The status of some genera allied to *Chrysonotomyia* and *Closterocerus* (Hymenoptera: Eulophidae, Entedoninae), with description of a new species from Dominican Amber

Gumovsky, Alex V.

Samenvatting. De status van enkele genera verwant met *Chrysonotomyia* en *Closterocerus* (Hymenoptera: Eulophidae, Entedoninae), met beschrijving van een nieuwe soort uit Dominicaanse amber

De taxonomie van de genera verwant met *Chrysonotomyia* Ashmead en *Closterocerus* Westwood wordt besproken. Uit Dominicaanse amber (Mioceen) wordt een nieuwe soort beschreven: *Chrysonotomyia dominicana* n. sp. Een ander specimen, eveneens bewaard in Dominicaanse amber, blijkt te behoren tot het genus *Achrysocharoides* maar kan verder niet beschreven worden.

Résumé. Le statut de quelques genres alliés à *Chrysonotomyia* et *Closterocerus* (Hymenoptera: Eulophidae, Entedoninae), avec description d'une espèce nouvelle de l'ambre dominicain

La taxonomie des genres alliés à *Chrysonotomyia* Ashmead et *Closterocerus* Westwood est discutée. Une espèce nouvelle, trouvée dans de l'ambre dominicain (Miocène), est décrite: *Chrysonotomyia dominicana* n. sp. Une deuxième espèce, également incluse dans de l'ambre dominicain, semble appartenir au genre *Achrysocharoides*, mais ne peut pas être décrite plus en détail.

Key words: ***Chrysonotomyia dominicana* sp. n. – *Chrysonotomyia* – *Closterocerus* – *Entedon* – *Ladna* – *Mangocharis* – *Asecodes* – *Eulophus* – *Achrysocharis* – *Neochrysocharis* – *Hispinocharis* – *Achrysocharella* – *Pediobius* – *Achrysocharoides* – *Emersonella* – *Pleurotroppopsis* – *Eprhopalotus* – Dominican amber**

Gumovsky, A. V.: Schmalhausen Institute of Zoology, 15 Bogdan Khmelnitsky St., UA-01601 Kiev MSP, Ukraine. e-mail: alex@cenos.freenet.kiev.ua; o_gumovsky@hotmail.com

Preface

Chalcidoid wasps (Hymenoptera: Chalcidoidea) represent a group rather poorly known from the fossils. The amber inclusions are probably the only source for such fossil data because of minute size and weak body sclerotization of these insects.

There are many reasons for the comparatively modest progress in this area: poor condition of the amber samples, minute diagnostic characters not visible in amber specimens, poor representation of the chalcids in amber fossils (in comparison with other groups of insects), to list some.

The most comprehensive data were published by Yoshimoto (1975) who listed Torymidae, Ormyridae, Tetracampidae, Chalcididae, Perilampidae, Eurytomidae, Pteromalidae, Eupelmidae and Agaonidae from Canadian ambers. Rasnitsyn (1980) mentioned Torymidae from the Taimyr amber (Russia). More attention was paid to the description of fossil chalcids from ambers in the recent years (for instance, Grissell 1980, Darling 1997 etc.).

The only record of the amber Eulophidae is a reference to *Entedon* sp. from Dominican amber (Bouček & Askew 1968). Identification of these chalcid wasps is still rather difficult despite the serious attention devoted to their systematics in the last years. In part this can be explained by the imperfectness in entedonine diagnoses. This paper deals, in particular, with amelioration of some generic diagnoses and discovery of two specimens of Entedoninae (Hymenoptera: Eulophidae) found during our study of the Dominican amber collection of the Natural History Museum, London (BMNH). One specimen represents a new species which belongs to one of the genera discussed below.

Discussion

The genera *Chrysonotomyia* Ashmead, *Ladna* Bouček, *Asecodes* Förster and *Closterocerus* Westwood have never been properly compared to each other (with partial exception of the revision of Schauff (1991), but this comparison was based on rather superficial characters used in the diagnoses of some of these genera). It is interesting that taxonomical status of the genera (except *Ladna*) was discussed often in the same paper, but without or with rather brief mutual comparison (Hansson 1994a, 1994b, 1995, 1996).

Eulophus auripunctata Ashmead, 1894 was removed into the newly described genus *Chrysonotomyia* by Ashmead (1904). There were no clear generic characters for the genus, and Bouček (1977) proposed synonymy of *Achrysocharis* Girault and *Chrysonotomyia* Ashmead and mentioned 2-segmented funicle and 3-segmented clava as key characters. This concept was accepted so far for the genus *Chrysonotomyia* (Bouček & Graham 1978, Bouček 1988, Hansson 1990, Schauff 1991, etc). *Closterocerus* and *Chrysonotomyia* had been supposed to be the synonyms till Hansson discovered them to be separate genera, and placed *Achrysocharis* under synonymy with *Closterocerus* (Hansson 1994b, 1996).

Hansson (1994b, 1995) regarded the genus *Chrysonotomyia* as separate from both *Closterocerus* and *Neochrysocharis*, while it has been misinterpreted and confused with two latter ones for a long period. The same author (1994a) characterized this genus by the well delimited clypeus; occiput without vertical furrow or weak fold between occipital margin and foramen magnum; midlobe of the mesoscutum with one pair of setae; well advanced axillae, forewing with two hairlines radiating from the stigmal vein, bare radial cell; transverse petiole and gaster being broadly attached to the propodeum. Since many of these characters vary within certain genera (in *Closterocerus* and *Asecodes*, in particular: Hansson 1996), the well delimited clypeus and midlobe of mesoscutum with one pair of setae, were of most phylogenetic importance.

The genus *Closterocerus* has been characterized mainly by the wing coloration and flattened antennae (Graham 1959, 1963, Bouček 1988, Schauff 1991) till Hansson showed these characters to be variable and moved most species treated previously in *Chrysonotomyia* into *Closterocerus* (Hansson 1994b). *Neochrysocharis* was supposed to be a sister group to *Closterocerus* (in having 2-segmented funicle and 3-segmented clava), but differing in straight or

almost straight trans-epimeral suture (curved in *Closterocerus*, Hansson 1990, 1994b, 1995). This character works poorly in large series of specimens, and its application for the separation purposes requires careful treatment.

The genus *Teleopterus* was synonymised with the genus *Asecodes* by Hansson (1996) as having subtorular grooves and complete occipital median furrow. The degree of the expression of the latter is varying even within certain species, so that it also requires very careful treatment as a generic character.

Fig 1. *Chrysonotomyia picta* (Bouček), comb. n., ♀ paratype (BMNH), a.– habitus, b.– head.

The genus *Ladna* was described by Bouček (1988) for the single species *picta* from Australia (Fig. 1a–b). There were no exact apomorphies proposed for this monotypic genus. Surekha and Narendran (1992) described a second species, *L. bengalica*, from India. I have not seen the type of the latter, and it is not quite clear from the description whether this species was placed in the proper genus.

It was Hansson (1996) who emphasized the role of the subtorular grooves in the systematics of Entedoninae. Presence of these grooves was recorded as a diagnostic character for the genus *Asecodes*, supporting monophyly of this genus (Hansson 1996). It was mentioned that these grooves are also present in some *Chrysoharis*, but there were no records of any other genera having this character.

A special attention was paid by me to this character when studying the phylogeny of the World entedonine genera. I have found that these grooves are present in some other genera of Entedoninae and can not be used for their separation from each other. There are certain differences between the subtorular grooves in *Asecodes* and *Closterocerus* (Fig. 2, 3). In the "true" *Asecodes* these grooves represent a continuation of the scrobal grooves (Fig. 2), while in the "true" *Closterocerus* these grooves are stretching downwards from the bottom of the antennal toruli (Fig. 3).

Fig. 2. *Closterocerus turcicus* (Nees), comb. n. (formerly places in the genus *Asecodes*), face; st– subtorular grooves.

The occipital groove (incomplete in *Asecodes* and missing or poorly visible in *Closterocerus*, according to Hansson 1995) and the structure of the sensory pore on the male scape (restricted to a small apicoventral group on the scape in *Closterocerus* [rare within Entedoninae] and situated along the major part of the ventral edge of the scape [more common] in *Asecodes*) were used for separation of these genera (Hansson 1996, etc.).

The genus *Hispinocharis* was described by Bouček (1988) for *Achrysocharella orientalis* Ferrière, 1933. Then Ikeda and Kamijo (1993) described another species, *H. nigrescens*. This genus was characterized mainly by two-segmented antennal funicle and deeply channeled posterior notauli. In regard to the grooves on the face, it was stated "frontal grooves X-shaped, as in *Pediobius*, also lower face as in that genus" (Bouček 1988). Subtorular grooves were not mentioned for this genus, although they are present in both described species (type materials studied).

Fig. 3. *Closterocerus* sp., face; st–subtorular grooves.

The genus *Mangocharis* (Fig. 4) was described by Bouček (1986) for a single species *longiscapus* reared from leaf galls of *Procontarinia matteianna* Kieffer & Cecconi (Cecidomyiidae) on the mango tree *Mangifera indica* L. The main character separating this genus from the closest *Closterocerus* and *Neochrysocharis* was the elongate scape (rather long in male, Fig. 3b, and reaching above the median ocellus in female, Fig. 3a).

Both, *Mangocharis* and *Hispinocharis*, differ from *Asecodes*+*Closterocerus* in rather quantitative (number of funicular joints and length of scape) or subtle (delimitation of posterior notauli) characters. However, both genera represent a monophyletic lineage with *Asecodes*+*Closterocerus*+*Neochrysocharis* in possessing the subtorular grooves.

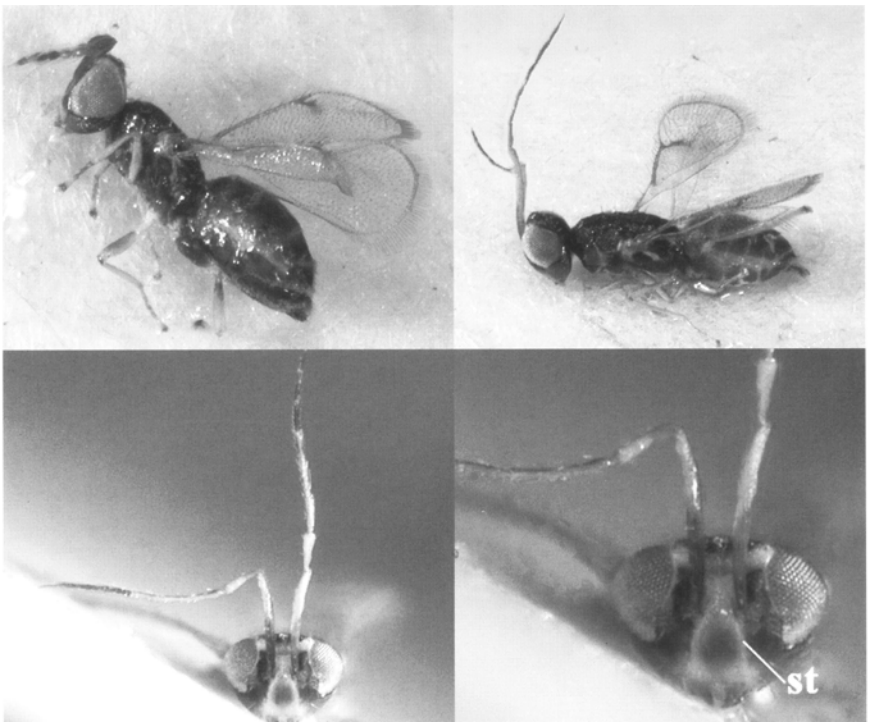

Fig. 4. *Closterocerus longiscapus* (Bouček), comb. n., habitus: a.– ♀; b.– ♂; c–d ♂ face ; st– subtorular groove.

The genus *Chrysonotomyia* (Figs. 5–8) is clearly separable from both *Asecodes* and *Closterocerus* in having delimited clypeus (Fig. 6, 8, cly). The genus *Ladna* was not characterized by the subtorular grooves, but rather by the delimited clypeus; however, this delimitation is hard to see. For a long time this genus was characterized by three-segmented antennal clava (Graham 1959, 1963, Bouček 1988, Schauff 1991, Trjapitzin 1978), so that many species were described in this genus erroneously. However, occasionally this placement was correct, for example, in the case of *Ch. postmarginaloides* (Saraswat) (Figs. 7, 8). This species has both subtorular grooves and delimited clypeus, the unique combination for *Chrysonotomyia*.

Careful study of paralectotypes of *Chrysonotomyia auripunctata* (Ashmead) (BMNH) and paratype of *Ladna picta* Bouček (BMNH, Fig. 1) led me to the conclusion of synonymy for these two genera. Although the subtorular grooves are not so clear in *L. picta*, they are visible in special light.

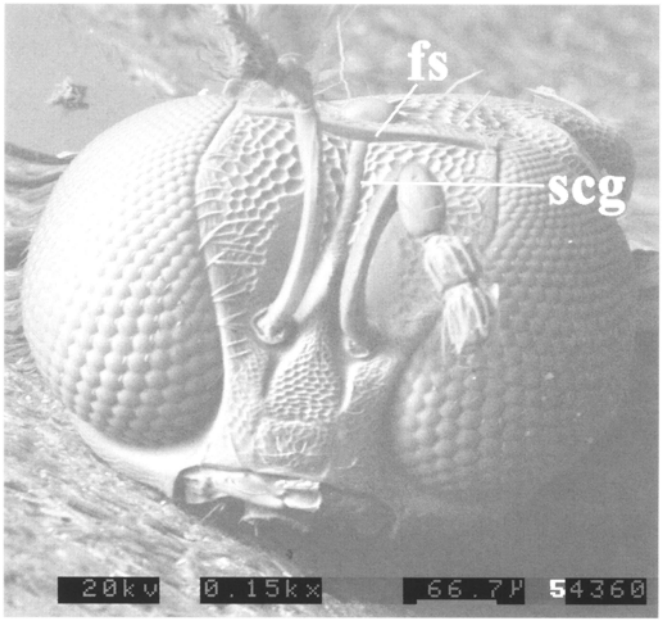

Fig. 5. *Chrysonotomyia* sp., face; scg–scrobal groove, fs–frontal sulcus.

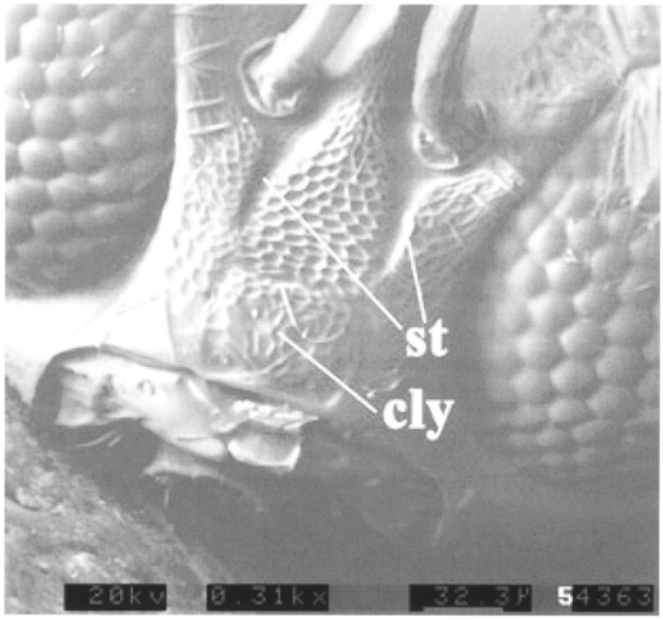

Fig. 6. *Chrysonotomyia* sp., lower face; st–subtorular grooves, cly–clypeus.

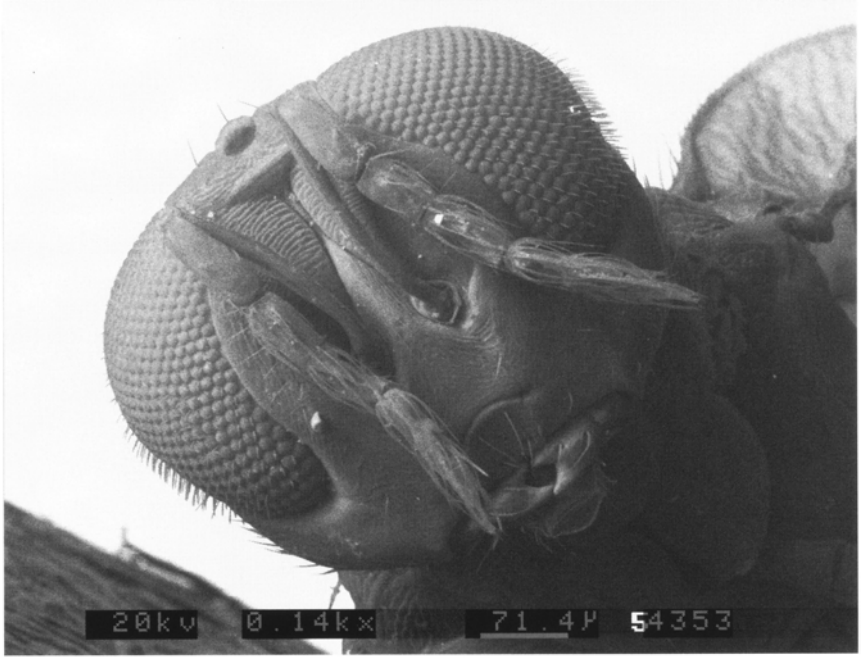

Fig. 7. *Chrysonotomyia postmarginaloides* (Saraswat), face.

All the consideration set forth above have eventually confirmed me in the opinion that of the seven discussed only two genera represent separate entities, i. e. *Closterocerus* and *Chrysonotomyia*. These two genera, sharing the subtorular grooves, differ from each other in the shape of scrobal grooves and of frontal sulcus, and in clypeus being delimited or not (see Table 1).

Genus *Closterocerus* Westwood

Closterocerus Westwood, 1833: 419. Type species: *Closterocerus trifasciatus* Westwood. By monotypy.

Neochrysocharis Kurdjumov, 1912: 234. Type species: *N. immaculata* Kurdjumov, 1912: 234 (= *Cirrospilus aratus* Walker, 1838: 453), by original designation. **Syn. n.**

Asecodes Förster, 1856: 79. Type species: *Asecodes fuscipes* Förster (= *coronis* Walker). By monotypy. **Syn. n.**

Hispinocharis Bouček, 1988: 718. Type species *Achrysocharella orientalis* Ferrière. Subseq. desig. (Bouček, 1988). **Syn. n.**

Mangocharis Bouček, 1986: 403. Type species: *Mangocharis longiscapus* Bouček. By monotypy. **Syn. n.**

For a full list of synonyms see Hansson 1996, and Bouček 1988.

Remark: in regard to the new concept proposed here some synonyms established earlier require a confirmation (A. A. Girault's genera, in particular).

Diagnosis. Clypeus not delimited, subtorular grooves present; scrobal grooves traced by sutures, short, converging, meeting frontal sulcus midway between torulus and anterior ocellus, frontal sulcus angulate, without a ridge above.

Biology. Wide spectrum of egg to pupal parasitoids mostly attacking holometabolous insects, and occasionally some Hemimetabola as well (Hansson 1990, 1994b, 1995).

Distribution. Cosmopolitan.

Genus *Chrysonotomyia* Ashmead

Chrysonotomyia Ashmead, 1904: 344. Type species: *Eulophus auripunctatus* Ashmead. By original designation.

Ladna Bouček, 1988: 718. Type species: *Ladna picta* Bouček, by original designation. **Syn. n.**

Diagnosis. Clypeus delimited; subtorular grooves present as short sutures not reaching clypeal sutures; scrobal grooves traced by sutures, long, meeting frontal sulcus at a point much closer to anterior ocellus than to torulus; frontal sulcus short, straight transverse and with overhanging ridge.

Supporting characters. Radial cell bare, mesoscutum with one pair of setae.

Remark. Most references to *Chrysonotomyia* concern *Closterocerus*.

Biology. The species with known biology are larval endoparasitoids of gall midges (Cecidomyidae) (Hansson 1994a, Saraswat 1975).

Distribution. Neotropical (Ashmead 1904), Oriental (Saraswat 1975, Bouček 1986), Australasian (Bouček 1988).

Key to the known species of *Chrysonotomyia*

1. All antennal segments free, speculum open ..... *Ch. dominicana* sp. n.
— At least two apical antennal segments fused 2

2. Two apical antennal segments fused ..... *Ch. auripunctata* (Ashmead)
— Three apical antennal segments fused 3

3. Mandible bidentate, with two large subequal teeth ..... *Ch. postmarginaloides* (Saraswat)
— Mandible multidentate, with one larger and several small teeth ..... *Ch. picta* (Bouček), comb. n.

Table 1. Character matrix.

Genus	subtorular grooves	scrobal grooves	frontal sulcus	frontal ridge	clypeus	trans-epimeral sulcus	setae on midlobe of mesoscutum
Chrysonotomyia	present	long, subparallel in upper part, almost reaching anterior ocellus	transverse	present	delimited	curved-straight	one pair
Ladna	present	long, subparallel in upper part, almost reaching anterior ocellus	transverse	present	delimited	somewhat curved	one pair
Closterocerus	present	short, not parallel, distant from anterior ocellus	angulate	absent	not delimited	curved	one or two pairs
Neochrysocharis	present	short, not parallel, distant from anterior ocellus	angulate	absent	not delimited	straight or weakly curved	two pairs
Asecodes	present	short, not parallel, distant from anterior ocellus	angulate	absent	not delimited	straight or weakly curved	two pairs
Hispinocharis	present	short, not parallel, distant from anterior ocellus	angulate	absent	not delimited	somewhat curved	two pairs
Mangocharis	present	short, not parallel, distant from anterior ocellus	angulate	absent	not delimited	curved	one pair

Chrysonotomyia dominicana sp. n.

Type material. Holotype ♀, BMNH Pal. PI II 335, Dominican amber, Dominican Republic, purchased McCallum, Marcus, 1993 (BMNH, Fig. 9).

Description [all dimensions 50×20]. Length 1.2 mm (70). Light white, but original body color probably lost when preserved in amber, legs and antennae seem to be darkened; setae on head and mesosoma have darkened bases.

Head in dorsal view about 2.3 (16/7) times as broad as long, with narrow temples. Ocelli large, POL:OOL:OCL:MDO in ratio 3:1:1:4. Head in frontal view 1.3 (17/13) times as broad as high. Oral fossa 2.5 (5/2) times as long as malar space. Eye large, with just few short setae, its height 6 (12/2) times longer than malar space; malar sulcus appears as a short line. Anterior margin of clypeus truncate, with delimitation of clypeus weakly traced. Frontal sulcus short, situated closely to anterior ocellus, with distinct short ridge above and long, subparallel scrobal grooves below. Subtorular grooves short. Combined length of pedicel and flagellum as long as head breadth. Antennae inserted barely above lower eye margin, with 1 narrow anellus and flagellum having all segments free. Scape 5 times as long as broad (10/2); pedicel 1.5 times as long as broad (3/2). Flagellar segments tapering gradually, all segments about twice as long as broad, their length/breadth ratio as follows: first 3/1.5, second 2.5/1.2,

third 2/1, fourth and fifth 2/0.9, the latter with long spine being as long as its segment.

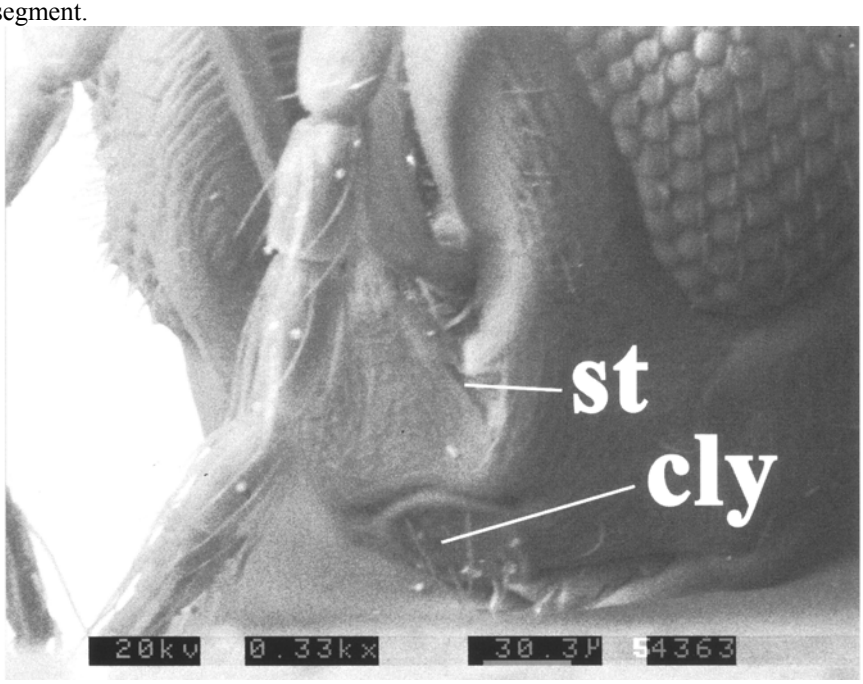

Fig 8. *Chrysonotomyia postmarginaloides* (Saraswat); st–subtorular grooves, cly–clypeus.

Mesosoma about 2.4 (27/11) times as long as broad. Pronotum conical, without collar, with some short setae along its posterior margin. Mesoscutum slightly broader than long (11/10); scutellum 1.66 times as long as broad. Propodeum without specific sculpture. Legs slender, with 4-segmented tarsi. Fore wing slightly more than twice (48/22) as long as broad, costal cell bare, narrow, subcosta of submarginal vein with 2 setae on its dorsal surface before distinct "break" where it meets praestigma; marginal vein 5 times (55/11) longer than costal cell, postmarginal vein and stigmal veins about subequal in length, radial sector bare; intercubital vein present as a row of 5 setae, speculum closed; fringe of apical margin about twice as long as breadth of marginal vein in its basal (broadest) part.

Metasoma. Petiole not visible (artifact), but obviously short, reduced. Gaster ovate, twice (30/15) as long as broad, slightly shorter than head+mesosoma. Ovipositor reaching along major part of gaster.

Male. Unknown.

Biology. Unknown.

Origin. Dominican amber (Miocene).

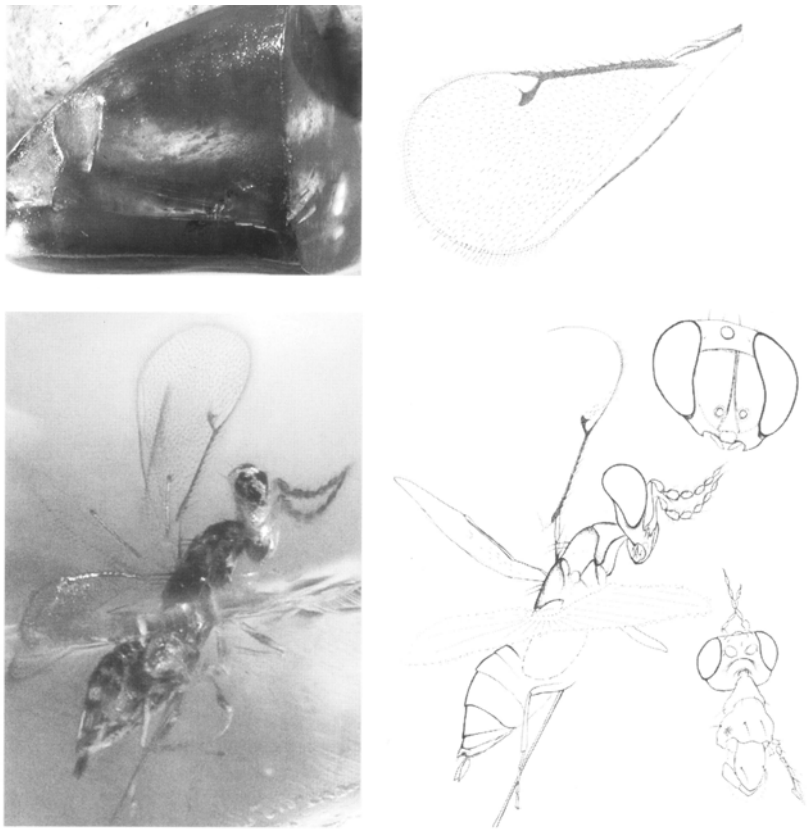

Fig. 9: *Chrysonotomyia dominicana* sp. n., ♀ holotype: a.– total view of the amber sample, b.– fore wing, c.– habitus, d.– line construction of some bodyparts.

Generic placement. It was not easy to place this species. Despite tiny sclerotization and peculiar specific characters, I feel this to be a *Chrysonotomyia* species. The character combination present in Table 2 demonstrates the background of our choice.

Achrysocharoides sp.

Material. ♀, BMNH Pal. PI II 437 (2), Dominican amber, Dominican Republic, purchased McCallum, Marcus, 1993 (BMNH), Fig. 10.

Morphological notes. There are several characters which may be seen in this eulophid specimen: frontal fork transverse, antennal flagellum with 5 segments, two apical fused, dorsal mesosoma evenly finely alveolate, notauli weakly depressed anteriorly, median propodeum flat, with no sculpture, postmarginal and stigmal veins short, subequal in length.

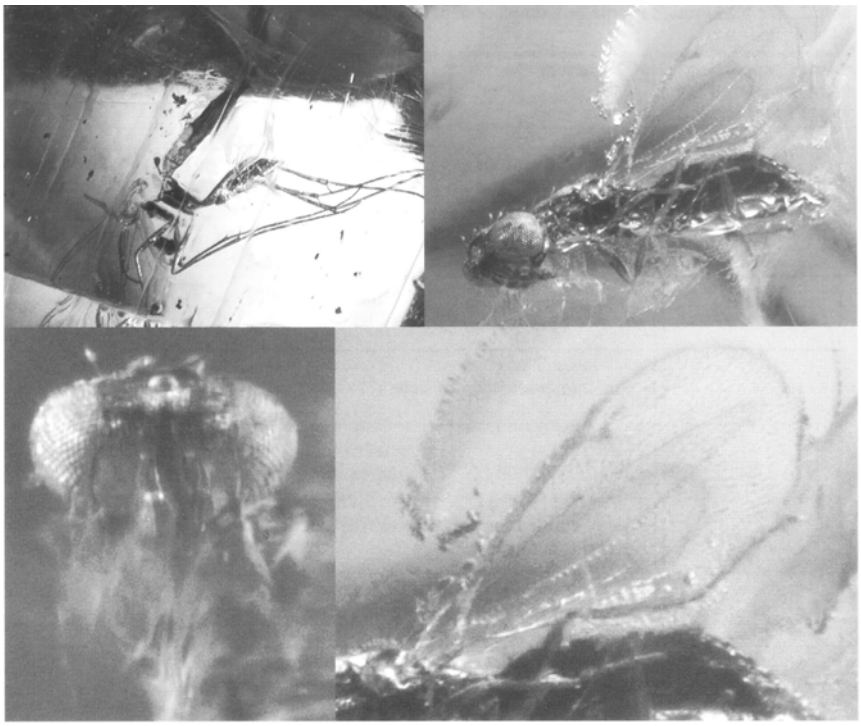

Fig. 10: *Achrysocharoides* sp., ♀, a.– total view of the amber sample, b.– habitus, c.– face, d.– forewing.

Generic placement. This eulophid species is recognized by the characters mentioned in Table 3. Other genera characterized by the transverse frontal sulcus and considered for the generic placement of this species are *Emersonella*, *Pleurotroppopsis*-complex and *Eprhopalotus*. *Emersonella* has peculiar structure of propodeum with two crescent median carinae and with foveae adjacent to them. Species of the *Pleurotroppopsis*-complex (*Pleurotroppopsis*, *Apleurotropis*, *Zaommomenedon*, *Platocharis* etc.) are easily recognizable by the channeled anterior notauli, pronotal shoulders present as lateral protrusions of pronotal collar, and mostly by the postmarginal vein much longer than stigmal, all these characters being absent in the amber specimen. *Eprhopalotus* has characteristic robust body, reduced pronotum and notauli sutured along their entire length, which clearly rules this genus out. In general aspect the amber species is close to *Closterocerus* and *Chrysocharis*. *Closterocerus* has angulate frontal sulcus, while the frontal sulcus is transverse in the amber specimen). Some species of *Chrysonocharis* have frontal sulcus nearly transverse, but then the last anellus is enlarged and postmarginal vein longer than stigmal: none of these characters is seen in the amber specimen.

Table 2. The background for the generic placement of *Chrysonotomyia dominicana* sp. n.

Amber specimen, BMNH Pal. PI II 335	**Characters**	**Taxonomic level**
+	Antenna with no more than 10 segments: 8 segments	EULOPHIDAE
+	Foretibial spur considerably reduced	
+	Tarsi 4- or 3-segmented: 4 segmented	
+	Scutellum with 1 pair of setae	Entedoninae
+	Face with frontal sulcus	
+	Gaster with 7 segments only (no separation between segments behind cerci)	
+	First pair of mesosomal spiracles covered by the overlapping margin of the pronotum, no pronotal emargination around spiracle	
+	Frontal grooves represent a special pattern with long subparallel scrobal grooves ended by short, transverse frontal sulcus traced above by a short ridge	Genus *Chrysonotomyia*
+	Scutellum with 1 pair of setae	
+	Clypeus delimited	
+	Radial sector of fore wing bare	
+	Subtorular grooves present	
+	Two apical flagellar segments free	Specific characters
+	Speculum closed	

Table 3. The background for the generic placement of *Achrysocharoides* sp.

EULOPHIDAE	**Entedoninae**	***Achrysocharoides***	**Amber specimen, BMNH Pal. PI II 437 (2)**
Antenna with no more than 10 segments: 8 segments	Scutellum with 1 pair of setae	Frontal sulcus transverse	+
Foretibial spur considerably reduced	Face with frontal sulcus	Notauli not channeled anteriorly	+
Tarsi 4- or 3-segmented: 4 segmented	Gaster with 7 segments only	Last anellus not enlarged	+
	First pair of spiracles covered by the overlapping margin of the pronotum, no pronotal emargination around spiracle	Postmarginal vein as long as or very slightly longer than stigmal vein	+
		Median propodeum either with no sculpture or with thin median carina	+
		Lateral panel of pronotum with semicircular plica	**?**

One of the most peculiar characters for *Achrysocharoides* is the semicircular plica on the lateral panel of pronotum (the character shared by *Entedon* and, to some extent, by *Pleurotroppopsis*-complex). Unfortunately, the pronotal structure is a bit deformed in the amber specimen, so we can not properly examine its lateral panel. But even without data on this character the generic placement of the specimen is still possible.

Species recognition. There are many morphological features (e. g. coloration, exact measurements of the antennal joints etc.) playing a significant role in identification of species of this genus. The condition of the amber specimen does not allow to see them, so we avoid any further speculation.

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