



A new species of *Hexacola* Foerster (Hymenoptera: Figitidae), parasitoid of *Lemnaphila neotropica* Lizarralde de Grosso (Diptera: Ephydriidae)

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Abstract

A new parasitoid wasp species, the eucoilinae *Hexacola lemnaphilae* Gaddi & Díaz, is described. Specimens were reared from pupae of *Lemnaphila neotropica* Lizarralde de Grosso (Diptera: Ephydriidae), a shore fly that mines least duckweed, *Lemna minuta* Kunth (Lemnaceae); the material examined was collected in Berisso (Buenos Aires, Argentina) and is housed in the collection of the División Entomología of the Museo de La Plata, Argentina. Photographs of diagnostic characters and data about the ecological and economic importance of these organisms are included.

Key words: *Hexacola lemnaphilae*, Eucoilinae, parasitoid wasp, miner fly, least duckweed, biological control

Resumen

Nueva especie del género *Hexacola* Foerster (Hymenoptera: Figitidae), parasitoide de *Lemnaphila neotropica* Lizarralde de Grosso (Diptera: Ephydriidae). Se describe una nueva especie de avispa parasitoide, el eucoilino *Hexacola lemnaphilae* Gaddi & Díaz. Los ejemplares fueron obtenidos de pupas de *Lemnaphila neotropica* Lizarralde de Grosso (Diptera: Ephydriidae), una mosca minadora en lentejita de agua *Lemna minuta* Kunth (Lemnaceae); el material examinado fue recolectado en Berisso (Buenos Aires, Argentina) y está depositado en la colección de la División Entomología del Museo de La Plata, Argentina. Se incluyen fotografías de caracteres diagnósticos e información acerca de la importancia ecológica y económica de estos organismos.

Palabras clave: *Hexacola lemnaphilae*, Eucoilinae, avispa parasitoide, díptero minador, lentejita de agua, control biológico

Introduction

The genus *Hexacola* was described by Foerster in 1869 and belongs to the Eucoilinae, the richest and the most diverse subfamily of Figitidae in the Neotropical Region (Díaz *et al.* 2008). This subfamily has 42 species belonging to 26 genera reported for Argentina (Díaz & Gallardo, in press). Eucoilines are all parasitoids of Diptera Muscomorpha (Buffington & Ronquist 2006; Ronquist *et al.* 2006). To date, all known species of *Hexacola* are parasitoids of Chloropidae and Ephydriidae (Diptera) (Quinlan 1978; Beardsley 1989).

Currently, 16 species of *Hexacola sensu* Diamond *et al.* (2002) and Fontal & Nieves-Aldrey (2004) are known. The genus is widespread, and is present in the Neotropical, Holarctic and Ethiopian regions, as well as Oceania. Díaz *et al.* (2008) mention four species of *Hexacola* in the Neotropics, all of them cited for Central America. In spite of this, the only Neotropical species reviewed after Weld (1952) was *Hexacola hexatoma* (Hartig) by Nordlander (1981). Taxonomic studies of *Hexacola* have been carried out by Foerster (1869), Kieffer (1907), Dalla Torre & Kieffer (1910), Weld (1952), Yoshimoto (1963), Yoshimoto & Yasumatsu (1965), Quinlan (1978), and Beardsley (1989). This genus has been included in the *Ganaspis* group (Nordlander 1982; Fontal-Cazalla *et al.* 2002; Buffington *et al.* 2007), at present recognized as Ganaspini in

Forshage & Nordlander (2008). Diversity studies made by Fergusson (1995) refer to the presence of several species of this genus in Costa Rica, while Fontal & Nieves-Aldrey (2004) cite it in Panama. In South America, Lizarralde de Grosso (1978) reports the genus in Argentina, but no species have been described there until now.

The objective of this work is to study specimens of *Hexacola* reared from pupae of *Lemnaphila neotropica* Lizarralde de Grosso (Diptera: Ephydriidae) collected in a patch of least duckweed, *Lemna minuta* Kunth (Lemnaceae) in Berisso, Buenos Aires, Argentina.

Lemna minuta is a freshwater perennial and floating plant; its high reproductive capacity and wide tolerance to different degrees of water eutrophication allow this plant to grow rapidly and cover extensive areas. Thus, not only producing a negative impact to local biota but also to man and its usage of freshwater (Center for Aquatic Plant Management 2004; Lynch 2004).

This plant is native to the Neotropical Region, and it is distributed all through temperate and tropical regions, from sea level to up to 4000 meters. In Argentina it is found in 19 provinces (Zuloaga *et al.* 2008). Its distribution is expanding also to other continents, and in many areas it is considered a noxious weed as stated in the Global Compendium of Weeds (Randall 2007). The Panel on Invasive Alien Species of the European and Mediterranean Plant Protection Organization (2004) stressed the great immediate risk that this plant represents in that continent.

Among the most environmentally friendly methods recommended or applied to control invasions or manage populations of *Lemna*, there are physical (Lynch 2004) and biological methods (Lankar & Krake 2002; Center for Aquatic Plant Management 2004). Little is it known about biological control by insects on this plant; most of the studies about insects (Hemiptera, Coleoptera, Lepidoptera, Diptera) that feed on *Lemna* species were done in USA by Center *et al.* (1999). According to these authors the real effects of these insects on their host are unknown or poorly measured, except for the aphids which can transmit plant viruses. The ecological and economic importance of *L. minuta* explain the relevance of these studies.

Material and methods

Five specimens (four females and one male) were studied. They are housed in the collection of the División Entomología of the Museo de La Plata (MLP), La Plata, Buenos Aires, Argentina.

The sampling was carried out in a lentic water body in Berisso (Buenos Aires Province, Argentina) by personnel of Instituto de Limnología “Dr. R. A. Ringuelet” (Berisso, Buenos Aires). Samples of the pleustonic carpet (*L. minuta* and *Azolla filiculoides* Lamarck, Azollaceae) were collected with a sieve, kept in a plastic container, and carried to the laboratory for examination under a dissection microscope. Miner larvae were only found in *L. minuta*, they were kept separated until the emergence of adult Diptera or their parasitoids. Some pupae were removed from the leaves and photographed. Diptera were identified by Dr. M. Lizarralde de Grosso (Instituto Fundación “Miguel Lillo”, San Miguel de Tucumán, Tucumán, Argentina).

The *Hexacola* specimens were not directly compared with type specimens of other described species of the genus. The species status was determined through reference to information in descriptions and keys (Kieffer 1907; Dalla Torre & Kieffer 1910; Weld 1952; Yoshimoto 1963; Yoshimoto & Yasumatsu 1965; Quinlan 1978; Beardsley 1989; Forshage & Nordlander 2008).

Descriptions of the parasitoids follow the terminology used by Weld (1952), Nordlander (1981, 1982), Fontal-Cazalla *et al.* (2002), and Forshage & Nordlander (2008). Total length (from head vertex to abdominal tip) is expressed in millimetres. The photographs were taken with a Scanning Electronic Microscope (JSM-6360 LM, MLP) (Figs. 1–6) and with a digital camera Sony Cyber-shot DSC-W55 adapted to a Leica binocular microscope (Figs. 7–9).

Results

Hexacola lemnaphilae Gaddi & Díaz sp. nov.

(Figs. 1–9)

Description. Female (Figs. 1–6). Total length 1.17 mm. Body scarcely setose; shiny yellowish brown; club flagellomeres, borders of mesosomal areas and posterolateral part of metasoma darker; mandibles, antennal flagellomeres 1–4, veins and legs yellowish.

Head (Figs. 1–3) in anterior view higher than wide. Antennae with 13 articles, flagellomere 1 straight, longer than 2 (2.5: 1.5); club consisting of seven flagellomeres, with rhinaria. Relative length and width of antennal articles 2.0(1.2): 1.2(1.2): 2.5(0.8): 1.5(0.8): 1.5(0.8): 1.5(0.8): 2.0(1.0): 2.0(1.0): 2.0(1.0): 2.0(1.2): 2.3(1.5): 2.3(1.5): 3.0(1.5). Toruli elevated anteriorly at their external side. Vertex and central area of face smooth, with few short setae. Malar sulcus present. Compound eyes small, convex, with few short setae. Genae flat. Occiput striate.

Mesosoma (Figs. 3–5) in lateral view scarcely longer than high. Pronotal plate smooth, anterior part faintly transversely striate, median bridge broad, lateral cavities open, posterior margin almost straight. Sides of pronotum smooth, highly setose behind genae, with a row of long setae on upper half of anterior margin. Mesoscutum smooth, convex in profile, in dorsal view as long as wide; anterior parallel lines faint; notauli absent, replaced by a row of long setae which turns anteriorly and continues laterally; suprategular furrows tenuous. Lateral bars reaching in length half of scutellum, broad at their base, dorsally smooth, external sides longitudinally striate. Scutellum and scutellar plate convex in lateral view. Proximal and mid surface of scutellum disk longitudinally striate, distal surface reticulate rugose, posterior margin rounded. Scutellar foveae as long as wide, smooth. Scutellar plate long and narrow, scarcely elevated above the disk, dorsal surface smooth with two setiferous punctures anterior of glandular release pit. Anterodorsal part of mesopleuron depressed; ventral part under mesopleural carina with faint striae; subalar pit absent. Metapleuron subrectangular, poorly sculptured; anteroventral cavity conspicuous and setose; hind margin distinct. Propodeum setose except on the carinae and area between them; propodeal carinae subparallel. Forewings apically rounded, completely hyaline, densely setose; marginal ciliation long; marginal cell open. Mid coxae with a small dorsolateral setose patch; hind coxae with a larger patch of setae posterodorsally.

Metasoma (Fig. 6) sessile. Setiferous ring on base of large tergite dense, broadly interrupted dorsally, with a weak row of long setae on each side posteriorly. Distally smooth.

Male (Figs. 7–9). Total length 1.26 mm. Similar to female except: antennae with 15 articles (Fig. 7), filiform, flagellomere 1 strongly curved, laterally flattened, distally swollen, longer than the following flagellomeres; flagellomere 2 straight and cylindrical, similar to the following flagellomeres. Flagellomeres 1–12 with rhinaria.

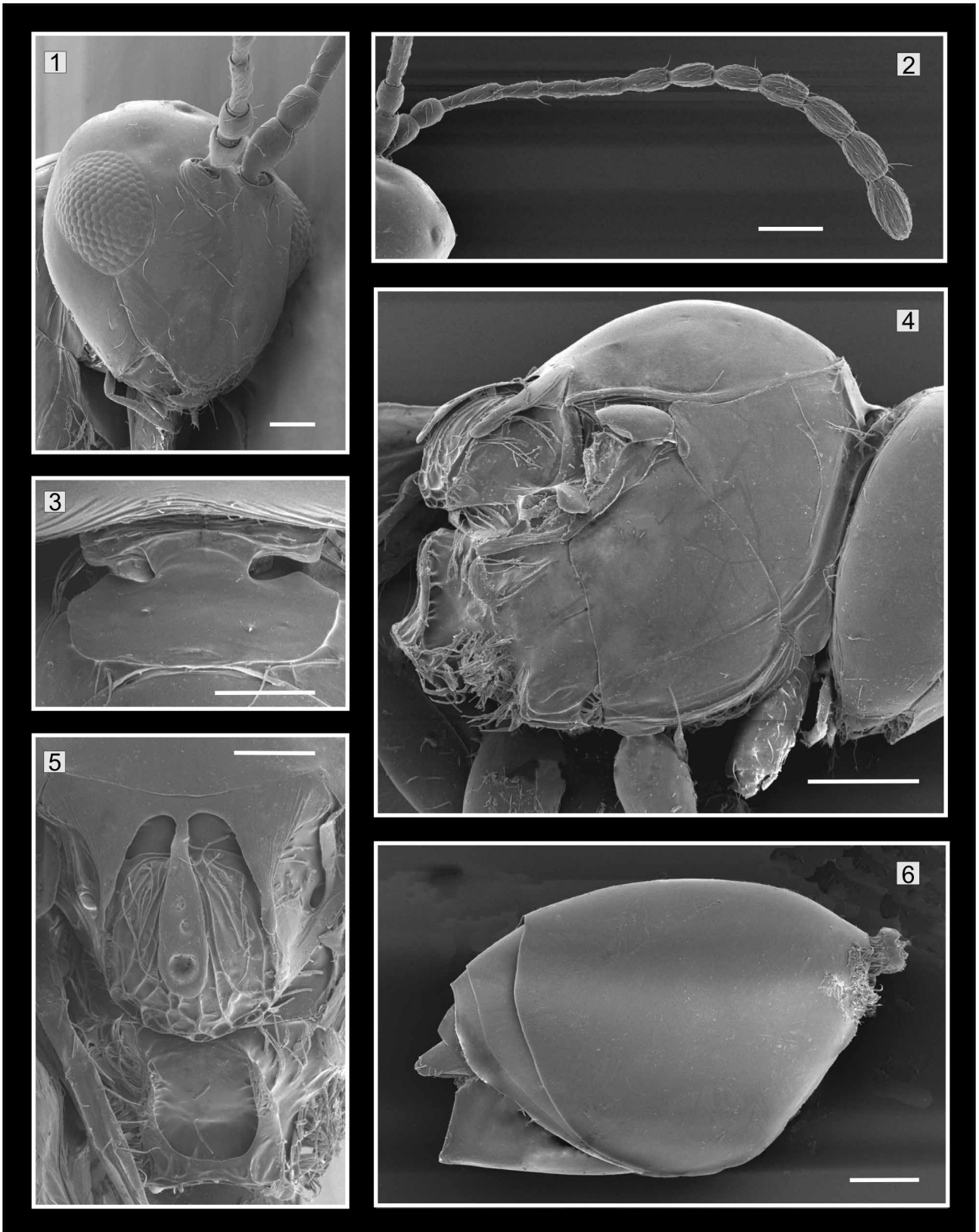
Etymology. In allusion to host species *Lemnaphila neotropica*.

Distribution. Argentina.

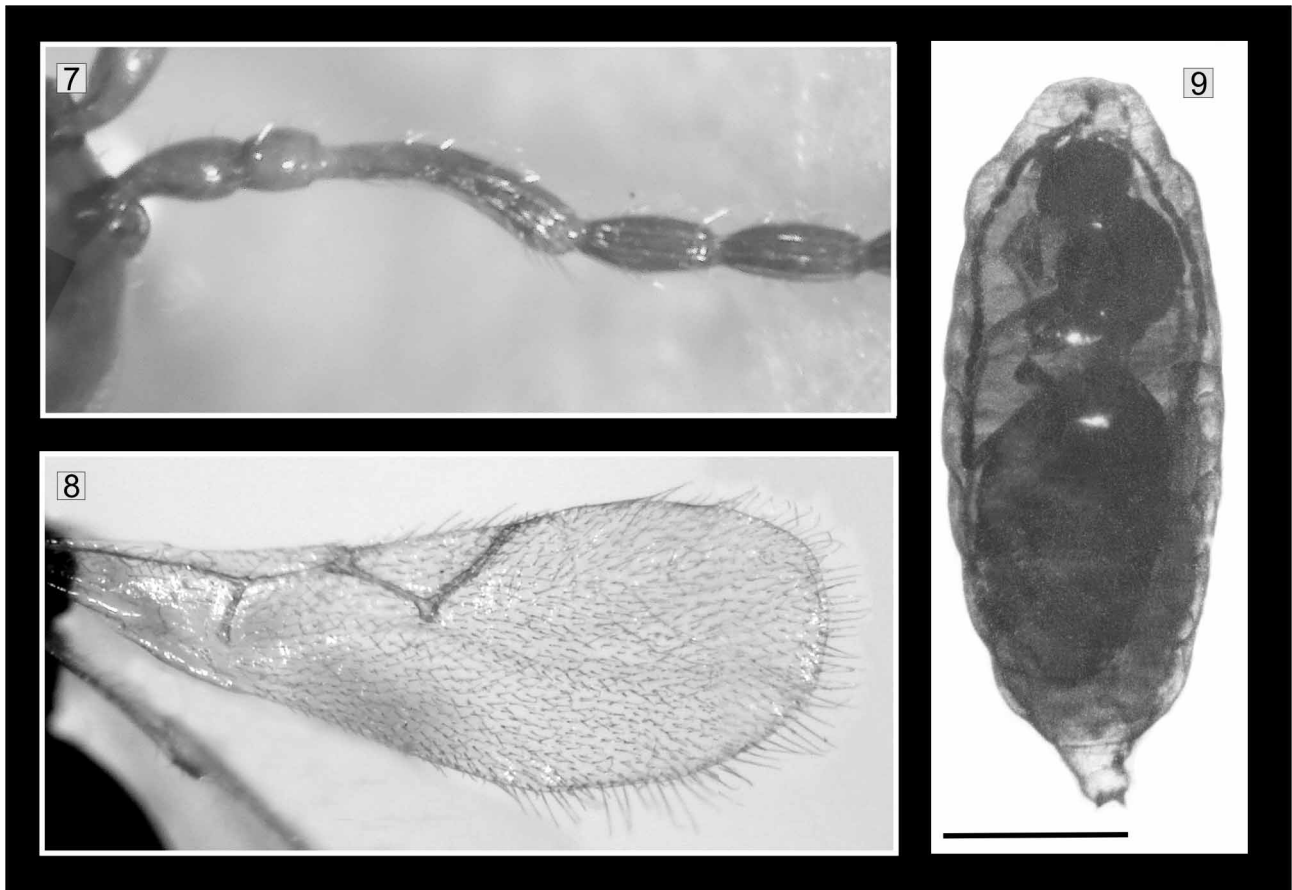
Type locality. Buenos Aires: Berisso.

Material examined. HOLOTYPE. 1 ♀, MLP 5282/1, ARGENTINA: Buenos Aires, Berisso, 4-vii-1970, obtained from puparium of *Lemnaphila neotropica* Lizarralde det. 1977, collected from a carpet of *Lemna minuta* (= *L. minima*) and *Azolla filiculoides*; Schnack col.; *Hexacola* Díaz det. (MLP). PARATYPES, 3 ♀♀, MLP 5282/3–5, and 1 ♂, MLP 5282/6, same data as Holotype.

Biological comments. *Hexacola lemnaphilae* Gaddi & Díaz sp. nov. was reared from pupae of *L. neotropica* (Fig. 9). Little is known about the biology of this fly, the adults hold a close relationship with the pleustonic carpet, and the larvae are leaf miners and pupate inside least duckweed *L. minuta* (Lizarralde de Grosso 1977, 1978).



FIGURES 1–6. *Hexacola lemnaphilae* Gaddi & Díaz **sp. nov.** Female: 1, head (in latero-frontal view) (270X); 2, antenna (140X); 3, occiput and pronotal plate (450X); 4, mesosoma (in lateral view) (200X); 5, scutellum and propodeum (in dorsal view) (270X); 6, metasoma (in lateral view) (150X). Scale bars = 50µm (figs. 1, 3, 5), 100µm (figs. 2, 4, 6).



FIGURES 7–9. *Hexacola lemnaphilae* Gaddi & Díaz **sp. nov.** Male: 7, antennae (160X); 8, forewing (100X); 9, male of *H. lemnaphilae* inside pupae of *Lemnaphila neotropica* (scale bar = 1mm).

Discussion

From the 16 species of *Hexacola* mentioned by Fontal & Nieves-Aldrey (2004), 11 are described while the rest are morphospecies currently under study.

As regards the comparison of original descriptions of *Hexacola* species, two morphologically different species groups can be distinguished. One of them is composed by *H. hexatoma*, *H. havanensis* (Kieffer), *H. fuscipes* (Kieffer), *H. cognata* Yoshimoto & Yasumatsu, *H. samuelsoni* Yoshimoto & Yasumatsu and *H. neocastellae* Beardsley. They all have the antennal club composed of six flagellomeres in the female. The second group is characterized by having seven flagellomeres in the female antennal club. It includes *H. antennata* Yoshimoto & Yasumatsu, *H. tahitiensis* Yoshimoto and *H. subaperta* (Kieffer). Members of both groups have the posterior margin of the pronotal plate almost straight or slightly emarginate, the dorsal surface of scutellum with longitudinal striation and the marginal cell open or partially open.

There are two species from eastern Asia, *H. quinaría* Yoshimoto & Yasumatsu and *H. octosegmenta* Yoshimoto & Yasumatsu, which cannot be considered part of any of the previously mentioned groups, as their antennal clubs consist of five and eight flagellomeres respectively, and the sculpture of the scutellum differs considerably from the species mentioned above. We conclude that it is doubtful that these species should be assigned to the genus *Hexacola*.

In those species where both sexes are known (*H. cognata*, *H. hexatoma*, *H. neocastellae*, *H. quinaría* and *H. samuelsoni*) the males and females are very similar morphologically except for the antennal dimorphism and the size of the body.

While Neotropical *Hexacola* species described up to now were cited for Central America and belong to the first species group, the new species *H. lemnaphilae* Gaddi & Díaz is the first described for the southern Neotropics, and it belongs to the second species group since its female antennal club consists of seven flagellomeres. This character, as well as the posterior margin of pronotal plate almost straight, proximal and mid surface of scutellum disk with longitudinal striation, distal surface reticulate-rugose, and marginal cell open, are diagnostic characters shared with *H. tahitiensis* from Tahiti in the Oriental region. Nevertheless both species differ in their antennal morphology.

The authors consider that the original descriptions of many *Hexacola* species are based on characters — such as the closure degree of the marginal cell and the number of enlarged articles forming the club of the female antennae—that were considered by Nordlander (1981) to be relatively plastic, and so bear little phylogenetic significance. Ultimately, a complete revision of the genus will be necessary to ascertain the true relationship of the other described species.

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