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A new species of the spider wasp genus *Claveliocnemis* Wolf, with new data on distribution and biology of its congeners (Hymenoptera: Pompilidae)

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ABSTRACT

The diagnosis of the poorly-known spider wasp genus, *Claveliocnemis* Wolf, 1968, is reviewed in view of a new species, *C. alata* n. sp., described from Tajikistan. *Claveliocnemis* contains two additional Asian species of brachypterous pepsine wasps, that feed as larvae on species of the burrowing mygalomorph spider genus *Anemesia* Pocock (Araneae, Cyrtaucheniidae). The paper also contains a key to the three species of *Claveliocnemis* and new data on their distribution and biology.

KEY WORDS: Pompilidae, *Claveliocnemis*, Central Asia, *C. alata* n. sp. natural history

INTRODUCTION

The small pepsine genus *Claveliocnemis* was established by Wolf (1968) on the basis of a single species, *C. incisipennis* wolf (1968), which was described from a single brachypterous female collected in Afghanistan. Wolf (1981) added to the genus his newly described *C. beaumonti*, but later (Wolf, 2001) synonymized it with the poorly known *Priocnemis brachypteris*, described by Gussakovskij (1935) from Tajikistan. Despite the large areal of this genus, almost nothing was known on the distribution and biology of the species. This study is an attempt to fill up these gaps, and it also contains a description of a new species of *Claveliocnemis* from Tajikistan.

MATERIAL AND METHODS

Two of the three species treated here have been found to possess a very specialized biology (see below) that could explain their rarity in collections. Almost all the studied specimens were collected during my field trips in 1986–1995. The holotype of *Priocnemis brachypteris* Gussakovskij was borrowed from the Zoological Institute, St. Petersburg (ZISP). The holotype of *C. alata* n. sp., described here, is deposited in the

insect collection of Tel Aviv University (TAUI). Most paratypes and other specimens are deposited in these two collections. A few other specimens were donated to the insect collection of the Oberösterreichischen Landesmuseum Linz.

Most of the observations on the wasp biology were conducted in the course of several field experiments. A few females of *C. incisipennis* and *C. brachypteris* were captured and kept separately for 1−3 days inside plastic vials (100 × 20 mm) closed with a cotton plug, with sugar syrup as nourishment. Each of them was then let out within the densest available aggregations of burrows of *Anemesia* spp. To observe the wasps hunting their prey, the burrowing mygalomorph spiders, inside the spider nests, the burrows were dug cautiously and opened laterally while the wasps were inside. Each of the paralyzed spiders was then placed into a small cartoon box with moistened peat and transported to the laboratory for further observations on the development of the immature pompilids.

Most indices are accurate to 0.05. Most figures were drawn with Adobe® Illustrator® 10.0 and arranged with Adobe® Photoshop® 7.0.

Abbreviations, ratios and terms (see also Wolf, 1990, and Zonstein, 2001) are as follows: Head: OOD – ocular-ocellar distance; POD – postocellar distance; antennal ratio – length of first four antennal segments (scapus – pedicellus – flagellomere I – flagellomere II) divided by length of pedicellus. Forewing: MR1 – ratio between lengths of posterior border and oblique proximal border of cell 1Rs; MR2 – lengths of posterior border and oblique proximal border of cell 2Rs; M2/M3 – ratio between length of vein M sectors of 2nd and 3rd radiomedian cells (1Rs and 2Rs); RH – ratio between the total length of radial cell (2R1) and its maximal width. Hindwing: RQ – ratio between length of first section of vein Rs and length of vein 1rm.

TAXONOMY

Claveliocnemis Wolf, 1968

Claveliocnemis Wolf, 1968: 235. Type species: *C. incisipennis* Wolf, 1968, by monotypy.

Diagnosis

Small to medium-sized pepsine wasps with body length 7.0 – 14.5 mm. Ground color of body mostly black, proximal metasomal segments concolorous with rest of body or dark red; wings (or their rudiments) infumated. Sculpture of integument: small dense pits spaced slightly closer than their diameter; propodeum and mesopleuron fine-striated transversely.

Description

Female. **Head**. Distinctly wider than long and wider than mesosoma. Eyes relatively narrow. Orbits divergent ventrally. Ocelli sessile, mound indistinct, anterior ocellar angle acute. Temple wide. Median frontal groove and thyridia weak to absent. Antennal

mound low but distinct. Gena low. Mandibles broadly tipped, bidentate. Clypeus wide trapezoidal, slightly convex, with slightly concave anterior edge. Flagellomeres rather short and thick: I 3.0–3.5 times, II–IV 2.5–3.0 times, distal flagellomeres 2.7–3.5 times as long as broad apically.

Mesosoma. More or less constricted in the middle in dorsal view, probably in correlation with reduction of wings and their musculature. Pronotum relatively long and convex, cervical ledge large. Mesonotum and postnotum narrowed, scutum diminished with reduced cuneoli. Postnotal junction extremely deep and narrow. Propodeum broad oval in dorsal view and steeply arched in lateral view.

Legs. Long and slender. Hind tibia distincly serrate. Distalmost tarsomere without median row of ventral spines. Pretarsal sclerite with distal comb of 10−12 short setae. Arolium relatively small, pentagonal, with apex pointed. Claw small and narrow, with single medioventral tooth.

Wings. Strongly reduced in size – narrowed and diminished to vestigial. Pterostigma long lanceolate. Veins and cells partially reduced (*C. incisipennis*) or present although developed disproportionally. Apical angle of radial cell acute.

Metasoma. Droplike with distal sclerites somewhat constricted laterally.

Male. Unknown.

Remarks

Claveliocnemis alata n. sp., the lesser modified representative of the genus, resembles members of the genus *Priocnemis* Schiodte, 1837, and especially species of the subgenus *Umbripennis* Junco, 1947. *C. alata* and the other congeners differ from the species of *Umbripennis* in the wider head, convex orbit, noticeably shorter antenna and particularly in the medially narrowed mesosoma, and the steeply arched anterior edge of the propodeum elevated over a deeper postnotal junction.

The latter two characters, which are probably correlated with the wings underdevelopment, occur neither in *Priocnemis*, nor in other related genera, and thus are considered apomorphic for *Claveliocnemis*. A mesosoma that is narrowed in the middle is known also in a few pepsine genera that are not related to *Claveliocnemis*, e. g. the Mediterranean *Ctenocerus* Dahlbom, 1845, the Australian *Iridomimus* Evans, 1970, and the South American *Sphictostethus* Kohl, 1884 (Šustera, 1913; Wolf, 1968; Evans, 1970; Roig-Alsina, 1987). *Sphictostethus* was sometimes considered a subgenus of the genus *Priocnemis* (Townes, 1957), but has recently been grouped together with *Eopompilus* Gussakovskij, 1932 and *Ctenopriocnemis* Ishikawa, 1962 (Pitts *et al*, 2006). The propodeum character is a unique autapomorphy of *Claveliocnemis*.

The three characters (head, orbit and antenna) mentioned above occur in a few lineages within *Priocnemis* and are considered homoplasies. Nevertheless, until this genus has been revised and its characters better studied, any further conclusions concerning the monophyly of *Claveliocnemis* would be premature.

Key to the species of *Claveliocnemis* Wolf (females)

1. Fore wing shorter than mesosoma (Fig. 5). Most of body including metasoma uniformly black, metasoma with strong greenish reflection; mandible (except blackish apex), clypeus, proximal flagellomeres and sometimes leg parts (femora distally, tibiae, and tarsi) dark red to fulvous. ♀ 8.0 – 14.5 mm. Northern Afghanistan, Uzbekistan and Tajikistan..... .....***C. incisipennis* Wolf**
-. Fore wing longer than mesosoma (Figs. 3, 4). Head and mesosoma black, metasoma bicolorous with reddish anterior segments. Mandible medially and clypeus apically reddish-brown. Antenna and legs dark brown to brownish-black. Size variable **2**
2. Fore wing equal to or shorter than head and mesosoma combined (Fig. 4). Metasomal tergites I and II entirely, and tergite III sometimes basally dark cherry-red. ♀: 8.5 – 14.0 mm. Uzbekistan and Tajikistan..... ***C. brachypteris* (Gussakovskij)**
-. Fore wing longer than head and mesosoma combined (Fig. 5). Tergite I entirely red, tergite II red with broad apical brownish-black fascia, and tergite III entirely black. ♀: 7.0 – 12.5 mm. Southern Tajikistan ..... ***C. alata* n. sp.**

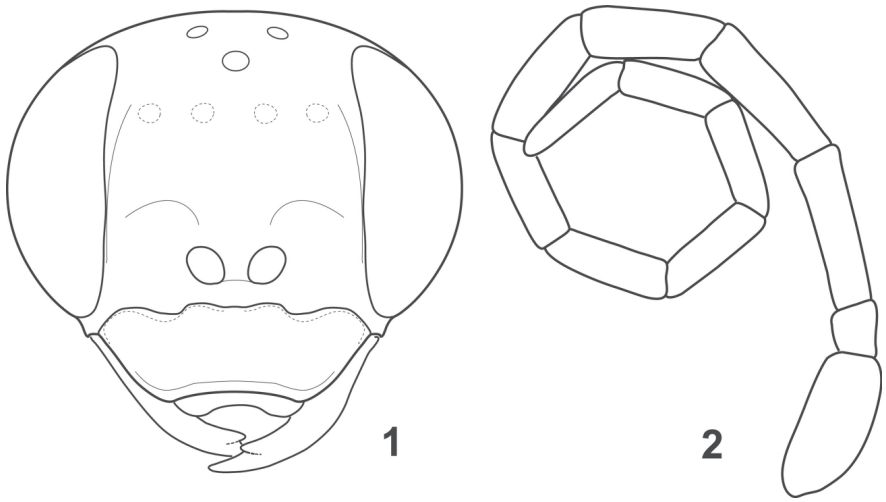
Claveliocnemis alata S. Zonstein, n. sp.
(Figs. 1–3)

Diagnosis

This species is the less derived member of the genus and, unlike the brachypterous congeners, it possesses well developed although narrow wings. It also differs from the two other species in the details of the coloration, mentioned in the key.

Description

Female. Habitus as in Fig. 3. Length 7.0–12.5 mm. Predominantly black; mandible medially and apically, most part of tergite 1 (except darkened proximal part) and tergite



Figs. 1–2. *Claveliocnemis alata* n. sp., female. 1. Face. 2. Antenna.

2, except broad apical brownish-black fascia, dark red; antenna, hind tibia posteriorly and tarsi dark brown to brownish-black. Wings light brownish-gray with darker blurred apical spot, pterostigma and veins yellowish-brown to brown. Body and legs covered with thin appressed black and brownish pubescence, face ventrally and coxae also with grayish pubescence. Frons, temple and femora dorsally with few short inclined setae; coxae, sternites and apical tergites with relatively long and dark erect bristles. Head, pronotum, mesonotum and metanotum coarsely and densely punctate. Head in frontal view (Fig. 1) 1.15−1.20 times as broad as high and 1.25−1.30 times as broad as pronotum. Eye in dorsal view 2.3−2.5 times as long as temple. Ocellar mound very low. Anterior ocellar angle 75−80°. POD/OOD ratio 0.70−0.92. Frons with weakly developed median groove and thyridia. Antennal mound low but distinct. Antennal ratio (Fig. 2) 3.0 : 1.0 : 3.4 : 3.0. First flagellomere 3.2−3.4 times as long as broad apically. Postnotal junction transversely striated, slightly shining, 0.55−0.60 times as long as metanotum. Metapleuron with well developed transverse striae. Propodeum anteriorly with fine cellular sculpture, posteriorly with dense and fine transverse ridges; median longitudinal groove absent. In fore wing RH 4.20−4.95, MR1 1.2−1.4, MR2 2.1−2.3, M2M3 0.60−0.75. In hind wing RQ 3.05−3.40. Metasomal segments finely and densely punctuate.

Male. Unknown.

Material examined

Holotype, ♀ "Gandzhina, Aruktau Mts., SW–Tadzhikistan, 750 m, 37°59'N 68°33'E, S. Zonstein, 18.iv.1992"; "Holotype ♀ *Claveliocnemis alata* sp. n., Zonstein det. 2004" (TAUI).

Paratypes: TAJIKISTAN, same locality as holotype, 16.iv.1991, 17−18.iv.1992, S. Zonstein (7♀; TAUI, ZISP); Sanglok Mts., Sharshar, 1400 m, 38°15'N 69°13'E, 2.v.1990, S. Zonstein (3♀; TAUI) Pyandzh Karatau Mts., Mt. Astana, 1650 m, 37°23'N 69°15'E, 23.iv.1992, S. Zonstein (1♀; TAUI).

Etymology

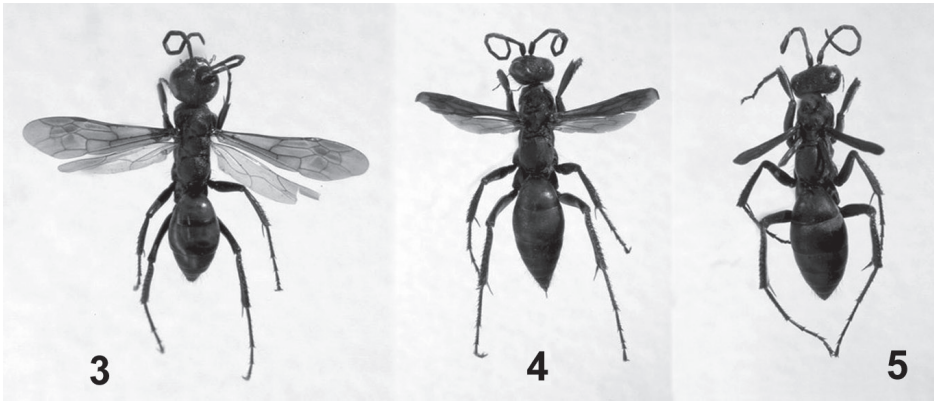
The specific epithet, *alata* (Latin), means "possessing wings, winged" and emphasizes the main distinction of the new species from its congeners.

Distribution

Tadjikistan.

Claveliocnemis brachypteris (Gussakovskij, 1935)
(Fig. 4, 7)

Priocnemis brachypteris Gussakovskij, 1935: 435.
Claveliocnemis beaumonti Wolf, 1981: 341. Synonymy by Wolf, 2001: 973.
Claveliocnemis brachypteris: Wolf, 2001: 973 [synonymy]; Zonstein, 2001: 13 [biology].



Figs. 3–5. *Claveliocnemis* spp., female, dorsal view. 3. *C. alata*. 4. *C. brachypteris*. 5. *C. incisipennis*.

Material examined

Holotype ♀, "Tadj[ikistan], Dzhurva, 26.iv.[1]931, Fursov" (ZISP). Other specimens: TAJIKISTAN: Aruktau Mts., Gandzhina, 750 m, 37°59'N 68°33'E, 15.iv.1986, 13.iv.1988, 16.iv.1991, 17–18.iv.1992, S. Zonstein (8♀; TAUI); Sanglok Mts., Sharshar, 1400 m, 38°15'N 69°13'E, 2.v.1990, S. Zonstein (2♀; TAUI); Pyandzh Karatau Mts., Mt. Astana, 1650 m, 37°23'N 69°15'E, 23.iv.1992, S. Zonstein (3♀; TAUI); Hissar Mts., foothills 7 km NNE Dushanbe, 1050 m, 38°40'N 68°47'E, 29.iv.1990, S. Zonstein (1♀; TAUI); Khazratishakh Mts., Khovaling, 1700 m, 38°22'N 70°00'E, 1.v.1990, S. Zonstein (1♀; TAUI). UZBEKISTAN: Zeravshan Mts., Aman–Kutan pass, 1700 m, 39°18'N 66°54'E, 26.iv.1993, S. Ovchinnikov (1♀; TAUI); Babatag Mts., Mt. Zarkassa, 1900 m, 38°00'N 68°11'E, 3.v.1995, S. Zonstein (1♀; TAUI).

Distribution

Southern Uzbekistan, Tadjikistan.

Remarks

Wolf (1981) cited the label data of the holotype of *C. beaumonti* as "7.5.74, Turkestan, Aman-Kuk, leg. M. Kraus, 1600 m, Serafschangeb.", which I interpret as collected within the nearest surroundings of Aman-Kutan pass located in the western part of Zeravshan Mt. Ridge, at 1675 m above sea level.

Habitus photographs (Fig. 4, 7) of this species are published here for the first time.

Claveliocnemis incisipennis Wolf, 1968
(Fig. 5, 6)

Claveliocnemis incisipennis Wolf, 1968: 235; Zonstein, 2001: 13 [biology].

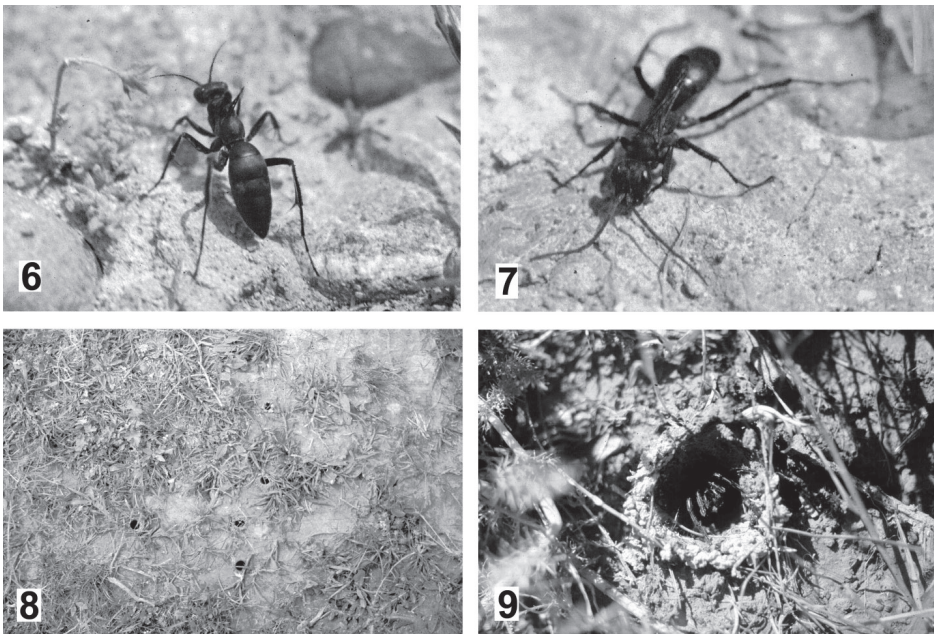


Fig 6–9. Living female wasps and their prey in the natural habitats. 6. *Claveliocnemis incisipennis*. 7. *C. brachypteris*. 8. Part of the spider colony showing separate burrows. 9. An adult female of *Anemesia incana* inside the burrow.

Material examined

UZBEKISTAN: Zeravshan Mts., Aman–Kutan pass, 1700 m, 39°18'N 66°54'E, 27.iv.1993, S. Zonstein (1♀; TAUI); Babatag Mts, Mt. Zarkassa, 1900 m, 38°00'N 68°11'E, 3.v.1995, S. Zonstein (2♀; TAUI). TAJIKISTAN: Aruktau Mts., Gandzhina, 750 m, 37°59'N 68°33'E, 17.iv.1986, 5.iv.1987, 13.iv.1988, 16.iv.1991, 15–17.iv.1992, S. Zonstein (17♀; TAUI, ZISP); Sanglok Mts., Sharshar, 1400 m, 38°15'N 69°13'E, 2.v.1990, S. Zonstein (1♀; TAUI); Hissar Mts., foothills 7 km NNE Dushanbe, 1050 m, 38°40'N 68°47'E, 29.iv.1990, S. Zonstein (1♀; TAUI).

Distribution

Southern Uzbekistan, Tadjikistan, northern Afghanistan.

Remarks

Beside the localities mentioned above, the species is known only from Bala-Murgab, north-west Afghanistan (Wolf, 1968). Within the greatest part of its known areal it occurs sympatrically with *C. brachypteris*. In south-west Tajikistan all three congeners inhabit the same biotopes.

Habitus photographs (Fig. 5, 6) of this species are published here for the first time.

NATURAL HISTORY

Zonstein (2001) noted that *C. incisipennis* and *C. brachypteris* are specialised parasitoids of burrowing mygalomorph spiders belonging to the genus *Anemesia* Pocock, 1895 (Cyrtaucheniidae). The somewhat reduced to distinctly rudimentary wings of these wasps (Figs. 6, 7) appear to be adaptations to constraints imposed on the female wasp during her search for prey within the dense spider colonies, where the distance between separate burrows, always lacking the protective trapdoor, usually does not exceed 10−50 cm (Figs. 8, 9).

Additional data on interactions between cyrtaucheniids and hunting spider wasps were obtained in the course of several experimental field observations carried out during 20−22.iv.1992 in the Gandzhina area, southern Tajikistan. Three females of *C. incisipennis* and one of *C. brachypteris* were captured and kept separately for 1−3 days inside the described plastic vials. To begin an observation a single wasp was let out within the densest available aggregations of spider burrows.

Wasps ignored destroyed or abandoned spider nests and quickly spotted inhabited burrows. Entering the inhabited nest, regardless of the size of its entrance, the wasp proceeded downward rather slowly, with the metasoma bent under the body so that the metasoma tip with the sting was extended ahead as far as possible.

Only six of 40 observations were completed succesfully with an entire sequence of behavior observed. Each of the tested wasp females was observed trying to immobilize a spider only when its size was approximately equal to, or did not exceed 1,5 times, the body length of the wasp, i. e. the size of the late juvenile instars. Any smaller specimens were rejected as food for the larvae. The large and aggressive adult cyrtaucheniids, when disturbed, counterattacked the wasp and ran after it up to the burrow entrance.

In all the cases a prey was paralized strictly inside its nest. Two juvenile spiders were observed running out from their burrows and trying to hide nearby. In both cases the wasp, following the escaping spider outside the burrow, discontinued the hunt, apparently preferring to start a search for the next inhabited burrow.

When the tested wasp stayed inside a burrow more than the 2−3 minutes necessary for its inspection, the burrow was dug cautiously throughout its depth so as to open it laterally. In all these cases the wasp was observed near the burrow bottom capturing the prey and stinging it repeatedly. The venom injections (at least 5−7, judging from the observations) were inflicted mainly into the ventral part of the spider body, including the metasoma.

Having paralized an appropriate spider specimen, a wasp left it for a while and dug out a short (2−3 cm) side cavity near the burrow bottom, where it then placed the prey. Then the wasp deposited an egg on the surface of the posterodorsal half of the spider metasoma and closed the entrance with a soil plug before the burrow was left. The entire sequence of the activities took no less than four hours. Only one of the tested females of *C. incisipennis* was observed immobilizing and storing up two juveniles of *Anemesia incana* Zonstein during an entire day. Otherwise, only one prey was treated during an entire day.

The larvae of *C. incisipennis* emerged from the eggs 3−6 days after the oviposition, and 7−12 additional days were required for their development. All these larvae pupated in a cocoon near the spider remains.

The life cycle of the parasitoids include a long-term diapose that coincides with the prey activities. The prey, cyrtaucheniids, are self-immured inside their burrows, which are closed with a plug, and unavailable for the wasps most part of a year – from May till next March. Thus, in *Claveliocnemis* spp. the adult appearance is delayed up to the next spring, when the prey is available again.

Almost nothing is known about the nourishment of the adult females beside the fact that a few females of *C. alata* and *C. brachypteris* have been observed visiting flowers of a large annual herb, *Crambe kotschyana* Boiss. (Brassicaceae). The brachypterous females of *C. incisipennis* have never been observed on blooming plants. However, based on the field observations, they can feed on the hemolymph of small juvenile cyrtaucheniids unsuitable as provision for their larvae but nevertheless killed and consumed by the adult wasps.

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