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## **Faunal Relations of Amazonian Chrysopidae**

By Phillip A. ADAMS, Fullerton Department of Biological Sciences California State University, Fullerton and Norman D. PENNY, San Francisco California Academy of Sciences

## ABSTRACT

Of 30 chrysopine species from the Amazon region, 10 have been described previously. We record 1 species of **Chrysoperla**, 2 of **Chrysopa (Plesiochrysa)**, both with extensive ranges. **Ceraeochrysa** is represented by 15 species, 9 undescribed, and **Chrysopodes** by 12 species, 11 undescribed. **Suarius** is not represented, nor are the species group of **Chrysopodes** distinguished by blunt-tipped mandibles, or the cordilleran genus **Meleoma**. The only genera with Old World connections, **Chrysoperla** and **Plesiochrysa**, are represented by few (3) wide ranging species; there appears to be no generic level taxon restricted to the Amazon Basin. Cuticular characters of the bursa and bursal duct are used, and technique of examination briefly described.

## 1. Introduction

The Chrysopidae of the Amazon region have previously received little attention from collectors. We shall review the findings of our study of the amazonian Chrysopini (ADAMS and PENNY, in press) and consider the relationship they bear to those of the remainder of South America. Unfortunately, the chrysopine fauna of areas contiguous to the Amazon Basin is still little-known, permitting only the most preliminary zoogeographic inferences. Inasmuch as ours is the first modern report dealing with the green lacewings of any major portion of South America, it is appropriate to review the status of the tribes of Chrysopinae represented in that continent.

## 2. Material Examined

We have had available 412 specimens from the Amazon region of Brazil. Much of this material has been collected by N. PENNY and his colleagues at the Instituto Nacional de Pesquisas da Amazônia at Manaus. Not surprisingly, approximately half the specimens come from within a 50 km radius of Manaus; the remainder from widely scattered localities. The collecting emphasis has been on forest rather than agricultural habitats, but the disturbed situations around Manaus are well represented. The coastal region remains virtually uncollected. Light traps suspended at various heights including the level of the canopy have been productive in obtaining material of some of the smaller previously undescribed **Ceraeochrysa** and **Chrysopodes** species. Of the 30 chrysopine species now recorded from the Amazon, 20 were previously undescribed. Of these, 12 are represented by single specimens or single pairs. This must be regarded as an indication that we have thus far seen only a portion of the species actually present. However, the sampling in the Manaus region, which is near the geographic center of the basin, is sufficiently thorough to convey an impression of the major faunal components.

## 3. Status of South American Tribes of Chrysopinae

## 3.1. Belonopterygini NAVAS 1913 (=Italochrysini HÖLZEL)

**Belonopteryx** resembles an acute-wing-tipped **Italochrysa**, without an intramedian cell; one species occurs in Argentina and southern Brazil. **Nacarina** now is known to contain at least 20 species, and ranges from Argentina to the Southeastern United States; it is sparingly represented in our Amazon material with three species. Elongate parameres such as those of **Italochrysa** do not occur in this genus, but rudiments may be present; in females the bursal duct exhibits extensive and complex coiling.

#### 3.2. Leucochrysini

This primarily New World tribe is characterized by long antennae, dark stigmatic spots, absence of gonapsis and tignum. The gonarcus often bears 2 horns, and the mediuncus may have a tooth flanked by incisions. In the female, the bursal duct is usually elongate and the spermatheca elongate or tubular. The pseudomedia of larger species curves anteriorly to run into the outer gradate series. Several genera differ from Leucochrysa mainly in wing maculation and minor venational peculiarities: Gonzaga, Vieira, Cacarulla, Berchmansus, Nuvol, Neula. The dominant genera Leucochrysa (about 36 described species) and Nodita (about 105 described species) are well represented in the Amazon region, and we expect that the diversity will approach or exceed that of the Chrysopini.

## 3.3 Chrysopini

This is a wastebasket taxon comprising genera lacking sufficiently striking apomorphic characters of wings and genitalia to be placed elsewhere. The South American fauna of this tribe is highly distinctive, consisting largely of the neotropical genera **Suarius, Ceraeochrysa** and **Chrysopodes**. Several genera found in North America are entirely absent: **Nineta, Chrysopa** s. str., **Mallada, Eremochrysa**. The xerophilic amphitropical

The xerophilic amphitropical **Chrysopiella** is represented in Chile and Argentina with 3 species, which differ from their Nearctic congeners in the gonapsis being bilaterally symmetrical or absent. Neither this genus nor the cordilleran **Meleoma** has been collected in the Amazon.

## 4. Chrysopini represented in the Amazon

#### 4.1 Chrysoperla

**Chrysoperla** is represented in South America by only 2 species. In the Amazon, **C. externa** was only moderately common. It is rather like a neotropical counterpart of **C. carnea**, rivalling



Fig. 1. **Chrysoperla externa**, female. Spermatheca; the short bursal duct is characteristic for the genus. that species in its tendency toward ubiquity within its range, which extends from Argentina to the southeastern United States. This species has been the subject of several biocontrol and life history studies (as lanata, CRCUZEL et al. 1977, RU et al. 1975, as plorabunda, MUMA 1959). Chrysoperla externa has the short bursal duct typical of this genus (Fig. 1).

## 4.2 Plesiochrysa

**Chrysopa (Plesiochrysa)** has three neotropical species, two of which, **brasiliensis** SCHNEIDER and **elongata** NAVAS are widespread in northern and central South America (Adams 1902a). Both of these were represented in our material from numerous localities.

## 4.3 Chrysopodes

The genus **Suarius** was delimited based upon what appears to be a group of genitalic plesiomorphies (TJEDER, 1966). (Absence of tignum and gonapsis is the normal condition in Nothochrysinae.) Our studies of the New World species with this genitalic specification are still in a very preliminary state, but now indicate the presence of three species groups which we consider to represent distinct evolutionary lineages. In North America, **Yumachrysa** has very elongate, loosely articulated entoprocessus, sternite 8 often with microtholi, and a distinctive array of secondary sclerites and gonocristae. This genus extends southward at least to arid regions of Oaxaca, Mexico. In South America, a few species, exemplified by **Suarius argentinus**, have an elongate smooth arcessus, numerous gonosetae, and pillbox-shaped spermatheca resembling those of its African congeners. Thus far, this group has not been recorded from the Amazon.

Another Suarius-like genus, Chrysopodes, has numerous species in Central and South America. The mediuncus is swollen, hollow, usually microsetose, often with two sclerotized bands dorsally; entoprocessus are absent or highly reduced (Fig. 2). The female spermatheca is elongate, and the bursal duct moderately to astonishingly elongate, reaching 4-6 cm in Chrysopodes (Fig. 3). Two species groups may be



Morphological features of **Chrysopodes collaris.** Fig. 2. Gonarcus complex showing microsetose mediuncus with sclerotised rods; lack of entoprocessus. Fig. 3. Bursa and spermatheca from right side, an approximately 5 cm section of slender bursal duct omitted. Fig. 4. Mandibles; relatively blunt-tipped.

recognized. One, typified by **C. divisa** (WALKER) and **collaris** (SCHNEIDER), has normally blunt-tipped mandibles (Fig. 4) and no unusual wing or external body characters. This group includes about 12 species in the cordilleran region of South America, many of which are conspicuously marked with brown or black, presumably as camouflage. At least one such species, **C. escomeli** (NAVAS) lurks and oviposits in cave entrances (R. B. MILLER, pers. comm.). Both **C. collaris** and **C. divisa** range widely, **collaris** from Paraguay to Florida, and **divisa** from Argentina to Cuba. Considering the abundance of these two species in collections from other regions, their absence from the Amazon must be regarded as curious. We consider their occurrance in the undercollected coastal region probable.

The second group, **Chrysopodes** in the strict sense, has mandibles with fang-like tips (Fig. 6); in some species the vertex is distinctively pitted (Fig. 5). Often the wings are broad with vide costal area and divergent irregular gradates (Fig. 7). The intramedian cell is usually triangular, not quadrangular as in the species illustrated. A remarkable feature is the button on the apical abdominal venter of both sexes, in several species, presumably used in production of acoustical signals (e.g. HENRY, 1979). Figure 8 shows the most extreme example of this feature observed (as well as some psocid damage). In this group, the length and configuration of the bursal duct affords excellent taxonomic characters. Some species have characteristic patterns of setation in the cuticle lining the bursal duct, a character never before observed in this family (Fig. 9). Nothing is known of the biology, but so many



Morphological features of Chrysopodes. Fig. 5. Chrysopodes pulchella. Mandibles acute-tipped. Fig. 6. Species from Manaus. Head showing pitted vertex often present in this genus. Fig. 7. Chrysopodes pulchella. Forewing. Fig. 8. Species from Pará, Oriximiná. Male abdomen, showing extreme development of hammer on ventral apex. Fig. 9. Species from Reserva Ducke, vic. Manaus. Bursal complex from right. Note tiny setae in bursa and duct; coiled spermatheca with elongate ventral impression (stippled).

specimens had guts filled with moth scales as to suggest the possibility that these chrysopids may feed opportunistically on Lepidoptera while in traps. Of course, an alternative explanation might be ingestion of scales as a result of grooming. Observations of feeding behavior are needed to explain the function of the unusual mandibles. We have not observed broken fragments of cuticle in the gut, suggesting that if the adults are predatory, they may feed by piercing prey exoskeleton and imbibing hemolymph.

Several species occur in Central America, but the group is most diverse in South America. Of approximately 16 previously described species, 1 occurs in the Amazon, as well as 11 new species.

#### 4.4 Ceraeochrysa

This exclusively New World genus is primarily tropical, with 2 species extending into the northern United States and Canada. The gonarcus horns and form of the mediuncus or arcessus resemble those in some Leucochrysini, and we consider this feature probably synapomorphic. The spermatheca is distinctive, opening into the bursa by a dorsal longitudinal slit, and the praegenital area may be sclerotized. ADAMS (1982) recognized 24 species in this genus. In the Amazon we record 6 previously described species; of these **cubana**, **claveri**, **sanchezi**, and **evere**s are widely distributed in the neotropics, and in our experience are frequently encountered in large numbers in agroecosystems. **C. caligata** ranges from Panama to Surinam, and is common in the Amazon, but is largely replaced by **C. cincta** elsewhere. **C. scapularis** extends from Pará to Colombia. We describe 9 new species, including a group with extraordinarily long gonarcus horns (Fig. 10); some have the gonapsis highly developed with a scythe-like appendage (Fig. 11), or even a crest like that of an ancient greek helmet (Fig. 12).

#### 5. Technique for preparation and examination of female genitalia

Our study is the first in which details of the bursa and bursal ducts are consistently used as a source of taxonomic characters. We are struck by the prevalence of very to extremely elongate bursal ducts in several neotropical taxa: Leucochrysini, Belonopterygini, and **Chrysopodes**. It appears unlikely that this



Morphological features of **Ceraeochrysa.** Fig. 10. A small species fairly common in light trap material. Gonarcus complex showing extreme development of the gonarcus horns and of dorsal arcessus spines, as well as arcessus tip. Fig. 11. Species from Pará, Belem. Gonapsis, dorsal view, showing asymmetrical appendage. Fig. 12. Species from Manaus. Gonapsis, dorsal and lateral, showing elaboration of crest-like structure. characteristic is indicative of any close relationship. The functional significance of duct length is entirely unclear. Inasmuch as workers on chrysopids from other geographic regions have studied the spermatheca in isolation from the bursa and ducts, it is impossible to state, based upon current literature, whether these elongate ducts are peculiar to the neotropical fauna, or are encountered more widely. Special care is required to visualize these structures intact.

As with males the abdomen is heated in almost boiling KOH solution, flushed with water, and loose debris removed with forceps or hooked probe. Dilute aqueous chlorazol black e stain is injected, allowed about a minute to act, and flushed out The object is to stain the cuticle of the bursa and ducts adequately, with water. while staining the tergites and sternites lightly if at all. After flushing and transferring to glycerine, the abdomen may become sufficiently transparent to examine without further preparation. Otherwise, we remove the exoskeleton on the right side to expose the spermatheca and ducts, by clipping with iris scissors along the dorsal midline, down the posterior margin of the ninth tergite + ectoproct, and ventrolaterally along the seventh sternite. The resulting flap may be reflexed or cut The parts can be examined in situ, and manipulated as necessary to untangle and off. make hidden parts visible. The stereoscopic microscope is adequate to convey spatial relationships of the parts, but it is necessary to utilize the superior illuminating and resolving power of the compound microscope in order to visualize the details of the duct and cuticle.

#### 6. Concluding Remarks

The striking feature of the Amazonian chrysopine fauna is the strongly indigenous makeup. Only **Plesiochrysa**, with oriental affinity (ADAMS, 1982), and **Chrysoperla** are with Old World ties, and they are represented by few wide-ranging species. **Suarius** species with morphological similarity to African congeners are not represented. The region serves as a center of diversity for the neotropical genera **Chrysopodes** and **Ceraeochrysa**. Thus far, we have not encountered any chrysopine genus restricted to the Amazon Region.

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Addresses of Authors:	Prof. Phillip A. ADAMS	Dr. Norman D. PENNY
	Department of Biological Science	Department of Entomology
	California State University	California Academy of Science
	Fullerton CA 92634	San Francisco CA 94118

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