



<http://dx.doi.org/10.11646/zootaxa.3835.2.2>

<http://zoobank.org/urn:lsid:zoobank.org:pub:4B629542-4FB4-42CE-B8B6-3BDF029086CB>

Apochrysinæ (Neuroptera: Chrysopidae): New Larval Description and Subfamilial Comparisons

CATHERINE A. TAUBER

Department of Entomology, Comstock Hall, Cornell University, Ithaca, NY 14853-2601 and Department of Entomology & Nematology, University of California, Davis, CA, USA 95616. E-mail: cat6@cornell.edu

Abstract

Although Apochrysinæ is considered an important, ancient clade of Chrysopidae, its immature stages are very poorly known. Larvae are rarely seen, and descriptions are limited to the third instar of only one species in the genus *Apochrysa*. Herein, the larvae (all instars) of a second species, *Apochrysa voeltzkowi* (Weele), are described, and the features of the two *Apochrysa* species are compared with those of other chrysopids. The results provide support (one potential synapomorphy) for a phylogenetic relationship between Apochrysinæ and Nothochrysinæ and additional support for two synapomorphies previously proposed for Nothochrysinæ. Diagnostic larval characteristics are proposed for the genus *Apochrysa*, and species-specific features are identified for the two known *Apochrysa* larvae.

Key words: Apochrysinæ, larval morphology, Nothochrysinæ

Introduction

The green lacewing subfamily Apochrysinæ is a small but distinctive group of 25 species in six genera (Winterton & Brooks 2002). Molecular data and evidence from adult morphology indicate that Apochrysinæ is a largely monophyletic grouping that falls at or near the base of the chrysopid phylogenetic tree (Brooks 1997, Winterton & Brooks 2002, Winterton & Freitas 2006, Haruyama *et al.* 2008). Nevertheless, relationships among the basal taxa are far from well understood, and future analyses of chrysopid phylogeny would benefit from incorporating a broad range of diverse taxa and an expanded range of characters, including those from larval morphology (e.g., see Tauber *et al.* 2014).

Larvae of the subfamily Apochrysinæ are poorly known; indeed, only three specimens have been reported previously, and all three were from the genus *Apochrysa*. Tsukaguchi (1995) described the third instar of *Apochrysa matsumurae* (Okamoto) (as *Nacaura*) and proposed a set of features that might distinguish the subfamily. A photo of this species (by Yusei Hara) shows a third instar carrying white, fluffy flocculence and material from male “cocoon” of the coccoidan *Drosicha corpulenta* (Kywana) (also shown in Tauber *et al.* 2014). Aspöck & Aspöck (2007) published P. Duelli’s photo of a third instar *Apochrysa voeltzkowi* (Weele); this larva too was carrying white sternorrhynchan flocculence (P. Duelli, personal communication).

Later, P. Duelli made his *A. voeltzkowi* specimens available for morphological study, and based on these additional specimens, I describe the first and third *A. voeltzkowi* instars and compare their features with those of the *A. matsumurae* third instar.

Material and methods

The specimens [two third instars, one second instar (pre-molt), and one first instar] were reared from a female collected by P. Duelli in the Republic of South Africa, Tsitsikamma National Park and identified by H. Hölzel. All descriptions, figures, and images here are based on these specimens. For the descriptive work, the specimens first

Thorax (Figs 5E, 6A, 6B, 8A) with each segment bearing relatively dense covering of medium-length dorsal setae. *Legs* highly setose, cream-colored, without markings except at coxal base, tarsal tip; claw, empodium brown (Fig. 1B).

Prothorax (T1) with two subsegments separated by shallow fold. Sc1 light brown, oblong, extending almost full length of second subsegment; Sc2 large, approximately pear-shaped. Venter with pair of large setae anteriorly, rows of smaller setae mesally, posteriorly.

Mesothorax (T2) with three, well delineated subsegments separated from each other by two distinct, smooth transverse folds; Sc2 small, embedded in first fold, with minute seta; Sc3 large, round, light brown, at lateral terminus of second fold. Venter with ~50 short, scattered setae, one pair of long to medium-length setae posteriorly.

Metathorax (T3) with three subsegments separated by two small folds. Sc2 large, light brown, round; posterior subsegment with transverse row of approximately 15 setae slightly longer than those elsewhere on thorax. Venter with two transverse bands of approximately eight short to medium-length setae.

Abdomen (Figs 5F–H, 6C, 8B, 8C) with laterodorsal tubercles smooth, each with 2–4 elongate robust setae (LDS), several shorter LDS. Spiracles circular, sessile, with small, simple atrium. A1: Segment with two subsegments separated by small fold. Anterior subsegment small, spindle shaped, with spiracle on lateral margin. Posterior subsegment longer, broader than first, with distinct LDT laterally. Dorsum of each subsegment with transverse bands of numerous elongate to short SMS; venter with single transverse band of ~12–15 short to medium-length setae. A2–A7: Segment with three subsegments separated by small folds. Subsegments roughly of similar size, each extending to margin of segment; dorsum of anterior subsegment with transverse band of 8–10 SMS; middle subsegment bearing spiracle laterally, transverse band of 10–12 SMS; posterior subsegment with pair of distinct, smooth LDTs laterally. Venter with two to three transverse bands of short to medium-length setae; each segment with posterior pair of long, prominent setae submesally. A8: LTs short, broad, with relatively short LS; spiracle at anterior base of LDT; anterior, middle subsegments each with transverse row of ~four SMS; posterior subsegment with ~12 SMS. Venter with posterior band of four robust setae, several shorter setae. A9: Cylindrical, brown marking anteromesally, with numerous short setae, especially robust laterally, dense posterolaterally. A10: Dorsum with longitudinal brown marking mesally, with scattered small setae laterally, with inflated, bilobed membrane terminally.

Larval diagnosis. Based on the description above and that of Tsukaguchi (1995) for *A. matsumurae*, it appears that the third instars of the two species are very similar morphologically. Thus they can be distinguished from known larvae in other chrysopid subfamilies by their elongate flagellar segments. The main differences between the two *Apochrysa* species are in the head and body markings. Tsukaguchi reported that his specimens of *A. matsumurae* were without markings, whereas our specimens of *A. voeltzkowi* (L3) have distinct, although light, brown head and body markings (Figs 5B–5H, 7A). First instars of *A. matsumurae* are not described, but the first instar of *A. voeltzkowi* also has faint head markings that may be distinctive (Figs 2B, 3A).

Acknowledgements

I thank Peter Duelli (Swiss Federal Research Institute WSL, Birmensdorf/Zurich, Switzerland) for generously providing the specimens of *A. voeltzkowi*, and Maurice J. Tauber and an anonymous reviewer for their helpful comments on the manuscript. As usual, the website “Lacewing Digital Library” (J. D. Oswald, chief editor), was useful during the research [<http://lacewing.tamu.edu/index.html>]. The study benefitted from funding by the National Science Foundation, the USDA Competitive Grants Program, the National Geographic Society, and Cornell University (to MJT & CAT) and is part of Regional Project W-3185.

References

- Aspöck, U. & Aspöck, H. (2007) Verbliebene Veilfalt vergangener Blüte. Zur Evolution, Phylogenie und Biodiversität der Neuropterida (Insecta: Endopterygota). *Denisia*, 20, 451–516.
- Brooks, S.J. (1997) An overview of the current status of Chrysopidae (Neuroptera) systematics. *Deutsche Entomologische Zeitschrift*, 44, 267–275. [Berlin (N.F.)]
- Díaz-Aranda, L.M. & Monserrat, V.J. (1995) Aphidophagous predator diagnosis: key to genera of European chrysopid larvae

- (Neur.: Chrysopidae). *Entomophaga*, 40, 169–181.
<http://dx.doi.org/10.1007/bf02373066>
- Haruyama, N., Mochizuki, A., Duelli, P., Naka, H. & Nomura, M. (2008) Green lacewing phylogeny, based on three nuclear genes (Chrysopidae, Neuroptera). *Systematic Entomology*, 33, 275–288.
<http://dx.doi.org/10.1111/j.1365-3113.2008.00418.x>
- Montserrat, V.J. & Díaz-Aranda, L.M. (2012) Los estadios larvarios de los crisópidos ibéricos (Insecta, Neuroptera, Chrysopidae), nuevos elementos sobre la morfología larvaria aplicables a la sistemática de la familia. *Graellsia*, 68, 31–158.
<http://dx.doi.org/10.3989/graellsia.2012.v68.055>
- Rousset, A. (1966) Morphologie céphalique des larves de planipennes (Insectes Névroptéroïdes). *Memoires du Museum Nationale d'Histoire Naturelle*, Series A (Zoology), 42, 1–199.
- Tauber, C.A. (2003) Generic characteristics of *Chrysopodes* (Neuroptera: Chrysopidae), with new larval descriptions and a review of species from the United States and Canada. *Annals of the Entomological Society of America*, 96, 472–490.
- Tauber, C.A. (2014) Nothochrysinæ (Neuroptera: Chrysopidae): New larval description and generic synonymy, with a consideration of generic relationships. *Psyche*, 2014 (839261): 1–10.
<http://dx.doi.org/10.1155/2014/839261>
- Tauber, C. A. & de León, T. (2001) Systematics of green lacewings (Neuroptera: Chrysopidae): larvae of *Ceraeochrysa* from Mexico. *Annals of the Entomological Society of America*, 94, 197–209.
- Tauber, C.A., de León, T., Penny, N.D. & Tauber, M.J. (2000) The genus *Ceraeochrysa* (Neuroptera: Chrysopidae) of America north of Mexico: larvae, adults, and comparative biology. *Annals of the Entomological Society of America*, 93, 1195–1221.
[http://dx.doi.org/10.1603/0013-8746\(2000\)093\[1195:tgcnco\]2.0.co;2](http://dx.doi.org/10.1603/0013-8746(2000)093[1195:tgcnco]2.0.co;2)
- Tauber, C.A., Tauber, M.J. & Albuquerque, G.S. (2014) Debris-carrying in larval Chrysopidae: unraveling its evolutionary history. *Annals of the Entomological Society of America*, 107, 295–314.
<http://dx.doi.org/10.1603/an13163>
- Toschi, C.A. (1965) The taxonomy, life histories, and mating behavior of the green lacewings of Strawberry Canyon (Neuroptera, Chrysopidae). *Hilgardia*, 36, 391–433.
- Tsukaguchi, S. (1995) *Chrysopidae of Japan (Insecta, Neuroptera)*. S. Tsukaguchi, Aioi-cho 6-14-102, Nishinomiya-shi, Hyogo, 662 Japan (Privately published), 223 pp.
- Winterton, S.L. & Brooks, S.J. (2002) Phylogeny of the Apochrysinæ green lacewings (Neuroptera: Chrysopidae: Apochrysinæ). *Annals of the Entomological Society of America*, 95, 16–28.
- Winterton, S.L. & Freitas, S. de (2006) Molecular phylogeny of the green lacewings (Neuroptera: Chrysopidae) *Australian Journal of Entomology*, 45, 235–243.
<http://dx.doi.org/10.1111/j.1440-6055.2006.00537.x>