; dorsum with one pair of medium-length, slender SMS arising from small chalazae anteriorly; pair of large LDTs posteriorly, each bearing three elongate, robust LDS, three to four shorter LDS; pair of medium-length, slender setae between LDTs; no identifiable SSp.

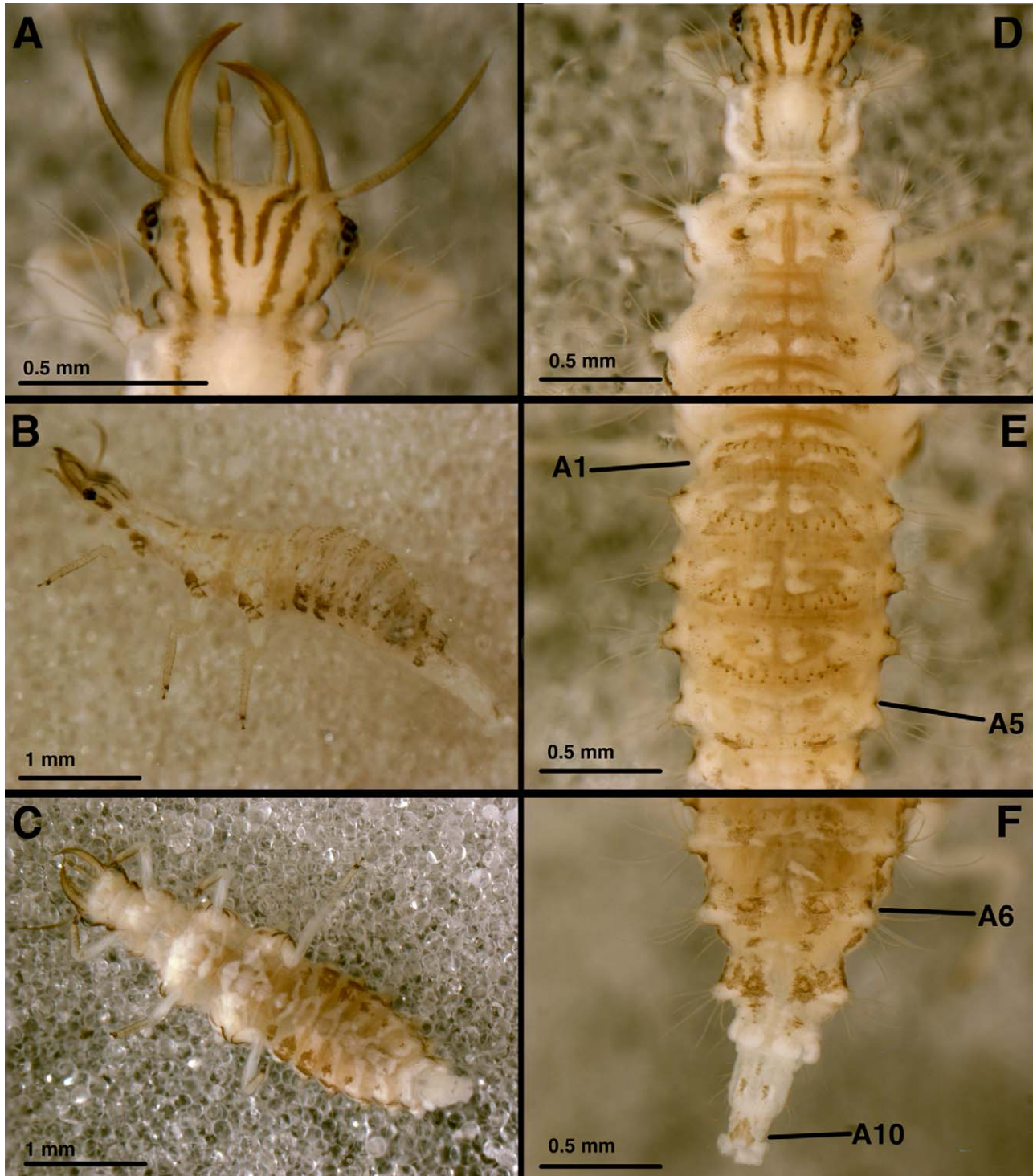


FIGURE 6. *Titanochrysa trespuntensis*, Second instar (Laboratory reared from female collected in Rio de Janeiro State, Brazil). A. Head, dorsal; B. Habitus, lateral; C. Habitus, ventral; D. Thorax; E. Abdominal segments 1 to 5; F. Abdominal segments 6 to 10.

A7: All setae straight, pointed; dorsum with two pairs of very short setae anteriorly, between spiracles; pair of LDTs posteriorly, each with one long LDS, two medium-length LDS, two short LDS; pair of setae between LDTs; pair of small setae (SSp) mesal to spiracles.

A8: LTs rounded, without straight sides, with one long LS, eight to nine medium-length to short LS; two pairs of small anterior setae; posterior row with three pairs of medium-length SMS; no identifiable SSp.

A9: Dorsum with two transverse rows of short to medium-length SMS, one almost midway down segment with four to five pairs of short to medium-length setae, one posterior, with five to six pairs of short to medium-length setae.

A10: Dorsum with ~five pairs of short setae, most lateral, two pairs posterior; patch of microsetae at terminus. Terminus with two membranous pouches, eversible laterally.

Second instar. Similar to third instar with following exceptions. *Body.* 4.2–4.6 mm long.

Head (Fig. 6A–C). Mandibles slightly shorter than width of head; head width across eyes, 0.59–0.60 mm; mandible length, 0.48–0.49 mm (ratio, mandible length to head width = ~0.82). Cranium with fewer secondary setae (~25). Labial palpus: basal segment lacking one short mesal setae; middle segment with four annulations: basal annulation with three short setae, one long seta, second and third annulations without setae, fourth (distal) annulation with three long setae. Palpiger with two medium-length to long ventral setae. Mentum with only one pair (not two) of medium-length setae posteriorly; others as on third instar.

Thorax (Fig. 6B–D). LTs each with approximately six to eight long LS, four to five shorter LS. T1: Notum with only one pair of secondary setae. T2: Notum without SSp, S1, S3Sc1, S2Sc3, S3Sc3, secondary setae. T3 without secondary setae.

Abdomen (Fig. 6B, C, E, F). LTs each with approximately four long, robust LS on large chalazae, five pairs of shorter LS on smaller chalazae. A1: Posterior row with seven to eight pairs of robust, elongate SMS, one pair of more slender, long SMS near lateral edge. A2–A4: Anterior row with two to three pairs of elongate, thin SMS arising from small, brown chalazae; mesal row with two pairs of elongate, thin SMS; posterior row with seven to eight pairs of short, robust SMS arising from large chalazae with brown, teardrop-shaped marks; patch of two to three pairs of elongate, thin SMS lateral to mesal and posterior rows; two pairs of setae (SSp) mesal to spiracles. A5: Anterior row with four to five pairs of slightly robust, medium-length SMS arising from small, robust chalazae in slightly irregular line; posterior row with four to five pairs of medium-length, robust SMS arising from large chalazae in irregular line, pair of laterodorsal tubercles, each with one long and one shorter, smooth, straight seta (LDS); two pairs of setae (SSp?) mesal to spiracles. A6: Dorsum with one to two pairs of medium-length setae anteriorly; middle row with two pairs of very small setae; LDTs each bearing one long and one shorter seta (LDS), one seta immediately anterior; pair of setae (SSp?) mesal to spiracles. A7: LDTs each with one long and one short seta (LDS); pair of setae (SSp?) mesal to spiracles. A8: LTs each with one medium-length LS, two to three shorter LS; anterior setae very small; pair of setae (SSp?) posteromesal to spiracles.

First instar. *Body.* 2.3–2.9 mm long, predominantly white to cream-colored, with small light brown to brown spotty markings; venter white, without markings. LS light amber to amber; dorsal setae pale.

Head (Fig. 7A–C, F, G). Mandibles slightly shorter than width of head; head width across eyes, 0.40–0.42 mm; mandible length, 0.32–0.35 mm (ratio, mandible length to head width = ~0.82). Cranial setae smooth, straight, pointed, golden to light brown. Epicranial marking divided, with pattern resembling that of L3, L2; mesal section light brown, elongate, narrow, longitudinal stripe, contiguous with postfrontal marking; lateral section diffuse, elongate, very light brown, intermandibular marking absent. Postfrontal marking dark brown, extending anteriorly to mesal base of antenna. Frontal marking paired, separate, dark brown, narrow, elongate stripe extending anteriorly, bending toward inner basal margin of mandible. Genal marking brown, elongate, extending from base of cranium anteriorly almost to eye, forked anteriorly. Labial palpus amber to light brown; terminal segment darker than others. Mandible brown to dark brown. Antenna light to dark brown.

Thorax (Fig. 7B, C, F, H). Legs white, with amber setae; tips of tarsi, claws, empodia, brown to dark brown. LS cream to white, curved to straight, without hooks; other setae pale amber, straight, without hooks.

T1: LT with two LS, microseta dorsally. Sc1 brown, elongate; S1Sc1 long, arising from small chalaza; S2Sc1 absent. S1 short; S3 intermediate-length, S4 short; S2, S5 absent.

T2: Spiracles brown, circular, sessile. LT with three white to cream-colored, granular to slightly granular LS, microseta dorsally. Sclerites brown; associated setae S1Sc1, S1Sc2 very small; S1Sc3 medium-length. Posterior subsegment with row of four straight setae posterior to Sc3 (mesal short; lateral pair long, arising from chalazae).

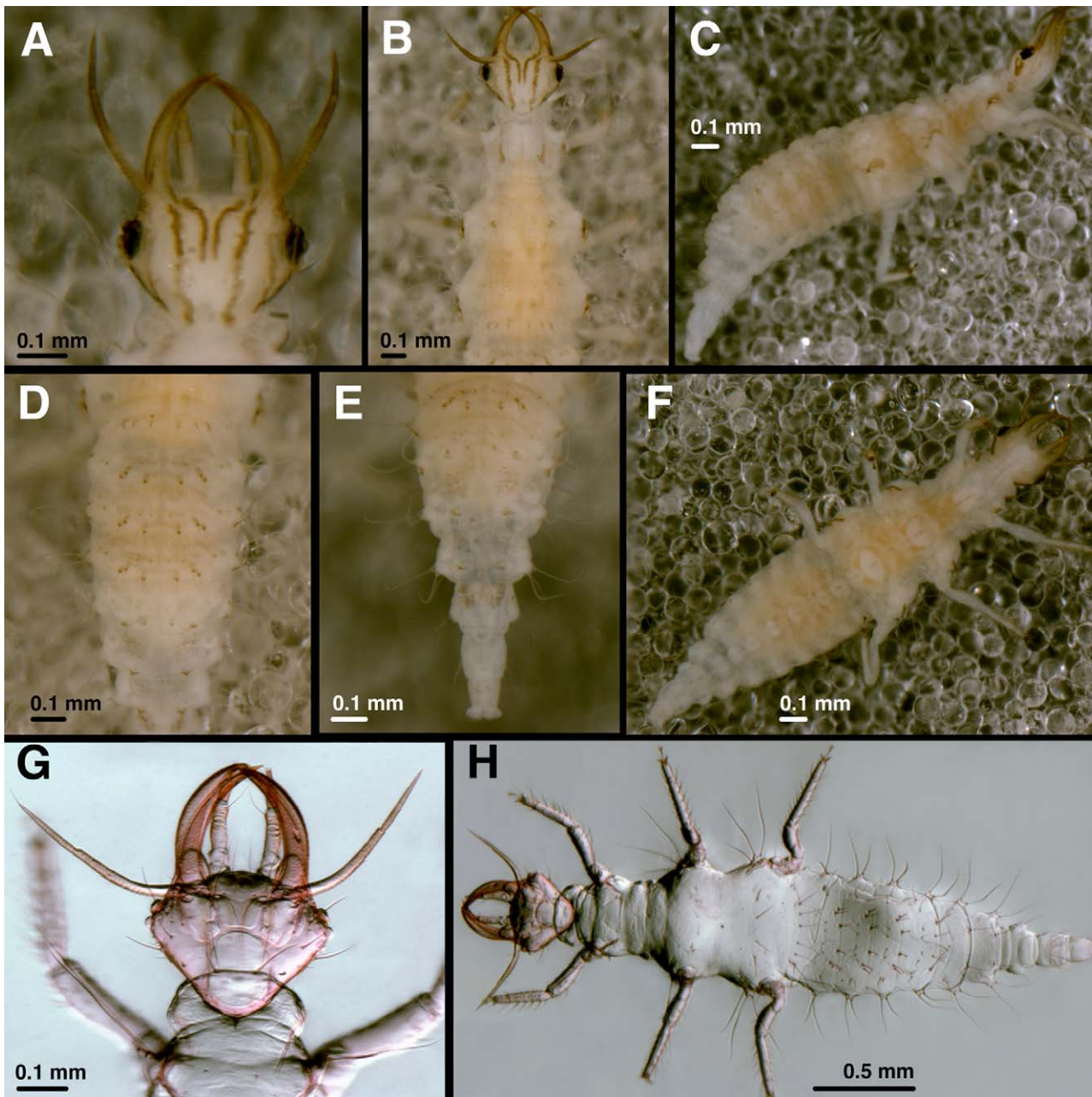


FIGURE 7. *Titanochrysa trespuntensis*, First instar (Laboratory reared from female collected in Rio de Janeiro State, Brazil). A. Head, dorsal; B. Head, thorax, dorsal. C. Habitus, lateral; D. Abdominal segments 1 to 5, dorsal. E. Abdominal segments 6 to 10, dorsal. F. Habitus, ventral. G. Head, cleared. H. Body, cleared.

T3: LT with three white to cream-colored, granular to slightly granular LS, microseta dorsally. Sclerites Sc1, Sc2 small, with S1Sc1 very small; S1Sc2 absent. Posterior region with row of four straight setae on chalazae, posterior to Sc2.

Abdomen (Fig. 7C–F, H). Dorsum white to cream-colored, with some very light brown mottling; chalazae of most primary dorsal setae brown; LTs with setal bases brown, with light brown marks or mottling anteriorly, posteriorly; A1–A4 each with three pairs of setae stemming from large brown chalazae with teardrop-shaped brown marks anteriorly; spiracles uncolored, difficult to see; SSp with brown chalazae. A1: Two pairs of straight, pointed submedian setae (SMS) between pair of laterodorsal tubercles, each bearing one long, one shorter LDS. A2–A4: SSp small; anterior row with two pairs of slender, hooked SMS; posterior row with three pairs of short, stout, hooked setae, one pair mesally, two pairs in close proximity, sublaterally; one to two pairs of short, straight, pointed setae anterolateral to posterior row. A5: Same as A4, except posterior row with lateral two setae on small

laterodorsal tubercle, one LDS long, straight, pointed, one short. A6: Anterior row with one pair of very short setae; posterior row with one pair of very short setae between LDTs, each with one medium-length, straight LDS, one very short LDS. A7: Anterior region without setae; posterior section with pair of prominent LDTs, each bearing one long, straight LDS, one short LDS. A8: LTs each bearing one medium-length LS, one shorter LS; posterior section with two pairs of SMS, lateral pair longer than mesal pair. A9: In cleared specimen, segment appears subdivided; anterior section with one pair of small setae mesally, two pairs larger, more robust setae posteriorly; posterior section with one pair of robust setae mesally, one pair laterally. A10: Two pairs of short, straight setae on sides; small, eversible, membranous pouches distally.

Larval specimens & variation. Our samples were restricted to the offspring of three field-collected females from two localities in mid-coastal to southern Brazil [two lots from Rio de Janeiro: Santa Maria Madalena, Terras Frias (Tauber Lots 2003: 50, 2003: 51, TRC) and one lot from Rio Grande do Sul: Cachoeira do Sul, São Nicolau (Albuquerque Lot 05.13, UENF)]. Other than some differences in the size and depth of head and body markings, there was little variation of note. Specimens showed minor variation in the setal numbers mentioned in the descriptions. Many showed asymmetry in the numbers between the left and right sides of the body; such a pattern of asymmetry appears to be the norm among chrysopid species (see Mantoanelli *et al.* 2006; Tauber *et al.* 2011). We did not determine if one side or the other consistently had the higher number.

Egg. Ovoid, 2.4–2.7 mm long; 1.2–1.3 mm wide; stalk golden, 6.0–8.0 mm long; apparently without droplets. Color: light green to green.

Biology. Adults of this species were collected in the shadowy, lower understory of forested areas. In the laboratory, two gravid, field-collected, females laid ~25 stalked eggs per day for several days; the eggs were deposited individually, in no particular pattern. Hatching occurred within approximately five to seven days at room temperature ($\sim 21 \pm 3^\circ\text{C}$). Larval development took approximately 20 to 25 days at the same temperature. During their development, the larvae were lively and fast moving; like most insects, they moved more slowly and less frequently as they approached ecdysis or spinning.

Generic comparisons. Behaviorally, *T. trespuntensis* shares many features with species in the two common Neotropical genera, *Ceraeochrysa* and *Chrysopodes*, that previously contained *Titanochrysa* species. For example, the larvae of all three genera are trash-carrying, and they have similar types of movements in placing and carrying debris on their dorsa. Moreover, females in all three genera lay their eggs individually, not in clusters with the stalks intertwined as do some species in other genera. One distinguishing feature of *T. trespuntensis* larvae is their agility and relatively rapid mobility; all three instars appeared to move more quickly and more frequently than species we have reared in the other two genera.

Like the larvae in other trash-carrying genera of Chrysopini, *T. trespuntensis* larvae have gibbous, setose bodies with well-formed lateral tubercles on the thorax and abdomen, and their dorsal setae are modified (elongate, hooked) for carrying small pieces of debris. Thus, superficially, they resemble the larvae of both *Ceraeochrysa* and *Chrysopodes* (see Tauber *et al.* 2000, 2001; Tauber 2003). However, the following set of traits can differentiate them:

1. Cephalic setae: all primary cephalic setae smooth (similar to *Ceraeochrysa*, but unlike many *Chrysopodes*); numerous small secondary setae across the midsection of the cranial dorsum [a few *Chrysopodes* species have several (not numerous) secondary setae on the cranium; *Ceraeochrysa* species have none].

2. All thoracic setae smooth, except those on the lateral tubercles that may be lightly granulose (under x200 magnification) (similar to *Ceraeochrysa*, unlike many *Chrysopodes*).

3. Metathorax with posterior subsegment bearing a row of robust, straight setae arising from brown chalazae with brown teardrop-shaped markings extending from the anterior surface (similar to *Chrysopodes*, but unlike *Ceraeochrysa*).

4. Posterior subsegment of metathorax not raised above anterior subsegment (similar to *Ceraeochrysa*, but unlike *Chrysopodes*).

5. Abdominal segment 1 with anterior row of robust, straight setae arising from large, brown chalazae with brown teardrop-shaped markings extending from anterior surface (unique),

6. Abdominal segments 2–5 each with anterior row of numerous long, smooth, hooked, submedian setae (SMS), middle row of four pairs of similar SMS (unique).

7. Abdominal segments 2–4 each with posterior row of three (first instar), seven to eight (second instar), or twelve to 14 (third instar) pairs of relatively short, stout, hooked setae, each extending from a brown chalaza with a teardrop-shaped, brown mark anteriorly (unique).

All of the above larval features that distinguish *T. trespuntensis* larvae are based on characters that are of general taxonomic value for chrysopine genera. Thus, we can use the differences to draw two general conclusions. First, although the validity of *Titanochrysa* as a distinct genus in the Chrysopini was well supported by adult characters (Sosa & Freitas 2012), the above striking differences between *T. trespuntensis* larvae and the larval features that characterize the other two genera provide additional, strong evidence for the validity of the genus. Second, we predict that many, if not all, the character states listed here for *T. trespuntensis* apply generally to the genus. We hope that larvae of other *Titanochrysa* species will be reared and described in the near future to confirm or refute our prediction.

New species description

Titanochrysa simpliciala Tauber

Figs 8–11

Type material. The holotype (a male) is in the Entomological Collection of the University of Minnesota [UMIN]. Its labels read: [1] “COSTA RICA: Heredia / Quebrada Amistad, 1.8 km / (road) NW Porosail / 10.097°N, 84.119W / 8.ii.1992, el. 1920 m / Holzenthal, Muñoz, Kjer”; [2] “*Chrysopodes* / sp. / det. Penny, 92”; [3] “HOLOTYPE / *Titanochrysa simpliciala* / des. C. A. Tauber 2012”.

Diagnosis. Externally, the *T. simpliciala* adult resembles many of the common *Chrysoperla* species [e.g., *Chrysoperla externa* (Hagen)] in its light green coloration with a yellow median stripe and simple, unmarked wings with regular, largely green venation and narrow costal area. However, it clearly falls into the genus *Titanochrysa*. It has a pronounced lateral stripe on the scapes, black genal markings, largely black labial and maxillary palpi, and basal inner gradates meeting Psm—all traits that typify *Titanochrysa* species. Also, it has a broadly based gonarcus, a broad, somewhat membranous mediuncus with beak-like apex and lateral lobes, microtholi on sternites 3–8, a simple, straight, dorsal apodeme on T9+ectoproct, and a spoon-shaped gonapsis—all character states that typify *Titanochrysa* males.

This species keys out at couplet 2 (*Titanochrysa trespuntensis* Sosa & Freitas) in the “Key to species of *Titanochrysa*” (Sosa & Freitas 2012: 17). For example, couplet 1: it has microtholi on abdominal sternites 3–8, and the dorsal rods on the median plate of the arcessus are parallel, not X-shaped; couplet 2: the membrane of the forewing is entirely without shading, and the male has a field of small setae below the mediuncus and above the gonosaccus. However, the species differs from *T. trespuntensis* in that the wing venation is entirely green (not with black areas as in *T. trespuntensis*); the setae on the flagellum are amber-colored (not black as in *T. trespuntensis*); there are more costal crossveins and they are slanted (not perpendicular or almost perpendicular as in *T. trespuntensis*); the dorsum of the mediuncus is not striated (as in *T. trespuntensis*); and the gonapsis lacks an acute dorsal projection (present on *T. trespuntensis*).

Description. *Head* (Fig. 8): 1.2 mm wide (including eyes); ratio of head width to eye width = 2.35 : 1. Vertex raised, rounded, dome-like; surface smooth, without setae; posterior region with prominent, flat, raised areas. Antenna 12.0, 12.2 mm long (~0.88 times length of forewing); scape slightly longer than broad (frontal view, 0.26 mm long, 0.23 mm wide); lateral margin of scapes straight, mesal margin convex; distance between scapes 0.09 mm; distance between tentorial pits 0.40 mm; length of frons (midway between scapes – midway between tentorial pits) 0.32 mm. Frons largely flat, with smooth, shiny surface, with anterior margin strongly concave, angular at midline. Clypeus smooth, shiny, with anterior margin straight. Labrum with dorsal surface sculptured, base slightly pinched mesally, distal margin with small, mesal indentation, anterolateral margins rounded. [Note: On the maxillae of the holotype, the galeae are large and they extend well beyond the labrum. Whether this condition is characteristic of the species or unique to this specimen is not known.]

Head coloration (Fig. 8): Antenna: scape light cream, with heavy black lateral stripe; pedicel light cream, with black distolateral stripe; flagellum light cream-colored, with pale setae. Vertex, dorsal torulus yellow to cream. Frons creamy white, without markings. Anterior torulus creamy white, with pair of small black lateral spots. Clypeus creamy white, with black stripe along lateral margin. Gena with base creamy white dorsally, ventrally; lateral surface black. Labrum cream-colored. Maxillary palpus: distal three palpomeres entirely black; basal two palpomeres cream-colored. Labial palpus: distal palpomere cream-colored, with black tip; basal two palpomeres cream-colored, unmarked. Venter cream-colored throughout.

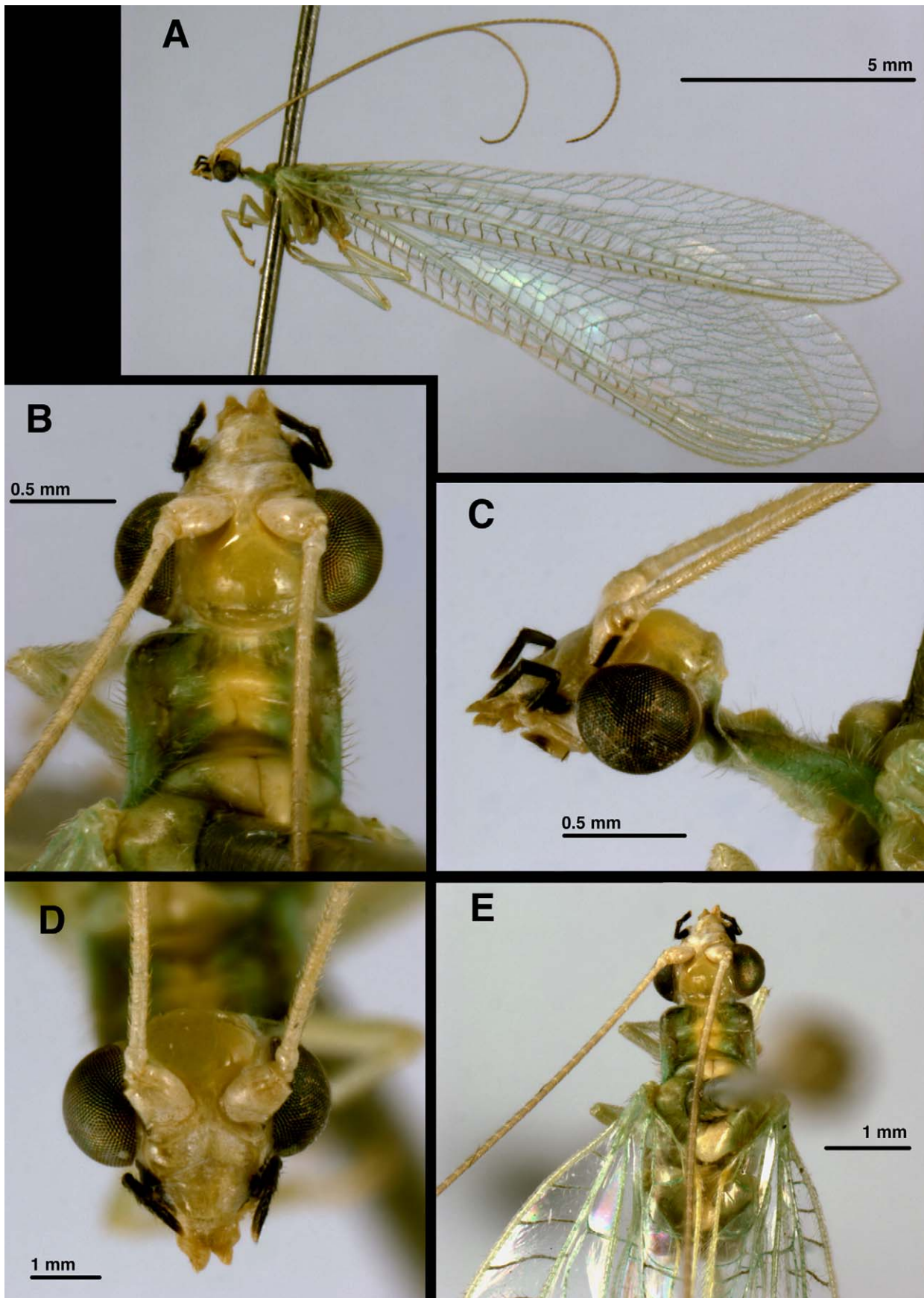


FIGURE 8. *Titanochrysa simpliciala*, Holotype, Entomological Collection, University of Minnesota. A. Habitus, lateral; B. Head and prothorax, dorsal; C. Head and prothorax, lateral; D. Head, frontal; E. Head and thorax, dorsal.

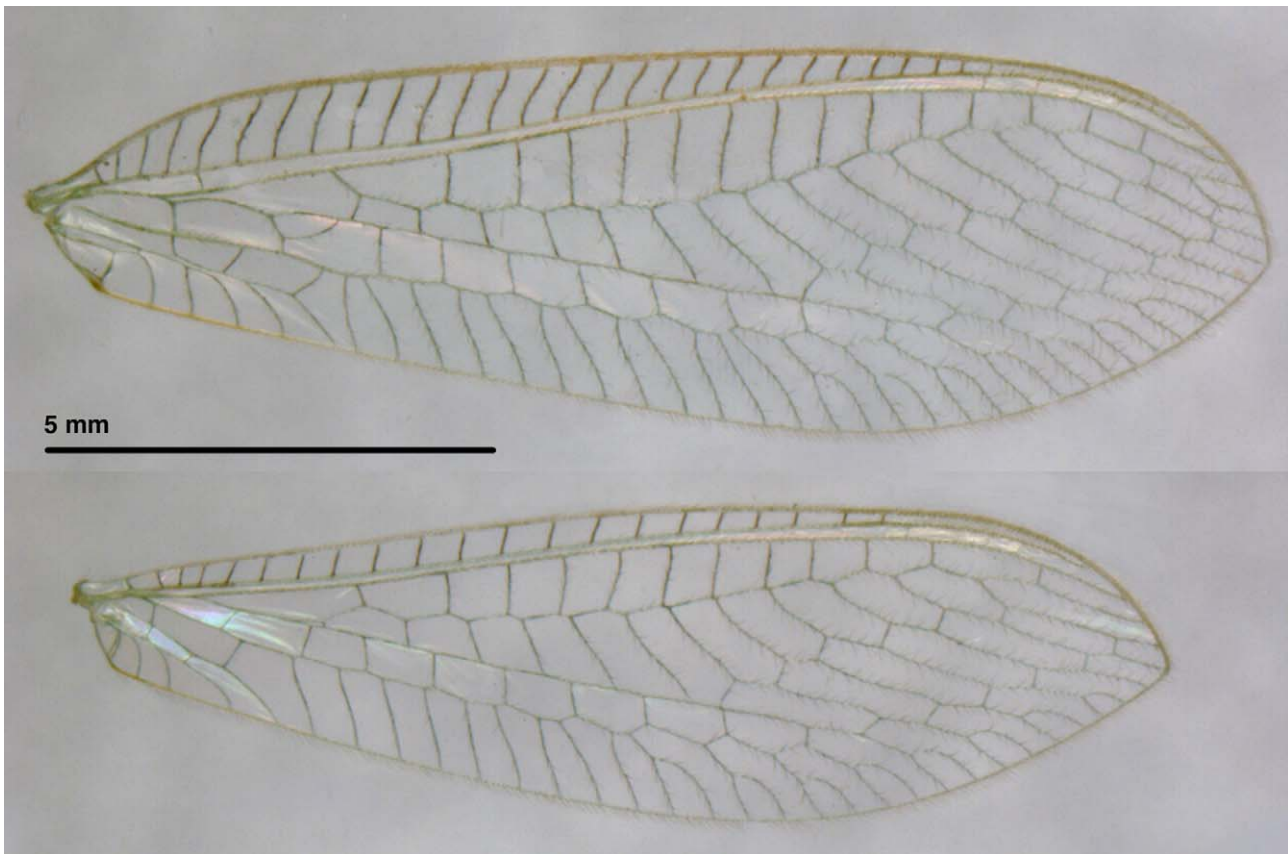


FIGURE 9. *Titanochrysa simpliciala*, Holotype, Entomological Collection, University of Minnesota. Upper, Forewing; Lower, Hindwing. Scale applies to both wings.

Thorax: (Fig. 8): Cervix mostly yellowish green, with small black spot laterally. Prothorax (sclerotized region) 0.48 mm long, 0.94 mm wide; ratio of length to width = 0.51 : 1; setae medium-length, light golden to light brown; pronotum green, with broad, yellow mesal stripe, pair of diffuse lateral (anterior) to sublateral (posterior) stripes, black anteriorly, becoming reddish posteriorly. Mesonotum, metanotum yellow mesally to very light green dorsolaterally; sides creamy white. Legs cream to very light green, with pale setae; tips of claws brown, bases pale, central area black.

Wings: (Fig. 9): Forewing 13.8 mm long, 3.5 mm wide (at widest point); ratio of length : maximum width = 3.3 : 1. Costal area relatively narrow; tallest costal cell (#7) 0.8 mm tall, 2.3 times width, 0.21 times width of wing (midwing). First intramedian cell ovate, 0.6 times width of third median cell. First radial crossvein distal to origin of radial sector (Rs); radial area (between Radius and Rs) with single row of 14 closed cells; tallest cell (#6) 1.9 times taller than wide. Six b cells (= cells beneath Rs, not including an inner gradate vein). Two series of gradate veins; eight inner, eight outer gradates (both in regular, parallel series). Six b' cells (cells beneath pseudomedia after second intramedian cell). Three intracubital cells (two closed). Stigma transparent, unmarked, with four subcostal crossveins below. Longitudinal veins green; costal veinlets brown throughout or at distal and basal ends, radial crossveins brown throughout or brown at basal end; other crossveins, gradates, veinlets green; membrane unmarked.

Hindwing 12.2 mm long, 3.5 mm wide. Two series of gradate veins; six inner, six outer gradate veins (all in regular, parallel series); twelve radial cells (counted from origin of Radius, not false origin). Six b cells (including one small "t" cell); six b' cells beyond second intramedian cell; three intracubital cells (two closed). Stigma slightly transparent; veins green, except costal veinlets, some radial crossveins brown; membrane clear.

Male abdomen: (Figs 10, 11): Tergites 3–7 roughly rectangular, very narrow, long, with rounded edges; in lateral view, length about six to seven times height; ventral margins regular, straight; T6, length approximately same as length of T7 (x 1.1). Spiracles small, oval externally; atria not enlarged. Integument of pleural region without folds; depth approximately same as height of sternites (lateral view). Length of sternites 4–7 approximately two times height.

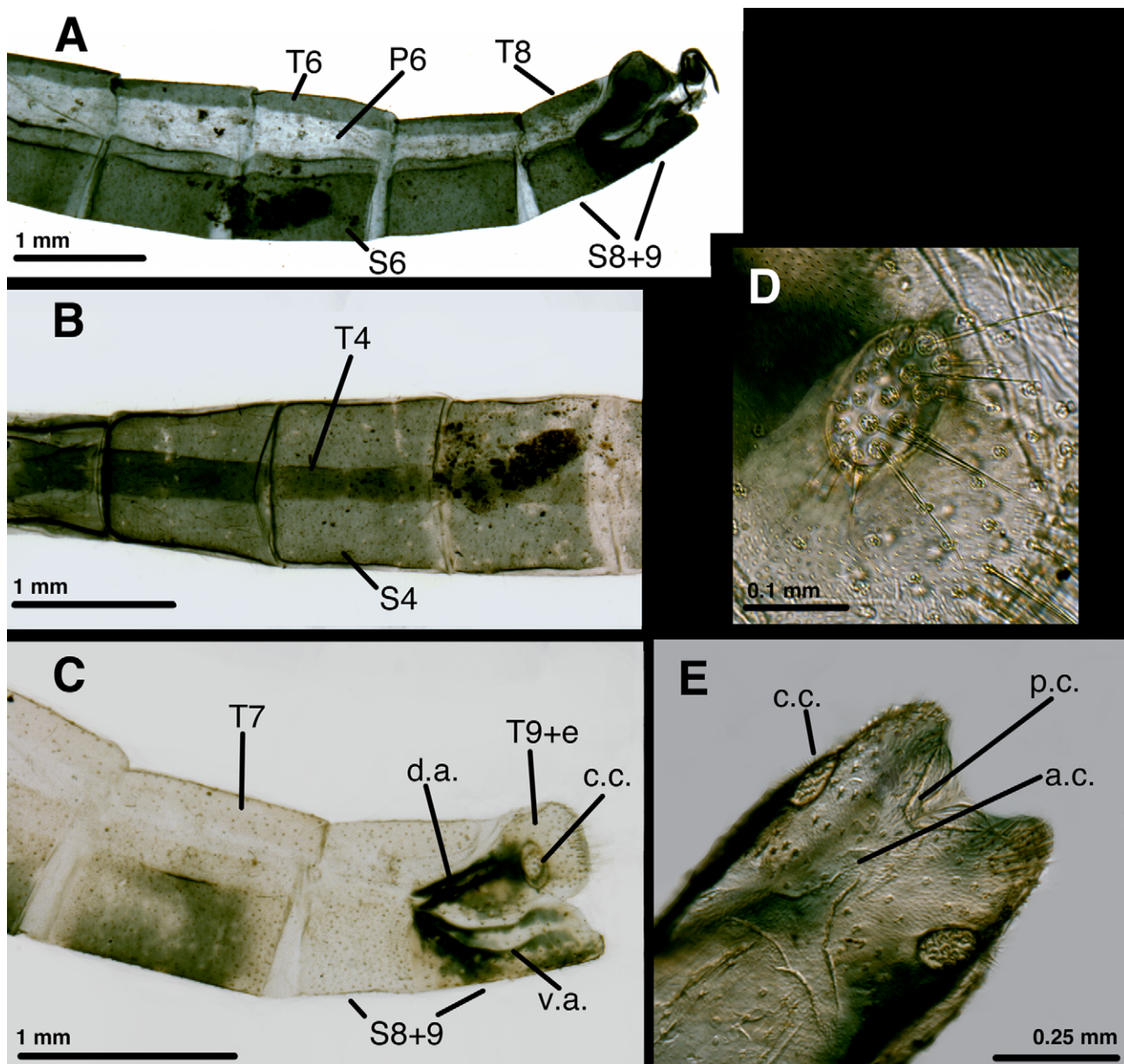


FIGURE 10. *Titanochrysa simpliciala*, Holotype, Entomological Collection, University of Minnesota. Male abdomen. A. Segments 4-terminus, lateral; B. Segments 2-5, ventral (full width of sternites, with tergites behind, visible through sternites); C. Terminal segments, lateral; D. Callus cerci; E. Tergite 9 + ectoproct, dorsal. Abbreviations: a.c., anterior cleft of T9+e; c.c., callus cerci; d.a., dorsal apodeme of ectoproct; p.c., posterior cleft of T9+e; P6, pleural membrane of sixth segment; S4, fourth sternite; S6, sixth sternite; S8+9, fused eighth and ninth sternites; T4, fourth tergite; T6, sixth tergite; T7, seventh tergite; T8, eighth tergite; T9+e, fused ninth tergite and ectoproct; v.a., ventral apodeme of S8+9. Note: The abdominal tergites are elongate and very narrow, whereas the sternites are broad and tall. In Fig 12A, T5 and T6 are shown in full width (they are not folded), and S5 and S6 are folded, offset from the midline; T8 and S8+9 are folded in the center. In Fig. 12B, the tergites and sternites are not folded, and the full width of each is in view (tergites: dark, narrow, mesal stripe, visible below the sternites, which extend the full width of the abdomen).

Callus cerci ovate, margins well sclerotized; 0.17 mm length, 0.10 mm width, with 23-34 trichobothria, mostly long. T9+ectoproct (lateral view) truncate distally, with long, robust, straight setae; (dorsal view) rounded distally, left and right sections of basal region separated by deep cleft, sections fused in distal region; ventral section extending broadly below approximately one-half of T8, to anterior margin of S8, with slender, well sclerotized apodeme extending from behind callus cerci, along dorsal margin of ectoproct to posterior margin; apodeme unbranched. S8+9 (lateral view) with proximal margin straight; ventral margin straight, without knob; dorsal margin fairly straight anteriorly, with deep concave depression after midregion; rounded terminus; dorsal margin

with heavy apodeme from base along entire dorsal length of sternite (absent from terminal margin). S8+9 (ventral view) broad basally; distal section rounded, narrowing to blunt terminus; microtholi present on S3–S8, absent from S1, S2, S9. Setae on terminal section of S9 robust, long. Subanal plate small, partially withdrawn; gonarc complex connected to terminus of ectoproct by relatively short, clear, smooth membrane that attaches to top of gonarcus, membrane extending around sides of gonarcus, becoming confluent with distal base of gonosaccus. Gonarcus fairly robust, arcuate, with lateral apodemes extending approximately perpendicularly from gonarcal bridge; gonarcal apodemes slightly enlarged, rounded, distally, with curved processes extending outward on lateral margins of gonosaccus below rods. Mediuncus broad basally, dome-like; pair of flat lateral rods extending from lateral margin of gonarcal bridge, along top of mediuncus to lateral edges of tip; tip of mediuncus with pair of rounded, lateral lobes, small, sharp beak mesally. Gonosaccus expanded below neck of mediuncus, smooth with field of small gonosetae immediately below mediuncus, large field of ~24 robust, long setae on large chalazae in lower region. Gonapsis elongate, flattened laterally, dumbbell-shaped in lateral view; tip with well sclerotized, internal beak, scalloped dorsal margin. Gonocristae absent; hypandrium internum not found.

Female: Unknown.

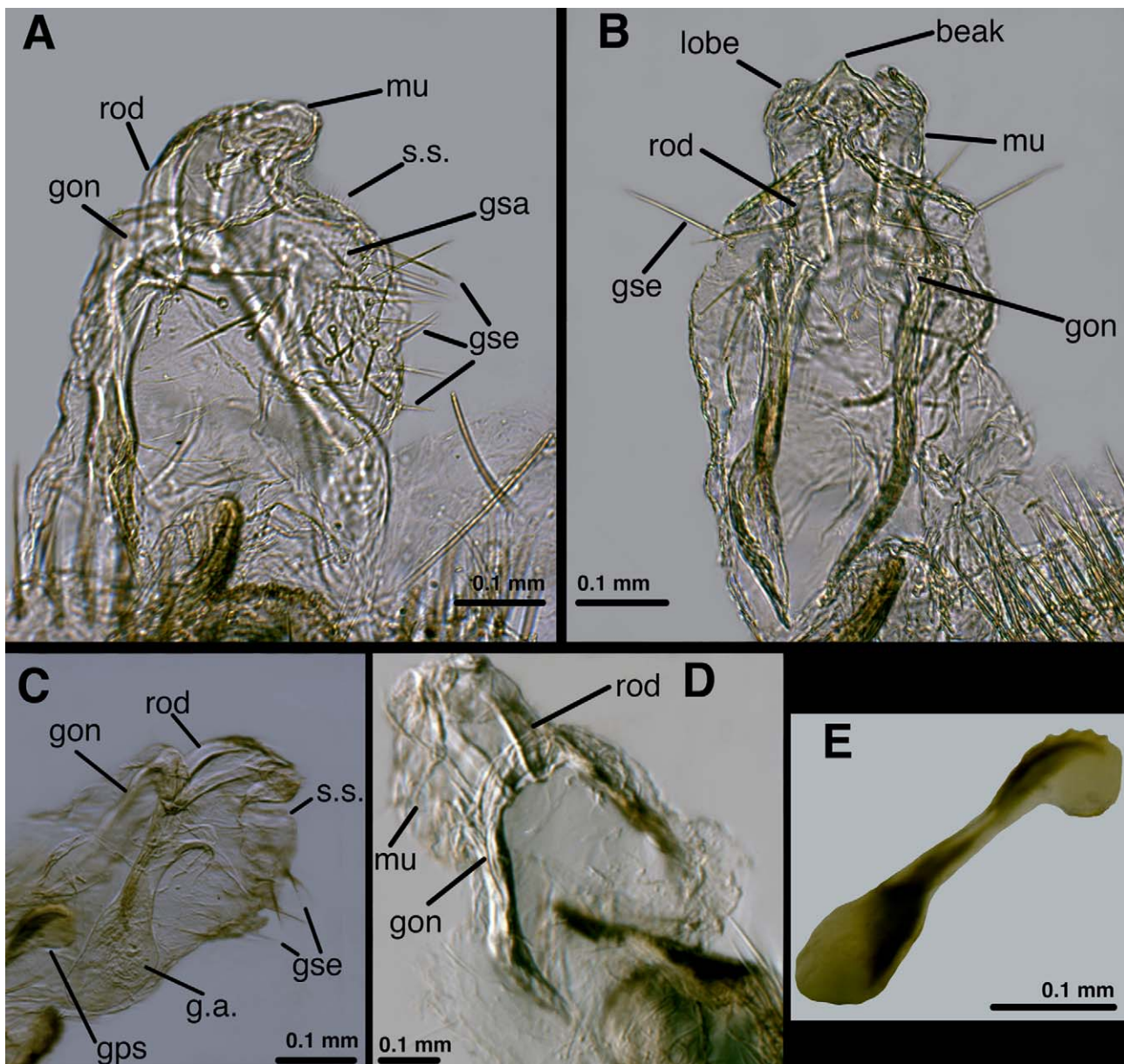


FIGURE 11. *Titanochrysa simpliciala*, Holotype, Entomological Collection, University of Minnesota. Male genitalia—gonarc complex. A. Ventrolateral; B. Ventral; C. Dorsolateral (Note gonapsis.); D. Dorsal; E. Gonapsis, lateral [Note scalloped edge on dorsal margin of distal lobe (right)]. Abbreviations: beak, mediuncal beak; g.a., gonarcal arm; gon, gonarcus; gps, gonapsis; gsa, gonosaccus; gse, gonosetae; lobe, mediuncal lobe; mu, mediuncus; rod, mediuncal rod; s.s., short setae.

Specimens examined. The species is known only from the type.

Variation. Unknown.

Known distribution. COSTA RICA (Heredia).

Etymology. The name “simpliciala” (simplici-, Latin adjective, meaning simple; “ala”, Latin noun, fem., meaning wing) refers to the species’ very simple wings (transparent stigmas, unmarked membranes, very regular, largely green venation).

Taxonomy

Titanochrysa annotaria (Banks, 1946), New Combination

Figs 12–15

Chrysopa annotaria Banks, 1945 [1946]: 152 [original description; locality: “Boquete, Chiriqui Province, Panama, 10 May (Fairchild)”]. Penny 1977: 16 [species list]; Brooks & Barnard 1990: 278 [species list, as *incertae sedis*]; Oswald 2007 [catalog listing].

Titanochrysa annotaria (Banks). **New Combination.**

Ceraeochrysa pseudovaricosa Penny, 1998: 62 [original description; locality: “Costa Rica: Puntarenas Province, La Amistad National Park, 1500 m, 8°57’N, 82°50’W, 18.II.1991. Penny.”]. Penny 2002: 216, 301–355 [faunal treatment, brief redescription, illustrations]; Freitas, Penny & Adams 2009: 569 [revision of genus, redescription, illustrations].

Titanochrysa pseudovaricosa (Penny). Sosa & Freitas 2012: 7 [transfer to *Titanochrysa*, redescription, images]. **New Synonym.**

Type material. *Chrysopa annotaria*. Lectotype (Figs. 12–15). Museum of Comparative Zoology [Harvard University, Cambridge]; one specimen, female (examined). Labels: [1] Boquete / Chiriqui Prov. / R. P. 10-V”; [2] “F. B. Fairchild / Collector”; [3] “M. C. Z. / Type / 25645” [red, printed, hand-written]; [4] “Chrysopa / annotaria Bks type”; [5] “*Titanochrysa annotaria* / (Banks) det. C. A. Tauber 2012”.

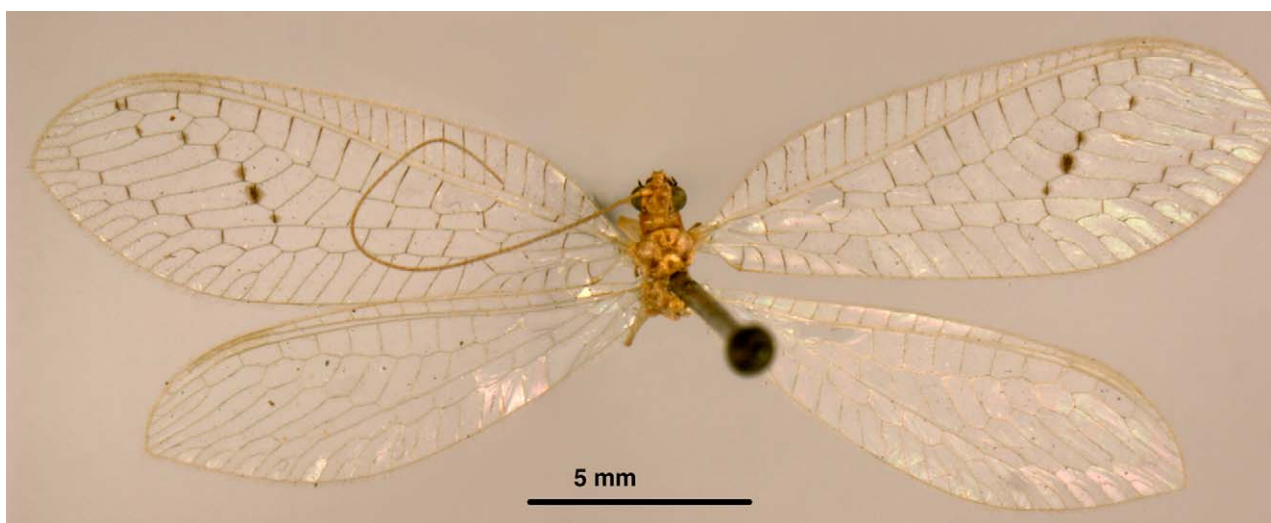


FIGURE 12. *Chrysopa annotaria*, Lectotype, Museum of Comparative Zoology. Habitus, dorsal.

Banks (1945) did not mention how many specimens he used to prepare his description of this species. There is only one type in the MCZ, and we consider it to be the lectotype. Although the genitalia are slightly damaged, the specimen is in fairly good condition.

Ceraeochrysa pseudovaricosa. Holotype. Instituto de Biodiversidad, Santo Domingo de Heredia, Costa Rica; one specimen, male (not examined). Allotype and paratypes, all from the type locality, in the CAS (examined, also images, supplied by F. J. Sosa Duque).

The synonymy of *C. pseudovaricosa* with *T. annotaria* is based on the shared characteristics of their female types (external: the reticulate dark spot in the middle of the forewing series of gradate veins, head markings, prothoracic stripe; female abdominal and genital structures: shape, size and proportions of the terminal segments,

the pillbox-like spermatheca, spermathecal duct extending from elongate slit on side of spermatheca; shape of the subgenitale). Both the *C. annotaria* type and the *C. pseudovaricosa* allotype have an unusual, thick, rounded structure with membranous connections to the base of the subgenitale and to the velum of the spermatheca. This structure, which we presume is the base of the subgenitale, was not mentioned in either the original description or the subsequent redescrptions of *C. pseudovaricosa*.

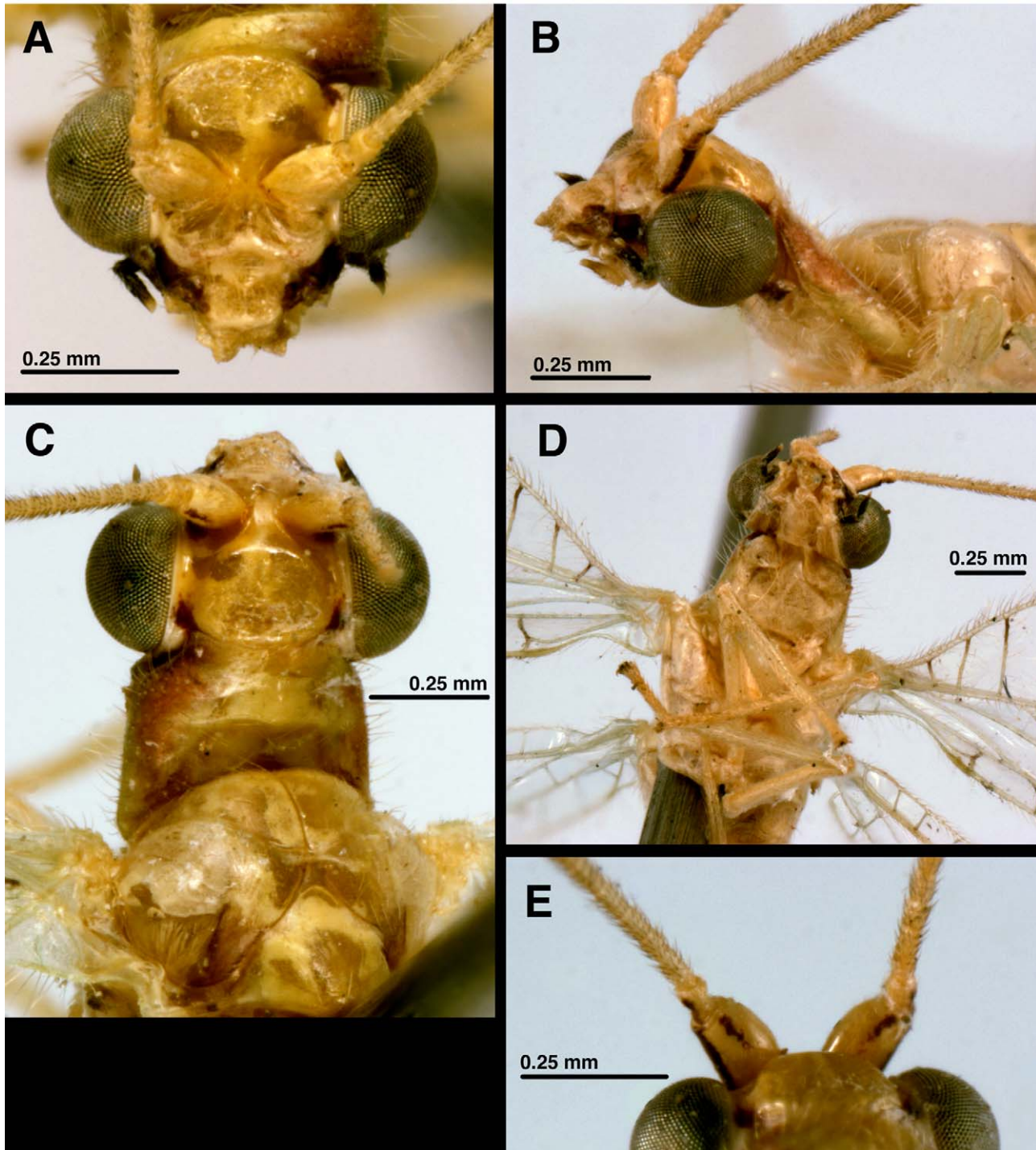


FIGURE 13. *Chrysopa annotaria*, Lectotype, Museum of Comparative Zoology. A. Head, frontal; B. Head, lateral; C. Head, prothorax, part of mesothorax, dorsal; D. Head, thorax, ventral; E. Scapes, dorsal.

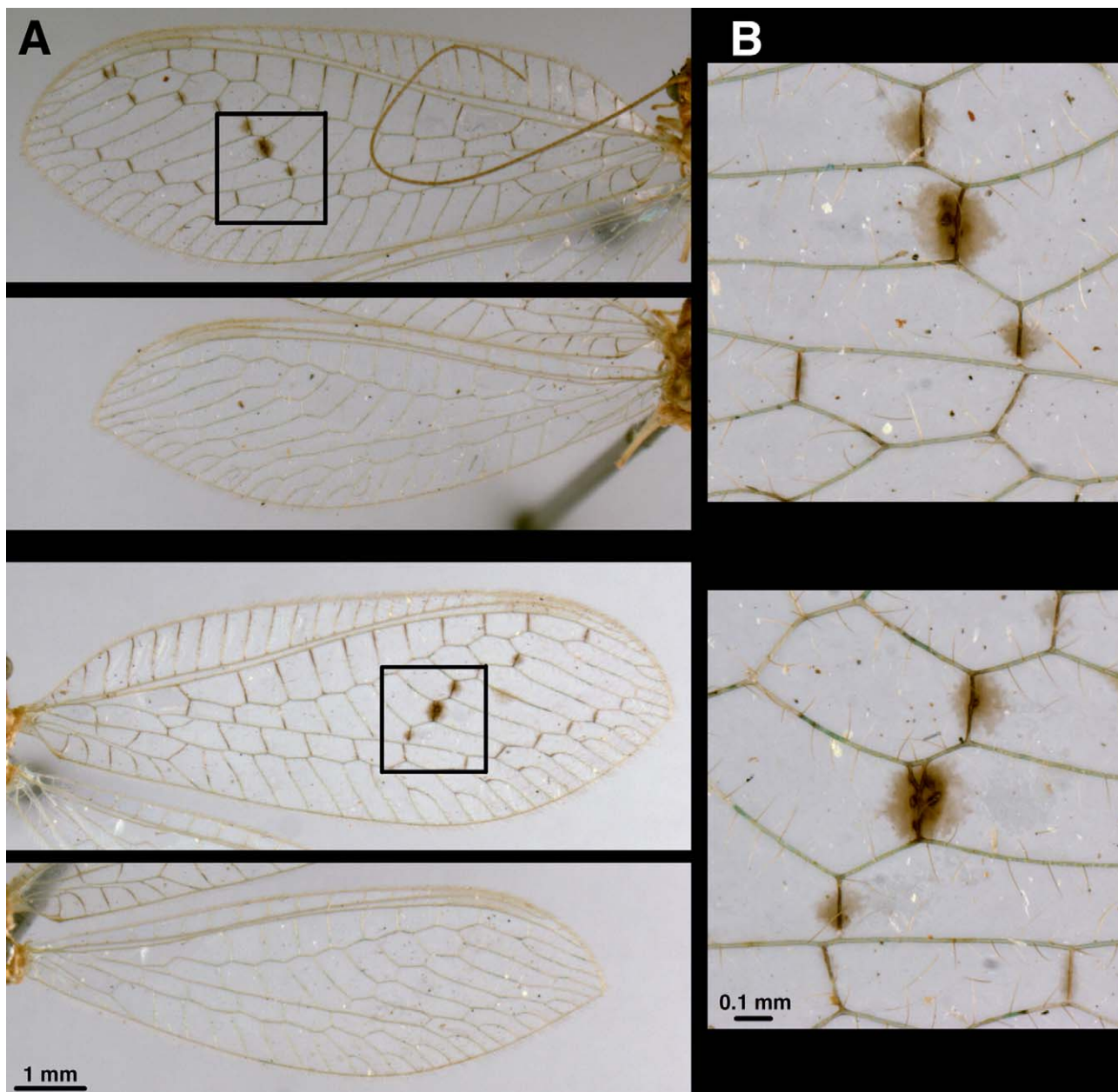


FIGURE 14. *Chrysopa annotaria*, Lectotype, Museum of Comparative Zoology. Column A: Upper two images: Left forewing, hindwing; Lower two images: Right forewing, hindwing. Box indicates enlarged section at right; scale at bottom applies to all images in column. Column B: Modified inner gradate veins of forewing. Scale at bottom applies to both images in column.

It should be noted that the ratios of S7 length : height of the *C. annotaria* female type and the *C. pseudovaricosa* allotype are considerably smaller (2.1 : 1 and 1.8 : 1 respectively) than that previously reported (3.4 : 1) and illustrated for the *C. pseudovaricosa* allotype (Fig. 8A in Sosa & Freitas 2012). Our side-by-side comparison of the abdomens of the two types (Fig 15: A1, B1, here) illustrates that the *C. pseudovaricosa* S7 is not particularly elongate, and that the two types are very similar in size and proportion. We suspect that the discrepancy in the measurements stems from differences in how we and the previous authors mounted the *C. pseudovaricosa* abdomen. Our abdominal images and measurements are always made from cleared specimens that are mounted in glycerin on slides with a coverslip. It appears that Sosa and Freitas' images were obtained from the specimen without a coverslip. Each method for mounting abdomens on slides has its advantages; however, use of a coverslip reduces errors in measuring the heights of tergites and sternites that stem from variation in their stiffness and curvature.

Known distribution. COSTA RICA (Puntarenas); PANAMA (Chiriqui).

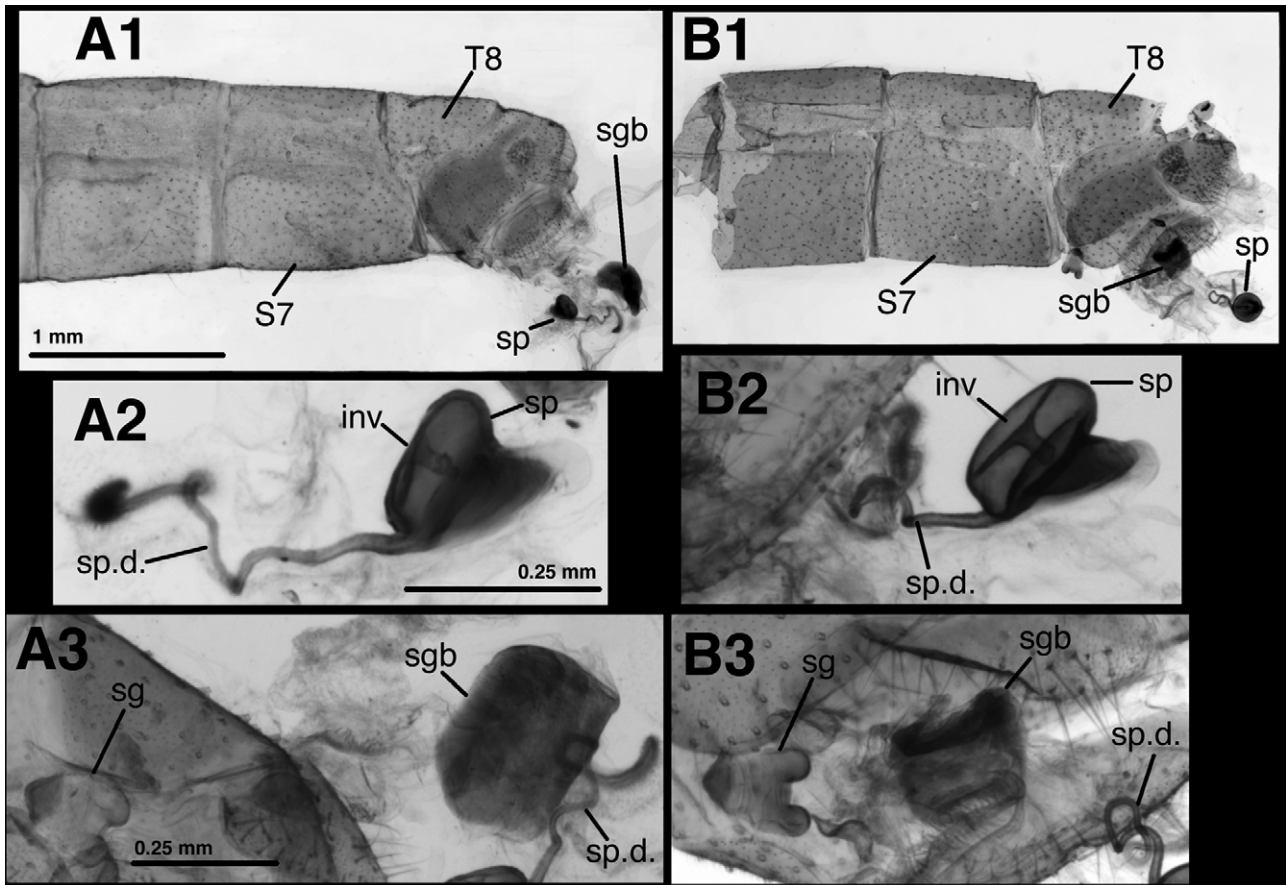


FIGURE 15. Female abdominal and genital characteristics: comparison between (A) *Chrysopa annotaria*, Lectotype, Museum of Comparative Zoology and (B) *Ceraeochrysa pseudovaricosa* Allotype, California Academy of Sciences. 1. Abdominal segments 6 to terminus, lateral; B. Spermathecal complex, lateral; C. Subgenitale, ventral. Abbreviations: inv, spermathecal invagination; sg, subgenitale (exterior face); sgb, heavily sclerotized structure with membranous attachment to spermathecal velum and subgenitale, probably the base of the subgenitale; sp, spermatheca; sp.d., spermathecal duct; S7, seventh sternite; T8, eighth tergite. The scales in column A also apply to column B.

Titanochrysa circumfusa (Burmeister, 1839)

Figs 16–20

Chrysopa circumfusa Burmeister, 1839: 980 [original description; locality: “Brasilien, von Herrn Thoren in Hamburg”]. Schneider 1851: 87 [redescription, illustration]; Walker 1853: 247 [brief redescription]; Navás 1913: 92 [brief redescription]; Navás 1913–14: 86 [species list]; Banks 1944: 10 [species list]; Penny 1977: 17 [species list]; Adams 1985: 7 [lectotype designation, comparison with *Chrysopodes limbata* (Navás)].

Cintameva circumfusa Burmeister. Navás 1927: 38 [first reference to species in *Cintameva*, locality data]; Navás 1929: 859 [locality data, as *Cintomeva*, misspelling].

Chrysopodes (Chrysopodes) circumfusus (= *circumfusa*) (Burmeister). Brooks & Barnard 1990: 272 [transfer to *Chrysopodes (Chrysopodes)*, species list]; Oswald 2007 [catalog listing].

Titanochrysa circumfusa (Burmeister, 1839). Sosa & Freitas 2012: 3 [transfer to *Titanochrysa*, redescription, images].

Chrysopa nigripalpis Banks 1910: 153 [original description; locality: “Colombia, St. Antonio, 1,800 ft., Febr. (Fassl)”]. Navás 1913: 92 [brief redescription]; Banks 1944: 10 [species listing]; Brooks & Barnard 1990: 280 [species list]; Oswald 2007 [catalog listing]. **New Synonym.**

Chrysopa burmeisteri Navás, 1929: 858 [original description; locality: “Brasil. Espírito Santo, Coll. Alichaelis M. H.”]. Banks 1944: 10 [synonymy with *Chrysopa circumfusa*]; Penny 1977: 19 [species list, as synonym of *C. circumfusa*].

Type material. *Chrysopa circumfusa*. Lectotype (Figs 16–18). Museum für Naturkunde, Berlin [ZMB]; one specimen, sex unknown (examined). Labels: [1] S. João d. Rey, Sellow [green, hand written]; [2] “circumfusa Burm. / Schneider.*” [hand written]; [3] “338”; [4] “Chrysopodes”; [5] “LECTOTYPE / *Chrysopa circumfusa* /

Burmeister desig. / by P. A. Adams 1985 / det. C. A. Tauber 2011" [red]. The type locality is probably São João del Rei in the state of Minas Gerais, Brazil.

In his original description, Burmeister (1839) did not mention how many specimens he worked with, where they were from, nor where they were deposited. Schneider (1851) redescribed and illustrated the species; he also mentioned a collection locality in Brazil ("Brasilia, apud San João del Rey", presumably the type locality) and three depositories ("Mus. Halenski" [HALLE], "Berolin" [ZMB] and "collectione de Selys-Longchamps" [IRNSB]). All three museums have specimens that carry "circumfusa" type designations. One of the specimens in the ZMB clearly fits Burmeister's original description and Schneider's redescription and figure; it is also the specimen that Adams (1985: 7) referred to as the "type" of the species. Although not specifically stated by Adams, his notation constitutes designation of the lectotype, and we concur. The specimen is in good condition, except the terminal segments of the abdomen are missing (Figs 16–18). The abdomen was present on Schneider's drawing, but absent when Adams examined the specimen in the 1980s.

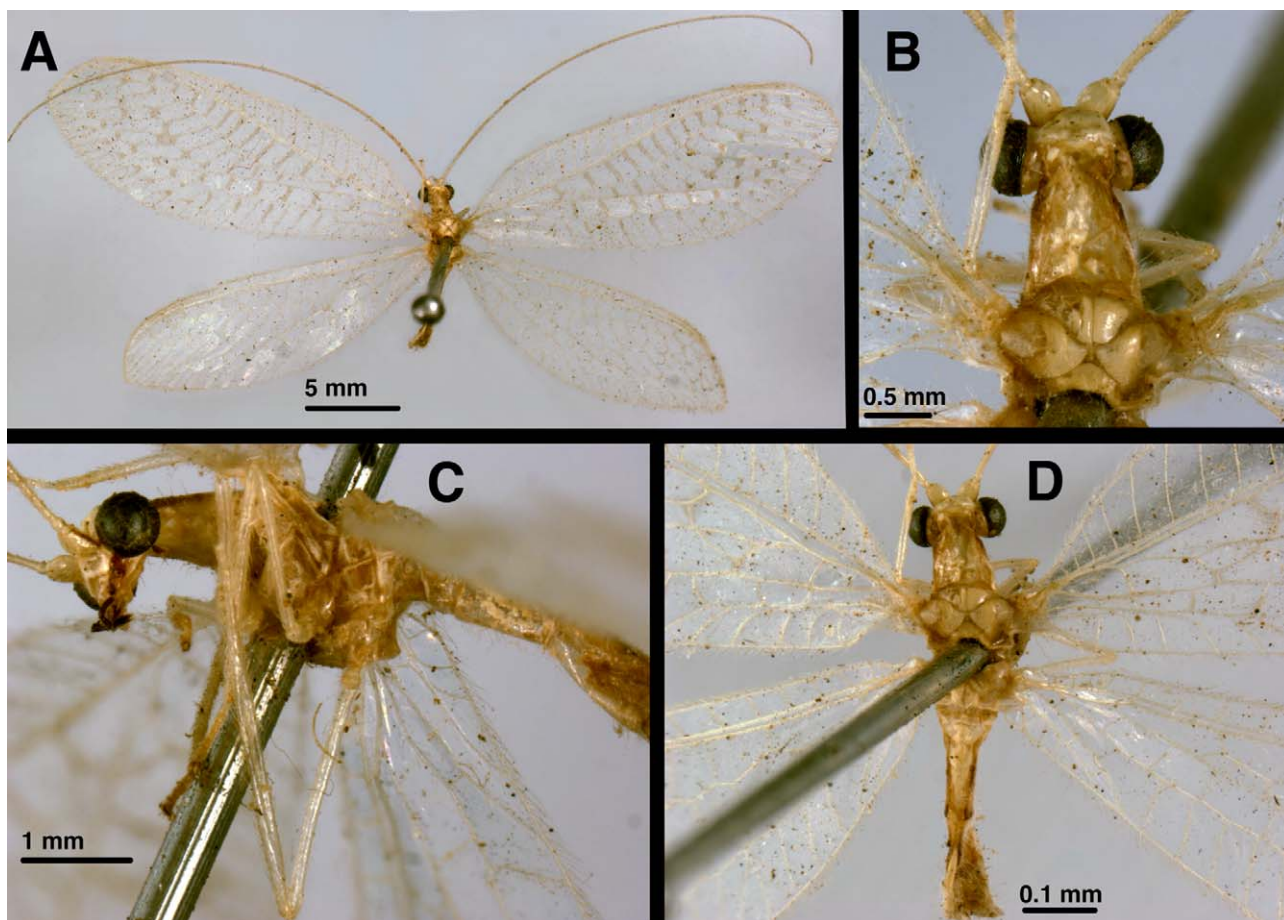


FIGURE 16. *Chrysopa circumfusa*, Lectotype, Humboldt-Universität zu Berlin. A. Habitus, dorsal; B. Head, prothorax, and mesothorax, dorsal; C. Body and legs, lateral; D. Body, dorsal.

The non-type specimen in the ZMB is a male of *Chrysopodes*, species undetermined; the specimen at Halle is a teneral male of *Ceraeochrysa cubana* (Hagen). The specimen in the IRNSB is a *Chrysopodes* male, species undetermined. Its head and tail are cleared and contained in a vial of glycerine; it bears a determination label "Chrysopodes sp. / det. S. J. Brooks 1986". It probably is the specimen that Brooks and Barnard (1990) considered to be the lectotype of *Chrysopa circumfusa*, and that formed the basis for their transfer of *C. circumfusa* to *Chrysopodes* (*Chrysopodes*). However, Schneider's and Adams' actions that constituted designation of the lectotype (see above) have precedence. Also, this specimen (head cleared, in an attached vial of glycerine) probably served as the source for the illustrations of the *C. circumfusa* mouthparts in Brooks and Barnard (1990: Figs 331, 332) that do not correspond to those of *T. circumfusa* (see Sosa & Freitas 2012: Fig. 17A).

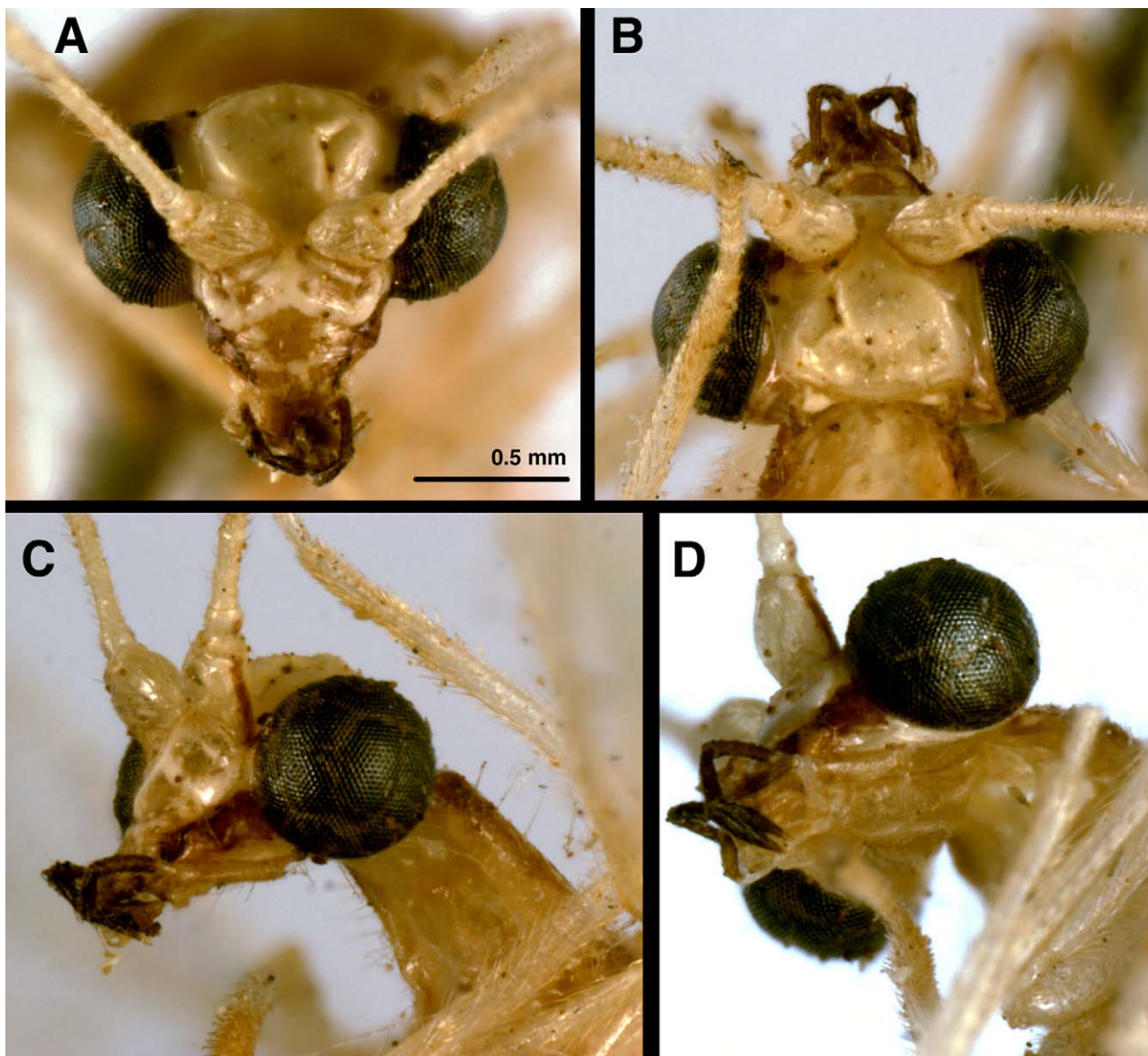


FIGURE 17. *Chrysopa circumfusa*, Lectotype, Humboldt-Universität zu Berlin. Head. A. Frontal; B. Dorsal; C. Lateral; D. Ventrolateral. Scale applies to all images.

Chrysopa nigripalpis. Lectotype (Figs 19–20). Museum of Comparative Zoology, [Harvard University, Cambridge]; one specimen, sex unknown (examined). Labels: [1] “San Antonio / Colombia Fassl / Feb. 1 800[?]” (hand written); [2] “Collection / N. Banks”; [3] “type” (red, hand written); [4] “Type / 11977” (red, print & hand written); [5] “Chrysopa / nigripalpis / Bks type” (white, red border, hand written).

Banks (1910) did not mention how many specimens he used to prepare his description of this species. There is only one type in the MCZ, and we consider it to be the lectotype. The specimen is in fairly good condition, except that it is somewhat compressed dorsoventrally and the last ~six segments of the abdomen are missing (Figs 19–20).

The synonymization of *Chrysopa nigripalpis* with *T. circumfusa* is based on the following shared characteristics: red genal markings, red lateral stripe on the scape, pattern of wing venation, and pattern of fumose markings on the forewing membrane.

Chrysopa burmeisteri. Navás deposited the type in the Hamburg Museum, presumably destroyed during WWII. In the absence of the type, the synonymy, made by Banks on the basis of R. C. Smith’s notes from the 1930s, pertains.

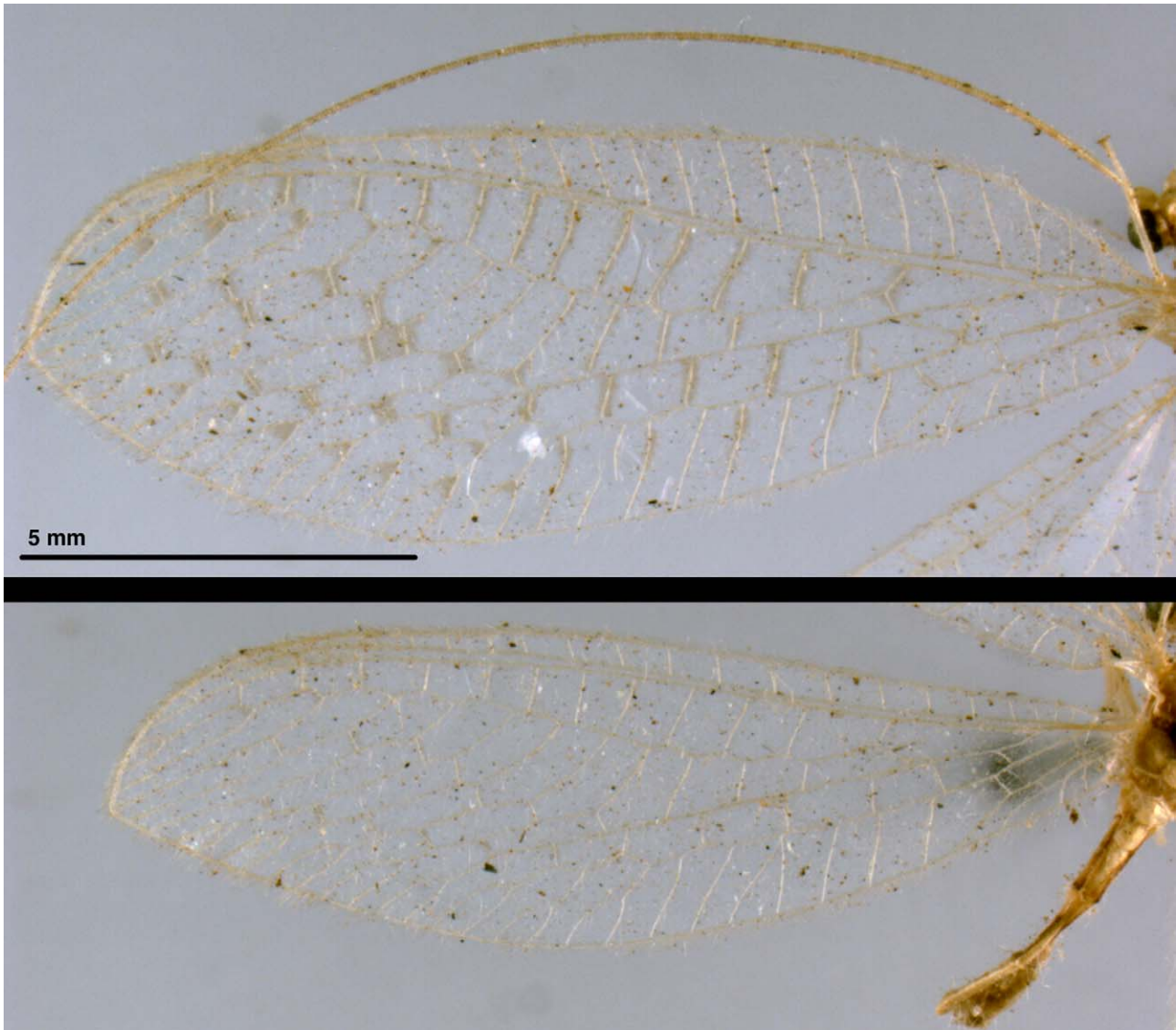


FIGURE 18. *Chrysopa circumfusa*, Lectotype, Humboldt-Universität zu Berlin. Upper, Forewing; Lower, Hindwing. Scale applies to both images.

Geographic distributions

Titanochrysa circumfusa (Burmeister, 1839)

New locality records. BRAZIL. São Paulo State, Serra do Mar, São Luiz do Paraitinga, 850 m, III-13 to 15-2001, M. J. Tauber, C. A. Tauber (UCB). BOLIVIA. Cochabamba, Alto Palmar, XI-1960 (CAS); Cochabamba, Carrasco, Siberia 1850 m, X-1963, F. Walz (CAS). ECUADOR. R. Bobonaza, Buckley (NHM, McLachlan Collection). VENEZUELA. Lara, Guárico, VII-7-1979, R. W. Brooks, A. A. Grigarick, J. McLaughlin, R. O. Schuster (UCD).

Currently known distribution. BRAZIL [States of Espírito Santo (Navás 1929: 858, record unconfirmed), Minas Gerais (Schneider 1839: 980, record confirmed), Rio Grande do Sul (Navás 1929: 859, record unconfirmed), São Paulo]; BOLIVIA (Cochabamba); COLOMBIA [probably Tolima (Banks 1910: 153, record confirmed)]; ECUADOR (Pastaza); SURINAME [Paramaribo (Banks 1944: 9, record unconfirmed)]; VENEZUELA [Lara (Sosa & Freitas 2012: 6)].

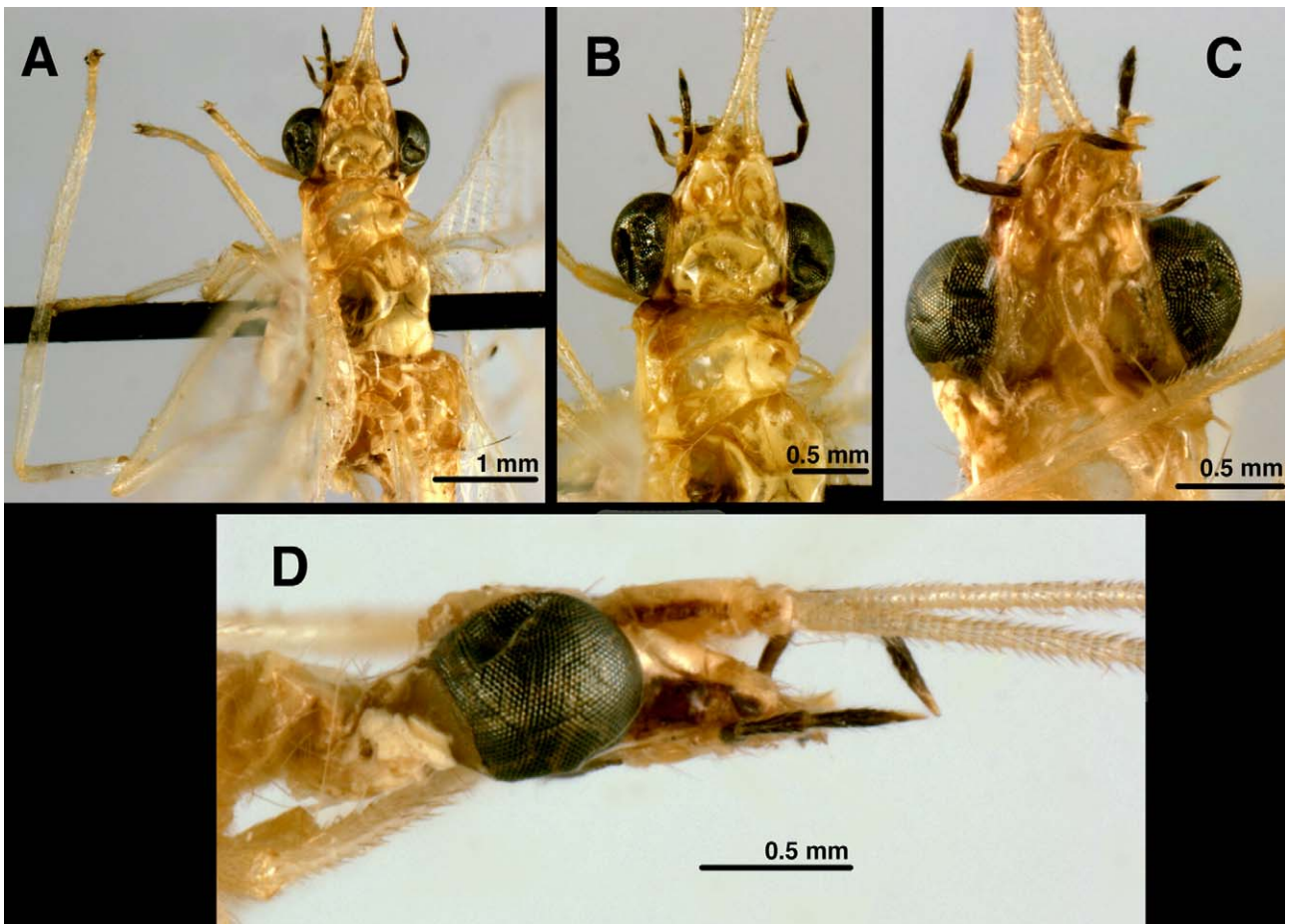


FIGURE 19. *Chrysopa nigripalpis*, Lectotype, Museum of Comparative Zoology. A. Head and thorax, dorsal; B. Head and prothorax, dorsal; C. Head, ventral; D. Head, prothorax, lateral.

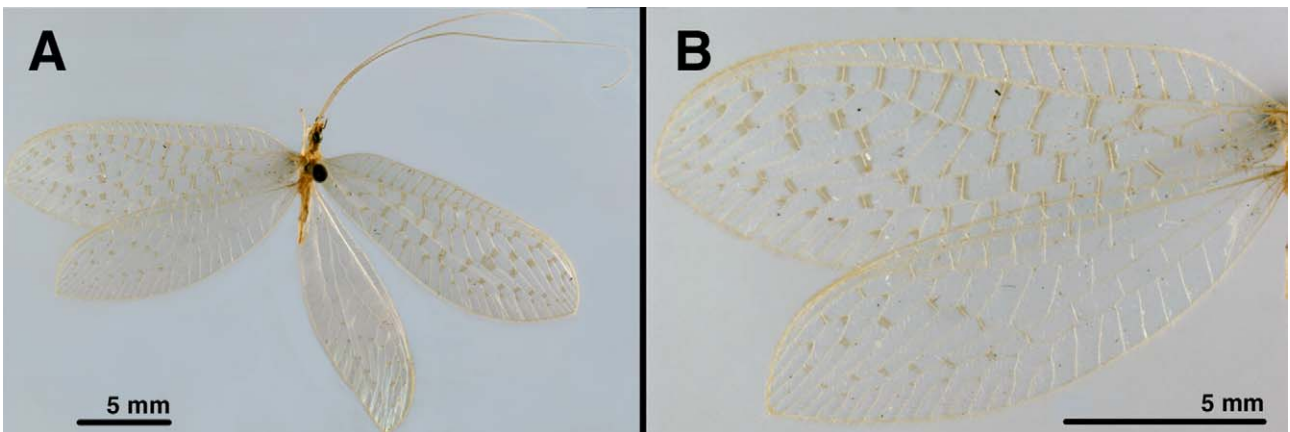


FIGURE 20. *Chrysopa nigripalpis*, Lectotype, Museum of Comparative Zoology. A. Habitus, dorsal; B. Wings.

Titanochrysa ferreirai Sosa & Freitas 2012

New locality record. VENEZUELA. Aragua, Rancho Grande, 4-VIII-1988, L. Stange & C. Porter (FSCA).

Currently known distribution. BRAZIL [Minas Gerais (Sosa & Freitas 2012: 12)]; VENEZUELA (Aragua).

Titanochrysa trespuntensis Sosa & Freitas, 2012

New locality records. ARGENTINA. San Miguel de Tucumán, VII-18-2003, G. Uzqueda (IFML). BRAZIL.

Rio de Janeiro State: Santa Maria Madalena, Terras Frias, V-15-2002, X-28-2003, M. J. Tauber, C. A. Tauber, G. S. Albuquerque, P. J. Tauber, A. J. Tauber, E. A. Silva (UCB); Rio Grande do Sul State: Cachoeira do Sul, São Nicolau, XII-30-2005, XII-26-2006, G. S. Albuquerque (UENF, UCB); Pelotas, II-6-1953, C. Biezanko (AMNH). VENEZUELA: Mérida, Mérida (city), 25-VI-1991, L. Stange & C. Porter (FSCA).

Currently known distribution. ARGENTINA (San Miguel de Tucumán); BRAZIL [States of Minas Gerais (Sosa & Freitas 2012: 16), Rio Grande do Sul, Rio de Janeiro]; VENEZUELA (Mérida).

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