Cheiloneurus pistaciae sp. nov. (Hymenoptera: Encyrtidae) a facultative hyperparasitoid of Kermania pistaciella Amsel (Lepidoptera: Tineidae), a pest of pistachio trees in Iran

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The pistachio twig borer moth, Kermania pistaciella Amsel (Lepidoptera: Tineidae), is a native and well known univoltine pest of pistachio (Pistacia vera L.) in Iran and Turkey (Mehrnejad 2001). The moth lays eggs on the flower clusters and the newly hatched larva penetrates into the cluster tissue. The earliest damage appears in the young succulent clusters when the whole cluster turns black and falls off the trees. A larva bores a tunnel in the cluster towards the twigs and lives there for about ten months. The pest causes fruit drop and the infested twigs do not grow well. Surveys were conducted from 2003 – 2006 in the pistachio growing areas in Kerman province, in the southern part of Iran, to monitor the parasitoid complex associated with K. pistaciella. During this project, an encyrtid parasitoid was reared from pupae of both the pest and its primary parasitoid, Chelonus kermakiae Tobias (Hymenoptera: Braconidae). As the biology of this encyrtid is unique within the family it is described below. It is provisionally placed within the genus Cheiloneurus Westwood (see discussion below).

Cheiloneurus Westwood

Cheiloneurus Westwood, 1833: 343. Type species: Encyrtus elegans Dalman, 1820 by monotypy.
Aulonops Timberlake, 1922: 158. Type species: Aulonops bifasciata Timberlake, by original designation and monotypy.
Bekilyia Risbec, 1952: 40. Type species: Bekilya metallica Risbec, by monotypy.
Blatticida Ashmead, 1904: 305. Type species: Blatticida pulchra Ashmead, by monotypy.
Cheiloneurus (Paracheiloneurus) Girault, 1915: 119. Type species: Cheiloneurus perpulcher Girault, original designation and monotypy.
Cheiloneurus Aggasiz, 1848: 231. Unjustified emendation of Cheiloneurus Westwood.
Chrysopophagus Ashmead, 1894: 246. Type species: Chrysopophagus compressicornis Ashmead, by monotypy.
Chrysopophagoides Girault, 1915: 90. Type species: Chrysopophagoides westwoodi Girault, original designation and monotypy.
Cristatothorix Girault, 1911: 169. Type species: Cristatothorix pulcher Girault, original designation and monotypy.
Epicheiloneurus Girault, 1915: 173. Type species: Epicheiloneurus albicoxa Girault, original designation and monotypy.
Eusemionopsis Girault, 1915: 78. Type species: Eusemionella cristata Girault, original designation and monotypy.
Eusemiophis Girault, 1918: 3. Type species: Eusemiophis centaura Girault, original designation and monotypy.
Hypergonatopus Timberlake, 1922: 142. Type species: Hypergonatopus hawaiiensis Perkins, original designation.
Cheiloneurus (Lepidoneurus) Hoffer, 1957: 340. Type species: Cheiloneurus kollari Mayr, original designation.
Procheiloneurus Girault, 1920: 39. Type species: Procheiloneurus triguttatipennis Girault, original designation and monotypy.

Cheiloneurus is a moderately large, cosmopolitan genus that currently includes about 130 valid species with many species yet to be described. As the generic synonymy suggests, it is morphologically diverse. It is best characterised by a marginal vein that is at least 3X as long as a very short stigmatic vein, and an almost exclusively hyperparasitic habit. Other diagnostic characters for the genus include a dorsally flat scutellum with a distinct subapical tuft of setae, the fore
wing with a naked proximal area in the basal cell, an infuscate area from below the parastigma to wing apex, or nearly so
and a naked, hyaline line connecting the apex of stigmal vein to the anterior wing margin adjacent to apex of postmargi-
nal vein, and the hypopygium not reaching more than two-thirds to the apex of the gaster. Unfortunately, most included
species exhibit at least one exception to these last named characters. The new species described below is provisionally
placed in *Cheiloneurus* on the basis of the long marginal and short stigmal veins, infuscate fore wing, short hypopygium
and hyperparasitic habit, although it lacks other characters that are normally associated with the genus (see discussion
below).

**Cheiloneurus pistaciae** Manickavasagam and Mehrnejad sp. nov.
(Figs 1–3)

**Diagnosis.** Female entire body dark greenish, mixed purple or brassy; scape dark brown, slightly expanded, flat and
slightly more than 4X as long as broad, funicle and clava uniformly brown; funicle segments subcylindrical and all lon-
ger than wide, clava round at tip; malar space about 0.5X as long as eye width; frontovertex broader than the distance
between the toruli; fore wing with uniformly dark setae present in medial and apical infuscate areas (except linea calva),
but bare and hyaline in basal 1/3 and hyaline vertical band located at about 2/3 the length of the wing; costal cell bare;
parastigma not downcurved; marginal vein about 2X as long as stigmal vein; postmarginal vein virtually absent; ovipos-
itor slightly exserted, exserted part about 0.25X as long as mid tibial spur.

Female (holotype) length, including ovipositor, 1.48 mm.

**FIGURES 1–3.** *Cheiloneurus pistaciae* ♀; (1) antenna; (2) fore wing venation enlarged (arrow indicates apex of ven-
tation); (3) fore wing.

Head with frontovertex polished green with interscrobal area more coppery with bluish green reflections; inner eye
margin with small silvery setae; radicle light brown; scape and basal 2/3 of pedicel dark brown, apical 1/3 of pedicel,
funicle and clava uniformly brown; thorax dark green with base of tegula metallic green and apex brown; fore leg uni-
formly testaceous except tarsomere 5 and claw dark brown, middle leg testaceous except basal 1/3 and tip of tibia and
Chelonus kermakiae

**Pistaciella** whilst in not abruptly convex as in the anterior wing margin and have a convex scutellum which lacks a subapical tuft of setae, but in these the scutellum is synonymised with well defined, subapical, hyaline band are unique within a subapical tuft of setae, the postmarginal vein is absent and there is no bare line connecting the apex of the stigmal vein to the anterior wing margin. However, species from Hawaii previously placed in ated with this genus are not in agreement. For instance, the scutellum is strongly convex in the apical two thirds and lacks **Cheiloneurus** pistaciae missing; venation similar to female; tip of gaster broad and blunt.

**Male.** Length, 1.05 mm. Body colour similar to female except antenna is yellowish brown and legs are uniformly pale yellow; frontovertex coppery blue with green reflections and with small silvery setae along inner eye and mouth margins, conspicuously longer above labrum; fore wing completely hyaline with pale setae; frontovertex polygonally reticulate; first funicular segment bearing long setae about 3X as long as diameter of F1, remaining flagellar segments missing; venation similar to female; tip of gaster broad and blunt.

**Hosts.** A facultative hyperparasitoid of pistachio twig borer moth, Kermania pistaciella (Lepidoptera: Tineidae), via Chelonus kermaikae (Hymenoptera: Braconidae) (see below).

**Distribution.** Iran


**Comments.** The species is provisionally placed in Cheiloneurus although several character states normally associated with this genus are not in agreement. For instance, the scutellum is strongly convex in the apical two thirds and lacks a subapical tuft of setae, the postmarginal vein is absent and there is no bare line connecting the apex of the stigmal vein to the anterior wing margin. However, species from Hawaii previously placed in Aulonops and Hypergonatopus (both synonymised with Cheiloneurus (Guerrieri & Viggiani 2005)) also lack a bare line connecting the postmarginal vein to the anterior wing margin and have a convex scutellum which lacks a subapical tuft of setae, but in these the scutellum is not abruptly convex as in C. pistaciae. The strongly convex, apically shiny scutellum and fore wing with a complete, well defined, subapical, hyaline band are unique within Cheiloneurus, although an interrupted, hyaline band can be found in C. bifasciatus (Timberlake). In related genera, only Tobiasia and Cheiloneuromyia have a similar complete hyaline band. The relationship of these genera with Cheiloneurus is unclear, and in a broader context both might be considered synonymous with Cheiloneurus. However, in Tobiasia the ovipositor is strongly exerted and bilaterally flattened, whilst in Cheiloneuromyia the body is completely yellow to pale orange and the scutellum is relatively flat with evenly reticulate sculpture.

**Biology:** Observations suggest that Cheiloneurus pistaciae is a gregarious facultative hyperparasitoid of Kermania pistaciella via its primary parasitoid Chelonus kermaikae.

Kermania pistaciella lays its eggs on the flower clusters of pistachio and these eggs are parasitized by the solitary, endoparasitic egg-larval parasitoid, Chelonus kermaikae. When the host egg hatches, the caterpillar penetrates the cluster...
tissue and tunnels into the twig where it develops for about 10 months. The fully developed caterpillar emerges from the twig from early March and, after about a day, spins a 2mm thick, pale brown cocoon nearby. At this stage the braconid larva emerges from the host’s larva, feeds on the remains of the host and then and spins a very thin, delicate, whitish cocoon within the cocoon of its host (Achterberg & Mehrnejad, 2002).

During the three year survey, 1600 *K. pistaciella* cocoons were collected. *Cheiloneurus pistaciae* adults emerged from about 0.07% of these cocoons from late April through early May. Two to five adult encyrtids emerged from a single cocoon. Subsequent dissection of these cocoons revealed that the encyrtids had emerged directly from either the lepidopteran pupae, or in similar numbers from *C. kermakiae* pupae. This suggests that *C. pistaciae* is a facultative hyperparasitoid of *K. pistaciella*, directly attacking either the primary host or its primary parasitoid.

It is not known at which stage *C. pistaciae* attacks either host species. It is unlikely to attack the caterpillar when it is inside the twig of its food plant. The pupa of the primary host (and thus the parasitoid host) is also protected by a 2mm thick cocoon that would probably be impenetrable to the tiny parasitoid. However, the host caterpillar would be vulnerable to attack between leaving its burrow in the twig and commencing spinning its cocoon, or before the cocoon becomes too thick to penetrate. Several species of *Cheiloneurus* are known to parasitise the pupae of Dryinidae (Hymenoptera) parasitoids whilst they are in a cocoon (see Guerrieri & Viggiani 2005), but the exact mechanism is not known. Oviposition by *C. pistaciae* could also take place into the moth egg, which is not hidden in plant tissue. The majority of *Cheiloneurus* species are hyperparasitoids of scale insects (Hemiptera: Coccidae) via other chalcidoid parasitoids, but a switch to parasitizing host eggs is quite possible. This may have occurred in *C. pyrillae* Mani which has been recorded as a primary parasitoid of the eggs of *Pyrilla perpusilla* (Hemiptera: Lophopidae) (Yadav & Chaudhary 1989), while species of the closely related genus *Baeoanusia* are known to be primary parasitoids or hyperparasitoids of eggs of Cerambycidae and Chrysomelidae (Coleoptera) (Schmidt & Noyes 2003; Tribe 2000).

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**References**


