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Stalk-eyed wasps—review of a largely unnoticed group of morphologically bizarre chalcidoid wasps (Hymenoptera: Eurytomidae: *Axima*)

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Abstract

Axima Walker is a small genus of Eurytomidae (Hymenoptera: Chalcidoidea) exclusive to the Western Hemisphere. Some species are distinctive in having stalked eyes and *Axima sidi*, sp. n. is described as the third stalk-eyed species based on a single female from Colombia. A key to facilitate species identification of stalk-eyed *Axima* is included. The only species of *Axima* for which host biology is known is a primary parasitoid of dwarf carpenter bees of the genus *Ceratina* Latreille (Apidae: Xylocopinae). A hypothesis about the possible function of stalked eyes in *Axima* as devices to assist the escape of adult wasps from hosts enclosed in the soft pith of plant stems is proposed.

Key words: Colombia, new species, functional morphology, Chalcidoidea

Introduction

Stalk-eyed species are known from various insect groups, including Diptera (e.g., Diopsidae, Drosophilidae, Platystomatidae), Coleoptera (Anthribidae: males of *Exechesops* spp.) and Heteroptera (e.g., Lygaeidae, Malcidae). The stalk-eyed condition in these insects is characterized by a unique head expansion into dorsolateral processes, which carry the compound eyes. Within Hymenoptera, this extreme form of head modification was so far only known from two morphologically bizarre species of Eurytomidae (Chalcidoidea), which were described independently from each other about 35 years ago and since then have received little attention. The description of *Axima noyesi* Subba Rao was published in December 1978 and that of *Aplatoides diabolus* Yoshimoto & Gibson just four months later in April 1979. Even though the species were described in different genera, they are closely related and today classified in *Axima* Walker (Lotfalizadeh *et al.* 2007). Here, we propose the common name “stalk-eyed wasps” for this unique group of Hymenoptera and describe a third species from Colombia. A possible tool-function of the stalked eyes during emergence from hosts is briefly discussed.

Material and methods

The newly described species was obtained as a result of a collaborative collecting effort in Colombia. The Amacayacu National Park was one of 31 natural areas throughout Colombia chosen for an intensive survey of Hymenoptera under the project “Insect Survey of a Megadiverse Country, Phase I & II: Colombia” [“Diversidad de Insectos de Colombia”]. Morphological terminology follows the Hymenoptera Anatomy Ontology (Hymenoptera Anatomy Consortium 2014). Images were taken with a Leica DXM 1200 digital camera attached to a Leica MZ 16 APO microscope and processed using AutoMontage (Syncroscopy) software and post-processed with Adobe Photoshop CS5.1. The following abbreviations are used in the text: cl = clava, F = flagellomere, fp = frontal projection, msc = mesoscutal carina, Mt = metasomal tergite, ped = pedicel, pi = pronotal invagination, PNN = Parque Nacional Natural, ssc = mesoscutellar carina.

Species of *Dirhinus* Dalman (Chalcididae) are parasitoids of muscoid flies such as *Musca domestica* Linnaeus, the common house fly (Alahmed 1999, Beaver 1986, Bouček & Narendran 1981). Their head bears a pair of projections because the frons is dramatically produced on either side of a deep excavation in which the antennae reside. In some species of *Dirhinus*, e.g., *D. himalayanus* Westwood, the broad projections may be used by the adult female to shovel through a sandy substrate in search of host puparia (Bouček & Narendran 1981). In all these examples the head modifications are present in both sexes.

In the stalk-eyed wasp species *A. diabolus*, *A. noyesi* and *A. sidi*, females have frontal projections that are even more pronounced than in their “normal-eyed” congeners. The head morphology of stalk-eyed wasps might be interpreted as a further development of an already existing “head butting device”. Such a function could be further supported by the fact that the head of *Axima* species can be locked by pronotal invaginations (Fig. 7). After the head is locked, more force can be exerted through the anteroventrally oriented frontal projections for butting or thrusting forward through plant tissue. However, the difference to the head modification in the above-mentioned parasitoids of wood boring hosts is that these emerge upward (not forward) using the dorsally oriented projections to leave the host’s burrow. In other insect groups the development of stalked eyes is never accompanied by sclerotized lateral projections, which would seem to exclude a similar “tool-function”. In hypercephalic Diptera, stalked eyes have been discussed with respect to enhanced vision for binocularity (Grimaldi & Fenster 1989), but sexual selection seems to play an important role (Zimmer 2008).

Until the host biology of stalk-eyed wasps is revealed, the possible function of the stalks as “head butting devices” for emergence from the host or the host habitat will remain uncertain. However, the presence of frontal projections in both sexes of other *Axima* species could support the hypothesis of eye stalks as a further adaption for escape from hosts enclosed in soft pith of plant stems.

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