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Research article

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Four new species and new records of Platygastrinae (Hymenoptera: Platygastridae) from Iran

Maryam ASADI-FARFAR [1], Younes KARIMPOUR [2,*], Hossein LOTFALIZADEH [3] & Peter Neerup BUHL [4]

[1,2] Department of Plant Protection, Faculty of Agriculture, Urmia University, Urmia, Iran.
[3] Plant Protection Research Department, East Azarbaijan Agricultural and Natural Resources Research & Education Center, AREEO, Tabriz, Iran.
[4] Zoological Museum, Department of Entomology, University of Copenhagen, Universitet sparken 15, DK-2100 Copenhagen, Denmark.

[*] Corresponding author: y.karimpour@urmia.ac.ir
[1] Email: Asadi.ent.65@gmail.com
[3] Email: hlotfalizadeh@gmail.com
[4] Email: pnbuhl@hotmail.com

[1] urn:lsid:zoobank.org:author:C1A134C0-1861-4E7C-8C5B-18F57082EF9A
[2] urn:lsid:zoobank.org:author:E7B0992C-BBFA-444A-A694-D3F54FDA10B0
[3] urn:lsid:zoobank.org:author:D7C681F3-C2E3-4FC1-BC4A-B0A6160B56CC
[4] urn:lsid:zoobank.org:author:394066D3-5642-4CCE-857B-0972C4D92327

Abstract. The following four species new to science are described: *Platygaster azarbaijanica* Buhl & Asadi sp. nov., *Platygaster lotfalizadehi* Buhl & Asadi sp. nov., *Platygaster karimpouri* Asadi & Buhl sp. nov. and *Synopeas calecai* Buhl & Asadi sp. nov. Diagnostic characters are discussed, and figures are provided to distinguish the new species. In addition, ten species of Platygastrinae Howard, 1892 belonging to the genera *Platygaster* Latreille, 1809, *Synopeas* Förster, 1856 and *Leptacis* Förster, 1856 are reported as new records for the fauna of Iran. Four species of *Platygaster* and one species of *Synopeas* are recorded as 'confer'.

Keywords. New species, new records, *Platygaster*, *Synopeas*, *Leptacis*, fauna, Iran.

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Introduction

The superfamily Platygastroidea Haliday, 1833 is the third-largest group of hymenopteran parasitoids after Ichneumonoidea Latreille, 1802 and Chalcidoidea Latreille, 1817 (Austin *et al.* 2005). Platygastridae Haliday, 1833 is a taxonomically poorly known family of parasitoid wasps with a relatively uniform morphology. The majority of the species belonging to Platygastrinae Haliday, 1833 are included in the

type-genus *Platygaster* Latreille, 1809 and in the mega-genera *Synopeas* Förster, 1856 and *Leptacis* Förster, 1856. These genera contain koinobiont egg–larval or egg–pupal parasitoids of gall midges (Diptera: Cecidomyiidae) (Masner 1993; Ushakumari & Narendran 2007; Buhl 2011). There are also many species, such as *P. polonica* Buhl & Jałoszyński, 2016 and *P. erdösi* Szelényi, 1958, with much longer females (4–5 mm) (Szelényi 1958; Buhl & Jałoszyński 2016b).

The genus *Platygaster* consists of well over 600 described species worldwide, representing more than one-third of the subfamily Platygastrinae (Johnson 2019; Popovici *et al.* 2019). Most species of *Platygaster* are very similar from a morphological point of view, dark-colored and 1–2 mm long.

The genus *Synopeas* has a worldwide distribution and is represented by 376 species (Rajmohana & Divya 2011; Veenakumari *et al.* 2014, 2015; Johnson 2019). Species of *Synopeas* are shiny micro wasps (1–2 mm body length) with metasomal tergites I and II fused in both sexes (Buhl 1997; MacGown & Evans 2003 add to refs). Finally, species of *Leptacis* are smooth and shiny wasps with around 271 species known worldwide (Johnson 2019).

Platygastrids are taxonomically challenging insects and in many countries these tiny wasps have been largely neglected and are very poorly known (Buhl 2016). The Palearctic is the best-studied zoogeographical region, and Europe, Denmark and Fennoscandia with about 220 recorded species of Platygastrinae are the most studied part (Buhl 1999). Even though Iran is regarded as a unique biogeographic location in the Palearctic, its position makes it transitional between the Palearctic, Afrotropical and Oriental regions, little taxonomic work has been done on Iranian species. Only 11 species of the subfamily Platygastrinae have been reported in Iran (Ghahari & Buhl 2011). Lotfalizadeh (2018) and Asadi-Farfar *et al.* (2020a, 2020b) considered the family Platygastridae a poorly known group in Iran. Our recent collecting, especially from northwest Iran, led us to find some new records, as well as some new species. Therefore, the purpose of this paper is the description of four new species and ten new records for the Iranian fauna.

Material and methods

Studied wasps in this research were collected using Malaise traps, sweep nets and Berlese funnels from different localities of Iran: East Azarbaijan, West Azarbaijan, Fars and South Khorasan Provinces. Collected specimens were card mounted and labeled. Examination of the external morphology of dry-mounted specimens was done using an Olympus™ SZH. Morphological terminology and abbreviations follow that of Masner & Huggert (1989).

Abbreviations in descriptions:
A1–A10 = antennal segments 1–10
LOL = distance between lateral and anterior ocelli
OOL = distance between lateral ocellus and eye
POL = distance between posterior ocelli
T1–T6 = tergites 1–6

Photomicrographs were taken using a CanonTM EOS 700D (Canon Inc., Japan) camera mounted with an adapter on a HundTM stereo microscope. Photos of some holotypes were taken using a BK Lab System by Visionary Digital and also Zerene Stacker ver. 1.04 (Zerene Systems LLC, Richland, Washington, USA) for focus stacking and then optimized in Photoshop CS4. Specimens were deposited in the HMIM (Hayk Mirzayans Insect Museum, Iranian Research Institute of Plant Protection, Tehran, Iran).

Results

Class Insecta Linnaeus, 1758
Order Hymenoptera Linnaeus, 1758
Superfamily Platygastroidea Haliday, 1833
Family Platygastridae Haliday, 1833
Subfamily Platygastrinae Howard, 1892

Genus ***Platygaster*** Latreille, 1809

Type species

*Platygaster ruficorni*s (Latreille, 1805).

Distribution

Worldwide (Buhl 2004a, 2004b, 2006a, 2006b).

Biology

Parasitoids of Cecidomyiidae (Austin *et al.* 2005; Buhl 2006a, 2006b).

From eleven species of *Platygaster* discussed below, three are described as new and three are new records for Iran.

Platygaster azarbaijanica Buhl & Asadi sp. nov.
urn:lsid:zoobank.org:act:4182ECAC-DE6A-447C-A266-71082E32D380
Fig. 1

Diagnosis (female)

A9 about 1.7 times as long as wide; head 2.1 times as wide as long, mostly reticulate-coriaceous behind, with only a few short carinae; notauli indicated in about posterior half, meeting in a fine point; female metasoma about as long as rest of body, T2 striate to 0.5 of length, shorter medially.

Etymology

The name of the new species is derived from the name of the province where it was first found, East Azarbaijan.

Material examined

Holotype

IRAN • ♀; East Azarbaijan Province, Khosroshah; 37°58′ N, 46°02′ E; 1357 m a.s.l.; Aug. 2008; H. Lotfalizadeh leg.; Malaise trap; HMIM.

Paratype

IRAN• 1 ♀; East Azarbaijan Province, Payam, Misho Mountain; 38°21′ N, 45°46′ E; 1750 m a.s.l.; 4 Aug. 2017; M. Asadi-Farfar leg.; sweeping net; HMIM.

Description (female)

Body length. 1.2–1.3 mm.

Color. Black; antennae, mandibles, tegulae and legs including coxae medium brown; base and apex of fore tibiae, base of mid and hind tibiae, and segments 1–4 of all tarsi light brown.

Head. From above 2.1 times as wide as long, 1.2 times as wide as mesosoma; occiput rounded, finely reticulate-coriaceous, medially with weak transverse elements, anteromedially with a few weak transverse carinae not wider than ocellar area; vertex finely reticulate-coriaceous (not transversely so); frons smoothly fan-like reticulate out from a weak longitudinal midline. Eyes bare. OOL : POL : LOL = 3.5 : 6.5 : 3.0. Head in frontal view one and a third times as wide as high. Malar space slightly more than half as long as eye height (5.0 : 9.5). Antenna with A1 shorter than height of head (15 : 16), longer than

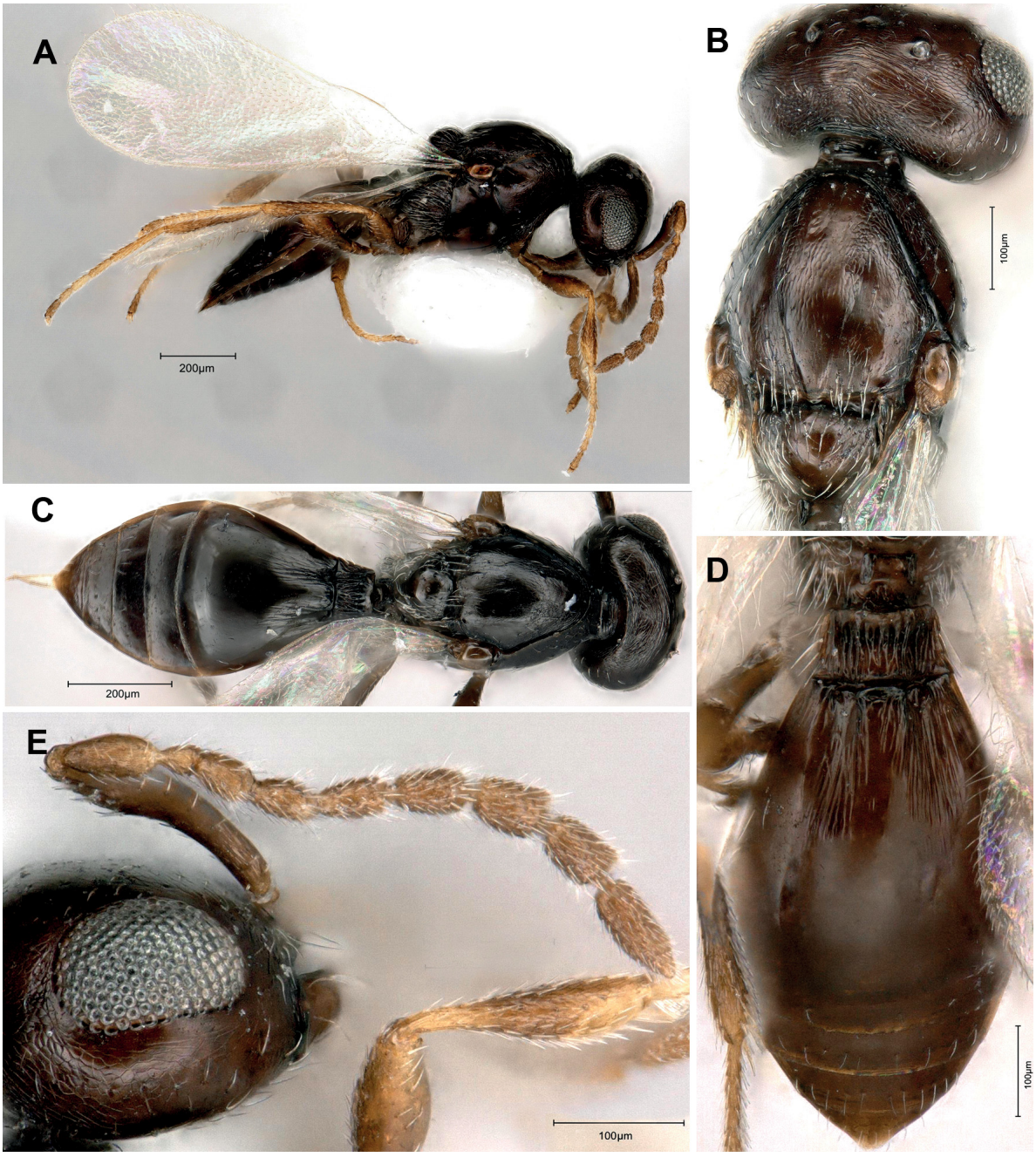

Fig. 1. *Platygaster azarbaijanica* Buhl & Asadi sp. nov., ♀; A, C, E = holotype (HMIM); B, D = paratype (HMIM). **A**. Habitus in lateral view. **B**. Head and mesonotum in dorsal view. **C**. Habitus in dorsal view. **D**. Metasoma in dorsal view. **E**. Head and antenna in lateral view. Scale bars: A, C =200 µm; B, D–E = 100 µm.

distance between inner orbits (15:14). Length:width of A1–A10 = 15.0:2.5; 4.0:1.9; 2.0:1.2; 2.5:1.7; 2.8:1.5; 3.5:1.9; 3.5:1.8; 3.4:2.0; 3.4:2.0; 4.5:1.9. Flagellar pubescence short.

Mesosoma. 1.45 times as long as wide, higher than wide (19:18). Sides of pronotum weakly reticulate, in lower half longitudinally so, smoother along narrow upper and hind margins. Mesoscutum with a few setae, most of them anterolaterally and along hind margin, weakly reticulate, smoother medially on lateral lobes and posterior 0.25; notauli distinct in about posterior half, then fade out, meeting in a fine point just touching base of scutellum; scuto-scutellar grooves narrowly triangular, each covered by about seven setae. Mesopleuron smooth. Scutellum evenly convex, smooth, anterolaterally slightly leathery, medially bare, towards margins dense setose. Metapleuron with pilosity all over, though not dense. Propodeal carinae short, parallel; area between them distinctly wider than long, smooth.

Wings. Fore wing 0.85 as long as entire body, 2.7 times as long as wide, surpassing tip of metasoma by a distance equal to 1.25 times combined length of T3–T6, clear, with fine and dense microtrichia; marginal cilia 0.08 width of wing. Hind wing 5.6 times as long as wide, with two hamuli; marginal cilia 0.3 width of wing.

Metasoma. As long as rest of body to very slightly longer (37:35), about 1.9 times as long as wide, 1.1 times as wide as mesosoma. Length:width of T1–T6 = 5.0:9.0; 20.0:19.7; 3.0:19.0; 3.5:17.0; 3.5:13.5; 4.0:8.5. T1 with about ten rather uniform, fine longitudinal carinae, with a transverse depression around midlength. T2 striate to half of its length, medially slightly shorter, rest of T2 as well as following tergites smooth, T6 with faint traces of reticulation. Apical tergites with setae in fine punctures: about four on T3, ten on each of T4 and T6, and 12 on T5.

Remarks

Similar to the species complex around *P. splendidula* Thomson, 1859, but with more slender antennae (A5 hardly transverse and A7–A9 each as wide as long in *P. splendidula*). As with *P. karimpouri* Asadi & Buhl sp. nov., *P. azarbaijanica* sp. nov. has slightly slender antennae than *P. pedasus* Walker, 1835, which, however, has head less transverse than *P. azarbaijanica* sp. nov. (about 1.7 × as broad as long in *P. pedasus* vs about 2.1 × as broad as long in *P. azarbaijanica* sp. nov.); T2 smooth medially (vs densely strigose in *P. pedasus*); and mid lobe between notauli not quite reaching scutellum (vs nearly complete in *P. pedasus*). *Platygaster azarbaijanica* sp. nov. has antennae slightly less slender than *P. ennius* Walker, 1835 (all funicular segments distinctly longer than wide in both species except relatively shorter A3 in *P. azarbaijanica* sp. nov.) which also has occiput transversely striate, nearly complete notauli, and T2 striate only in the basal third. *Platygaster azarbaijanica* sp. nov. also has the head slightly more transverse and mesoscutum slightly more sculptured than in the *splendidula* group; but antennae are distinctly slender than in this group.

Platygaster karimpouri Asadi & Buhl sp. nov.
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Fig. 2

Diagnosis (female)

A9 about 1.7 times as long as wide; head 1.7 times as wide as long, finely and densely striated behind; notauli indicated in about posterior half; female metasoma 1.1 times as long as rest of body, more than half of T2 striated at base, shorter medially.

Etymology

Named after Dr Younes Karimpour at the Department of Plant Protection, Urmia University, Iran.

Material examined

Holotype

IRAN • ♀; East Azarbaijan Province, Tasuj; 38°19′ N, 45°21′ E; 1500 m a.s.l.; 23–30 May 2015; H. Lotfalizadeh leg.; Malaise trap; HMIM.

Paratype

IRAN • 1 ♀; East Azarbaijan Province, Khosroshah; 37°58′ N, 46°02′ E; 1357 m a.s.l.; Aug. 2008; H. Lotfalizadeh leg.; Malaise trap; HMIM.

Description (female)

Body length. 1.2 mm.

Color. Black; metasoma towards apex with brownish tint; antennae, mandibles, tegulae, coxae and legs dark brown; A2–A5, trochanters, most of fore femora, entire fore tibiae, base of mid and hind tibiae, and all tarsi light brown.

Head. From above 1.7 times as wide as long, 1.15 times as wide as mesosoma; occiput rounded, finely but distinctly half-circularly striated all over; vertex smooth; frons with fine oblique striation on each side of a smooth midline. OOL : POL : LOL = 3.3 : 5.5 : 2.0. Eyes bare. Malar space about equal to half of eye height. Head in frontal view 1.2 times as wide as high. Antenna with A1 hardly noticeable, shorter than height of head (about 15.0 : 15.5), longer than distance between inner orbits (15 : 13). Length : width of A1–A10 = 15.0 : 2.3; 4.0 : 1.7; 1.4 : 1.0; 3.0 : 1.3; 2.8 : 1.3; 3.0 : 1.8; 3.2 : 2.0; 3.2 : 2.0; 3.2 : 1.9; 5.0 : 1.8. Flagellar pubescence hardly noticeable.

Mesosoma. 1.5 times as long as wide, hardly 1.1 times as high as wide. Sides of pronotum smooth except for sparse hair sockets in upper half and very weak rugosity in upper anterior corner. Mesoscutum with scattered hairs towards sides, bare on mid 0.4 of width, smooth, only slightly rugose at anterior ends of notauli, these weakly indicated in slightly more than posterior half; mid lobe broad, at hind margin slightly but distinctly prolonged, covering extreme base of scutellum; numerous greyish hairs cover rather narrow scuto-scutellar grooves. Mesopleuron smooth. Scutellum weakly and evenly convex, almost bare along the middle, towards sides moderately densely hairy, smooth except for hair sockets. Metapleuron with pilosity all over, though in anterior half very sparse, smooth. Propodeal carinae short, parallel; area between them smooth, much transverse.

Wings. Fore wing 0.75 as long as entire body, 2.4 times as long as wide, surpassing tip of metasoma by a distance equal to length of T6, clear, with fine and dense microtrichia; marginal cilia about 0.05 width of wing. Hind wing 5.0 times as long as wide, with two hamuli; marginal cilia very slightly more than 0.2 width of wing.

Metasoma. Around 1.1 times as long as rest of body, 2.1 times as long as wide, slightly wider than mesosoma (about 18 : 17). Length : width of T1–T6 = 5.0 : 8.5; 19.0 : 18.0; 3.5 : 17.0; 3.0 : 14.5; 3.0 : 11.0; 5.0 : 7.5. T1 with about six somewhat uneven, rather weak longitudinal carinae and a few even weaker additional ones, bare dorsally, along sides with a few inconspicuous hairs. T2 weakly striated from basal foveae to 0.65 of length of tergite, medially with four short striae to 0.15 of length, rest of tergite as well as following tergites smooth. T3–T6 with moderately strong punctures with inconspicuous hairs: about four on T3, 12 in a transverse row on each of T4–T5, slightly fewer and more scattered on T6.

Remarks

Very similar to *P. papei* Buhl, 2007 (from the United Arab Emirates) but with more slender antennae, more striate occiput and T2 (vs occiput finely and irregularly transversely striate in posterior half, rest

of occiput and vertex almost smooth except for fine and weak reticulation around ocelli in *P. papei*), and more distinct notauli (vs absent in *P. papei*). *Platygaster karimpouri* sp. nov. has slightly more slender antennae than *P. pedasus* Walker, 1835 which also has the occiput and T2 less striate, and mid lobe between notauli not quite reaching scutellum. *Platygaster karimpouri* sp. nov. has antennae slightly less slender than *P. ennius* Walker, 1835 which also has head 2.2 times as wide as long, nearly complete notauli, and T2 striate only in the basal third.

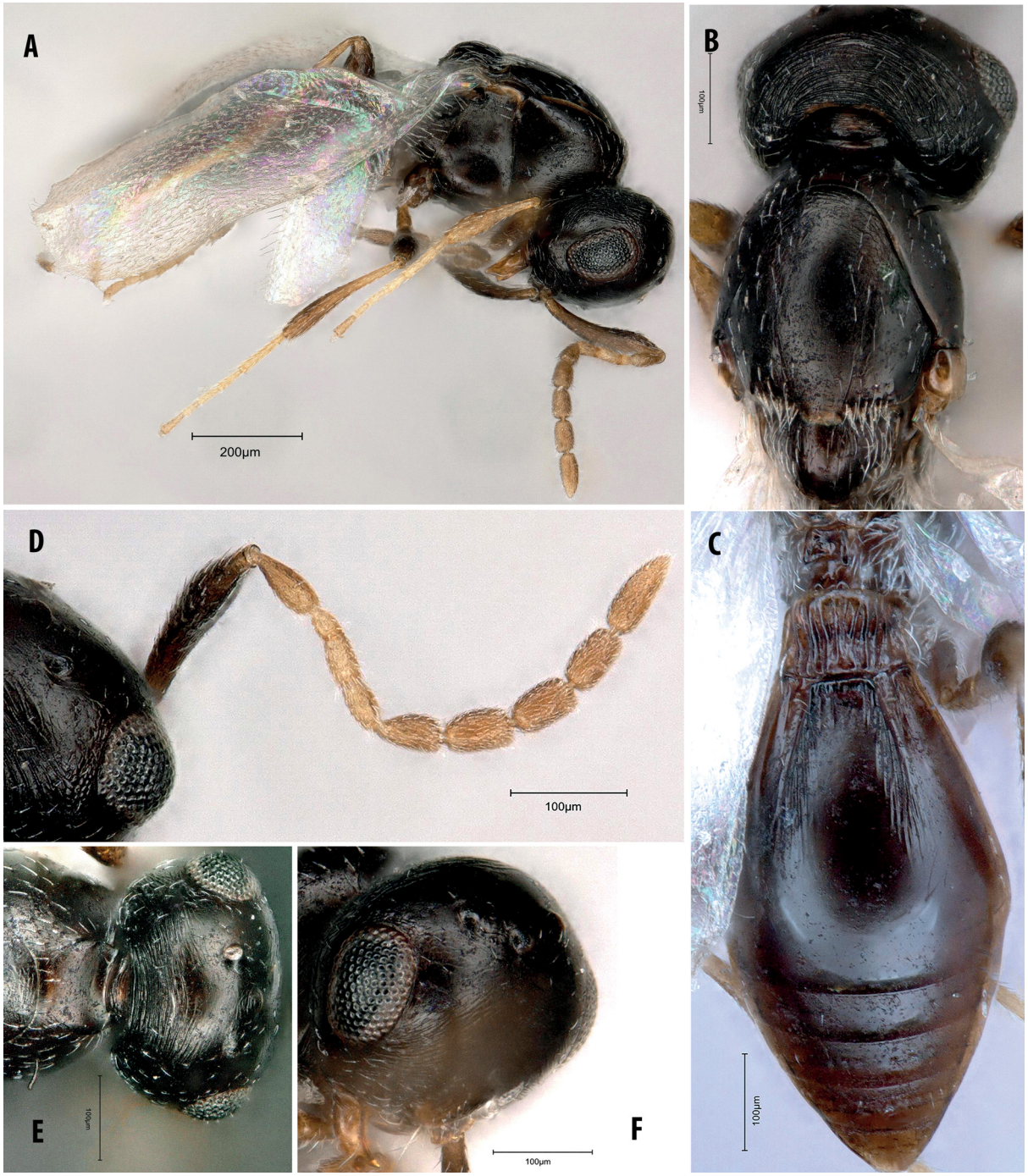

Fig. 2. *Platygaster karimpouri* Asadi & Buhl sp. nov., holotype, ♀ (HMIM). **A**. Habitus in lateral view. **B**. Head and mesonotum in dorsal view. **C**. Metasoma in dorsal view. **D**. Antenna. **E**. Head and pronotum in dorsal view. **F**. Head in latero-frontal view. Scale bars: A =200 µm; B–F = 100 µm.

Platygaster lotfalizadehi Buhl & Asadi sp. nov.
urn:lsid:zoobank.org:act:CDA154E6-C8A0-4CD5-91C0-624A11D51C8D
Fig. 3

Diagnosis (female)

A9 1.5 times as long as wide; occiput with oblique striation, medially almost longitudinal; notauli nearly complete; female metasoma 1.1 time as long as rest of body, T2 smooth except for very short carinae anteromedially; T6 finely pointed, very slightly wider than long.

Etymology

Name dedicated to Dr H. Lotfalizadeh (Iranian Research Institute of Plant Protection, Tabriz, Iran) for his overall contribution to the taxonomy of Hymenoptera, especially the superfamily Chalcidoidea in Iran. Most of the studied specimens in this study and type materials of new species were collected by him.

Material examined

Holotype
IRAN • ♀; East Azarbaijan Province, Tasuj; 38°19′ N, 45°21′ E; 1500 m a.s.l.; Jul. 2015; H. Lotfalizadeh leg.; Malaise trap; HMIM.

Paratype
IRAN • 1 ♀; same collection data as for holotype; HMIM.

Description (female)

Body length. 1.3–1.4 mm.

Color. Black; antennae, mandibles and legs including coxae dark brown; trochanters, tibiae and tarsi lighter brown.

Head. From above 1.9 times as wide as long, 1.15 times as wide as mesosoma; occiput rounded, behind eyes partially finely coriaceous, partially smooth, behind ocellar area with distinct oblique striation over whole length, medial striae almost longitudinal. Vertex smooth and laterally with traces of reticulation. Frons smooth, with a longitudinal midline from anterior ocellus, halfway to antennal insertions this impression fans out in numerous striae, this striate area becomes slightly wider than width of antennal insertions, merging with longitudinal reticulation on malar space. Eyes bare. OOL : POL : LOL = 2.5 : 8.0 : 3.0. Head in frontal view 1.3 times as wide as high. Antenna with A1 0.8 times as long as height of head, as long as distance between inner orbits. Length : width of A1–A10 = 14.0 : 2.0; 4.0 : 1.7; 1.1 : 1.2; 2.2 : 1.5; 2.4 : 1.8; 2.2 : 1.7; 2.8 : 1.8; 3.0 : 2.0; 3.0 : 2.0; 4.0 : 1.9. Flagellar pubescence hardly noticeable.

Mesosoma. 1.5 times as long as wide, higher than wide (20 : 19). Sides of pronotum smooth, with sparse setae, most numerous on anterior part. Mesoscutum with a row of setae along inner margins of notauli, and along outer and posterior margins of lateral lobes, otherwise bare; disc smooth except for weak rugosity at anterior ends of notauli, these strong and almost complete; mid lobe rather narrowly pointed, covering the extreme base of scutellum; scuto-scutellar grooves narrowly triangular, each of their front margins with six short setae. Mesopleuron smooth. Scutellum with very few setae, smooth, evenly convex. Metapleuron smooth, with very sparse pilosity except for a short white fringe along hind margin. Propodeal carinae short, parallel, dark; area between them smooth, distinctly wider than long.

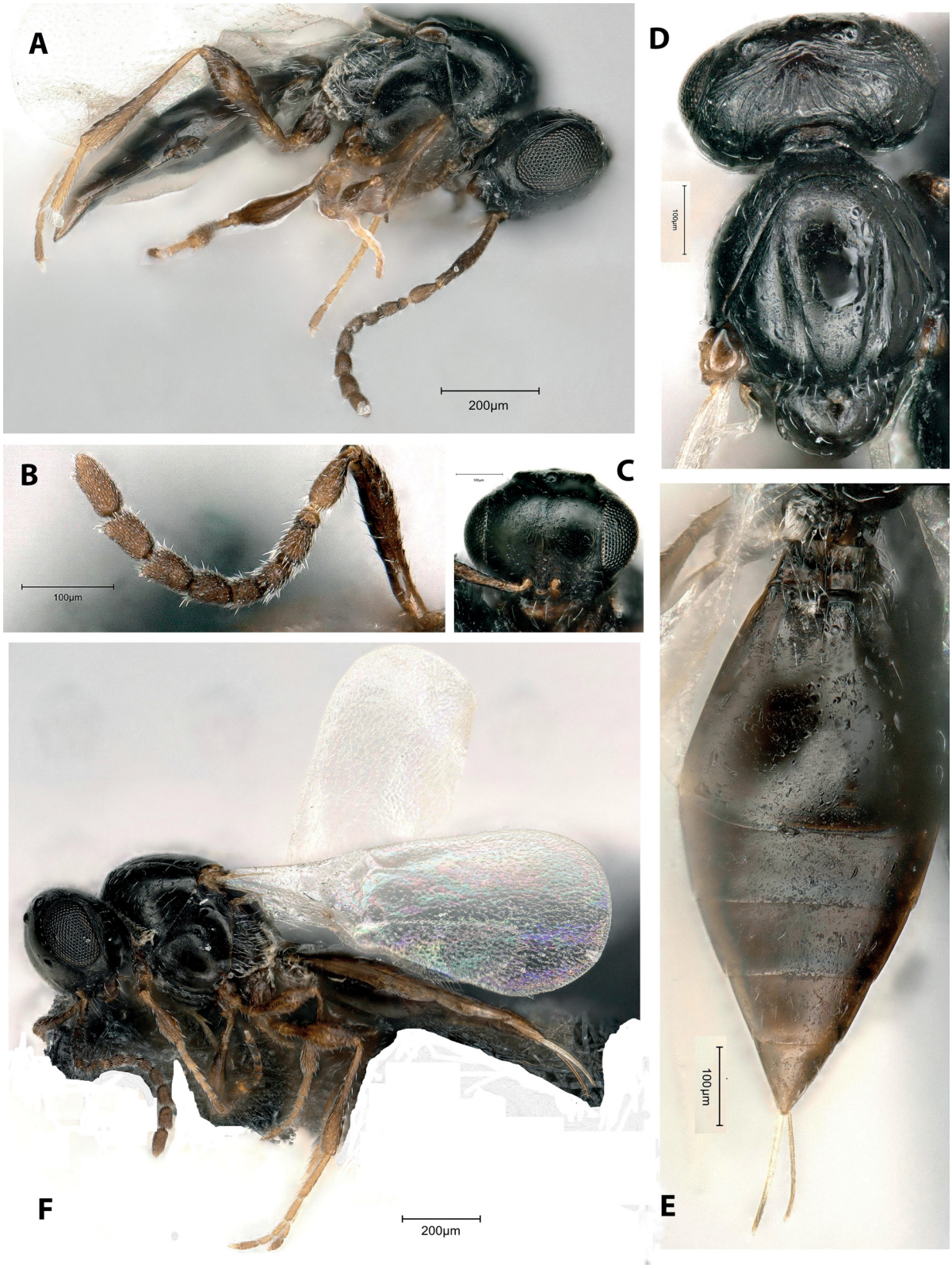

Fig. 3. *Platygaster lotfalizadehi* Buhl & Asadi sp. nov., ♀; A = holotype (HMIM); B–F = paratype (HMIM). **A**. Habitus in lateral view. **B**. Antenna. **C**. Head in frontal view. **D**. Head and mesonotum in dorsal view. **E**. Metasoma in dorsal view. **F**. Habitus in lateral view. Scale bars: A, F =200 µm; B–E = 100 µm.

Wings. Fore wing 0.75 times as long as entire body, 2.45 times as long as wide, reaching about apex of metasoma, clear, with dense, fine and pale microtrichia; marginal cilia very short. Hind wing 5.1 times as long as wide, with two hamuli; marginal cilia 0.2 width of wing.

Metasoma. About 1.1 times as long as rest of body, 2.1 times as long as wide, as wide as mesosoma. Length : width of T1–T6 = 5.0 : 10.0; 18.0 : 19.0; 4.0 : 18.0; 4.0 : 14.0; 5.0 : 10.0; 5.0 : 5.5. T1 with two strong longitudinal carinae, smooth between them. T2 with two smooth basal foveae reaching 0.4 lengths of tergite, between them with a couple of carinae reaching one-sixth length of tergite, this otherwise smooth. T3–T6 smooth, with a few inconspicuous setae in shallow punctures (only about four on T4, six on each of T5–T6), T6 finely pointed. Sternite 2 anteriorly flat, without prolongation.

Remarks

In general, body shape much as in *P. iberica* Buhl, 1999 (though this has metasoma somewhat longer) but occiput of *P. lotfalizadehi* sp. nov. characteristically striate, in this approaching *P. marginata* Thomson, 1859, but *P. lotfalizadehi* sp. nov. with distinctly more slender antennae.

Platygaster lotfalizadehi sp. nov. also has smoother mesoscutum and scutellum than *P. iberica*, and more setose scuto-scutellar grooves. *Platygaster lotfalizadehi* sp. nov. also has smoother mesoscutum, scutellum and T2 than *P. marginata*.

Platygaster arabica Buhl, 2007

Material examined

IRAN • 1 ♀; East Azarbaijan Province, Khajeh; 38°10′ N, 46°38′ E; 1450 m a.s.l.; 1 Jul. 2016; H. Lotfalizadeh leg.; Malaise trap; HMIM.

Distribution

United Arab Emirates (Buhl 2007); Iran (new record).

Host

Unknown

Platygaster breviscapa Buhl, 2009

Material examined

IRAN • 1 ♀; East Azarbaijan Province; Marand, Farfar Village; 38°48′ N, 45°68′ E; 1365 m a.s.l.; May 2017; M. Asadi leg.; sweep net; HMIM.

Distribution

Finland (Koponen *et al.* 2016); Croatia and England (Buhl 2009; Buhl *et al.* 2016); Iran (**new record**).

Host

Unknown.

Platygaster* cf. *dryope Walker, 1836

Material examined

IRAN • 2 ♀♀; East Azarbaijan Province, Khosroshah; 37°58′ N, 46°02′ E; 1357 m a.s.l.; 11 Jun. 2016; H. Lotfalizadeh leg.; Malaise trap; HMIM.

Distribution

Ireland, Isle of Man (Buhl *et al.* 2016); Fennoscandia and Denmark (Buhl 1999, 2006a); Finland (Koponen *et al.* 2016); Germany (Buhl *et al.* 2016); Iran.

Remarks

Our studied specimens are similar to *Platygaster dryope*, but can be distinguished from it by the following morphological characters: smooth body, short female antennae, non-pointed female metasoma.

Host

Unknown.

Platygaster* cf. *gladiator Zetterstedt, 1838

Material examined

IRAN • 1 ♀; East Azarbaijan Province, Kandovan, Arshadchaman; 37°46′ N, 46°15′ E; 2349 m a.s.l.; Jun. 2008; H. Lotfalizadeh leg.; Malaise trap; HMIM.

Distribution

Finland (Koponen *et al.* 2016); British Isles (Buhl & Notton 2009); Fennoscandia and Denmark (Buhl 1999, 2006a); Norway (Vlug 1995); Iran.

Host

Unknown.

Platygaster harteni Buhl, 2007

Material examined

IRAN • 1 ♂; South Khorasan Province, Birjand, vicinity of Mud; 32°11′ N, 59°53′ E; 1867 m a.s.l.; 31 Mar. 2017; H. Lotfalizadeh leg.; on *Haloxylon ammodendron* (C.A.Mey.) Bunge; HMIM • 1 ♀, 1 ♂; East Azarbaijan Province, Khosroshah; 37°58′ N, 46°02′ E; 1357 m a.s.l.; May 2009; H. Lotfalizadeh leg.; Malaise trap; HMIM.

Distribution

Holarctic region (Jordan/United Arab Emirate) (Buhl 2015); Iran (Fars Province, Khonj) (Buhl 2015).

Remark

One male specimen of *P. harteni* was obtained from *Stefaniola similata* Mamaev, 1972 (Diptera: Cecidomyiidae) on *Haloxylon ammodendron*, South Khorasan Province, 50 km of Birjand, Mud; *S. similata* represents a new host for *P. harteni*.

Host

Stefaniola similata Mamaev, 1972 (Diptera: Cecidomyiidae) on *H. ammodendron* is a new host record for *Platygaster harteni.*

Platygaster nisus Walker, 1836

Material examined

IRAN – **East Azarbaijan Province** • 2 ♀♀; Khosroshah; 37°58′ N, 46°02′ E; 1357 m a.s.l; Jul. 2008; H. Lotfalizadeh leg.; Malaise trap; HMIM • 1 ♂; Marand-Yam; 38°48′ N, 45°77′ E; 1334 m a.s.l.; Jul. 2007; H. Lotfalizadeh leg.; Malaise trap; HMIM • 1 ♀; Marand; 38°25′ N, 45°46′ E; 1023 m a.s.l.; Aug. 2007; H. Lotfalizadeh leg.; Malaise trap; HMIM.

Distribution

Common, distributed from Europe to the Korean Peninsula (Buhl & Choi 2006; Buhl & Jałoszyński 2016b); Canary Islands and Madeira (Buhl & Koponen 2003b); Poland (Buhl & Jałoszyński 2016a); Germany (Buhl *et al.* 2016); Iran (**new record**).

Host

Parasitoid of *Sitodiplosis mosellana* (Géhin, 1857) (Diptera: Cecidomyiidae) (Chavalle *et al.* 2018).

Platygaster* cf. *papei Buhl, 2007

Material examined

IRAN – **East Azarbaijan Province** • 1 ♀; Khosroshah; 37°58′ N, 46°02′ E; 1357 m a.s.l.; 10 Jul. 2007; H. Lotfalizadeh leg.; Malaise trap; HMIM • 1 ♀; Khajeh; 38°10′ N, 46°38′ E; 1450 m a.s.l.; 1 Jul. 2016; H. Lotfalizadeh leg.; Malaise trap; HMIM.

Distribution

United Arab Emirates (Tourenq *et al.* 2009); Iran.

Remarks

Our studied specimens are similar to *Platygaster papei*, but can be distinguished from it by the following morphological characters: occiput finely transversely striate; female A9 very slightly longer than wide; scutellum convex; metasoma short, with basal foveae very faintly striate to less than half of length.

Host

Unknown.

Platygaster* cf. *rugosiceps Buhl, 1994

Material examined

IRAN • 1 ♂; East Azarbaijan Province, Marand, Yam; 38°35′ N, 45°77′ E; 1365 m a.s.l.; 26 May 2017; M. Asadi leg.; sweep net; HMIM.

Distribution

Austria (male only) (Buhl 1994); Sweden (female described) (Buhl 1998); Spain (Buhl & Nieves-Adrey 2000); Finland (Buhl & Koponen 2003a); Fennoscandia and Denmark (Buhl 1999, 2006a); Korean Peninsula (Buhl & Choi 2006); Iran.

Key to species of Platygaster from Iran

1. Mesoscutum with notauli 2
– Mesoscutum without notauli 9

2. Notauli complete or almost complete 3
– Notauli incomplete 7

3. T2 hardly striate 4
– T2 striate 5

4. Occiput with oblique striation, medially almost longitudinal ..... ***Platygaster lotfalizadehi*** Buhl & Asadi sp. nov.
– Occiput without oblique striation ..... ***Platygaster breviscapa*** Buhl, 2009

5. Sternite 2 with a hump between hind coxae ..... ***Platygaster* cf. *gladiator*** Zetterstedt, 1838
– Sternite 2 without a hump between hind coxae 6

6. Frons smooth; sternite 1 and base of sternite 2 without dense greyish pubescence ..... ***Platygaster* cf. *dryope*** Walker, 1836
– Frons except upper lateral parts strongly transversely striate; first sternite and base of second sternite with dense greyish pubescence ..... ***Platygaster* cf. *rugosiceps*** Buhl, 1994

7. Notauli very short; T2 without striae ..... ***Platygaster nisus*** Walker, 1836
– Notauli indicated in about posterior half; T2 with striation 8

8. T1 with about ten rather uniform, fine longitudinal carinae, with a transverse depression around mid-length. T2 striate to 0.5 of length, medially slightly shorter ..... ***Platygaster azarbaijanica*** Buhl & Asadi sp. nov.
– T1 with about six somewhat uneven, rather weak longitudinal carinae and a few even weaker additional ones. T2 weakly striate from basal foveae to 0.65 length of tergite, medially with four short striae to 0.15 of length ..... ***Platygaster karimpouri*** Asadi & Buhl sp. nov.

9. Base of T2 covered with dense, silvery setae ..... ***Platygaster harteni*** Buhl, 2007
– Base of T2 without dense setae 10

10. T2 striate in basal fovea to hardly one-third of length ..... ***Platygaster arabica*** Buhl, 2007
– T2 very faintly striate in basal foveae to 0.4–0.5 of length ..... ***Platygaster* cf. *papei*** Buhl, 2007

Genus ***Synopeas*** Förster, 1856

Type species

Synopeas inermis Thomson, 1859.

Distribution

Worldwide (Rajmohana & Divya 2011; Veenakumari *et al.* 2014, 2015).

Biology

Parasitoids of Cecidomyiidae (Austin *et al.* 2005; Hernández Mahecha *et al.* 2018). From seven species of *Synopeas* discussed below, one is described as new and five are new records for Iran.

Synopeas calecai Buhl & Asadi sp. nov.
urn:lsid:zoobank.org:act:91FEB88D-4B82-4734-ADF5-C4F1A25816F2
Fig. 4

Diagnosis (female)

A9 1.5 times as long as wide; hyperoccipital carina weak; notauli indicated in posterior two-thirds; female metasoma 1.3 times as long as rest of body, 1.3 times as wide as high, T2 anteromedially swollen, here striate to 0.2 of length.

Etymology

Named after Dr Virgilio Caleca, University of Palermo, Italy.

Material examined

Holotype

IRAN • ♀; East Azarbaijan Province, Khajeh; 38°10′ N, 46°38′ E; 1450 m a.s.l.; 1 Jun. 2015; H. Lotfalizadeh leg., Malaise trap; HMIM.

Description (female)

Body length. 1.5 mm.

Color. Black; coxae hardly lighter; A1 and legs light brown, A2–A10 and tegulae dark brown.

Head. From above 1.8 times as wide as long, hardly 1.1 times as wide as mesosoma, very faintly reticulate-coriaceous, just behind ocellar area with a short, incomplete, weak hyperoccipital carina. OOL : POL : LOL = 2.0 : 8.0 : 3.5. OOL very slightly longer than longest diameter of lateral ocellus. Eyes bare. Head in frontal view 1.15 as wide as high. Antenna with A1 0.8 as long as height of head, longer than distance between inner orbits (15 : 14). Length : width of A1–A10 = 15.0 : 2.1; 4.7 : 1.3; 2.0 : 1.0; 4.0 : 1.0; 2.0 : 1.1; 2.2 : 1.5; 2.9 : 1.7; 3.0 : 2.0; 3.0 : 2.0; 4.8 : 2.0. Flagellar pubescence negligible.

Mesosoma. 1.4 times as long as wide, about as high as wide. Sides of pronotum reticulate-coriaceous (in lower half longitudinally so). Mesoscutum with very sparse, scattered setae, very finely and evenly reticulate-coriaceous; notauli faintly indicated in posterior two-thirds; mid lobe slightly prolonged, somewhat bluntly, to base of scutellum, dark and swollen here. Scuto-scutellar grooves wide, each with six strong, pale setae in anterior half. Mesopleuron smooth, with two strong longitudinal furrows and some weaker ones just below tegula. Scutellum smooth and bare on large medial area, finely coriaceous on anterior slope, along sides with dense white setae, posteriorly obliquely angled in lateral view, bluntly triangular in dorsal view. Metapleuron in anterior half smooth and bare, in posterior half with dense, white adpressed pilosity. Propodeal carinae low, dark, well separated, slightly diverging; area between them only slightly longer than its posterior width.

Wings. Much damaged in a unique specimen, but fore wing seems to be of average size (reaching at least base of T6), with whitish tint and without visible microtrichia or marginal cilia.

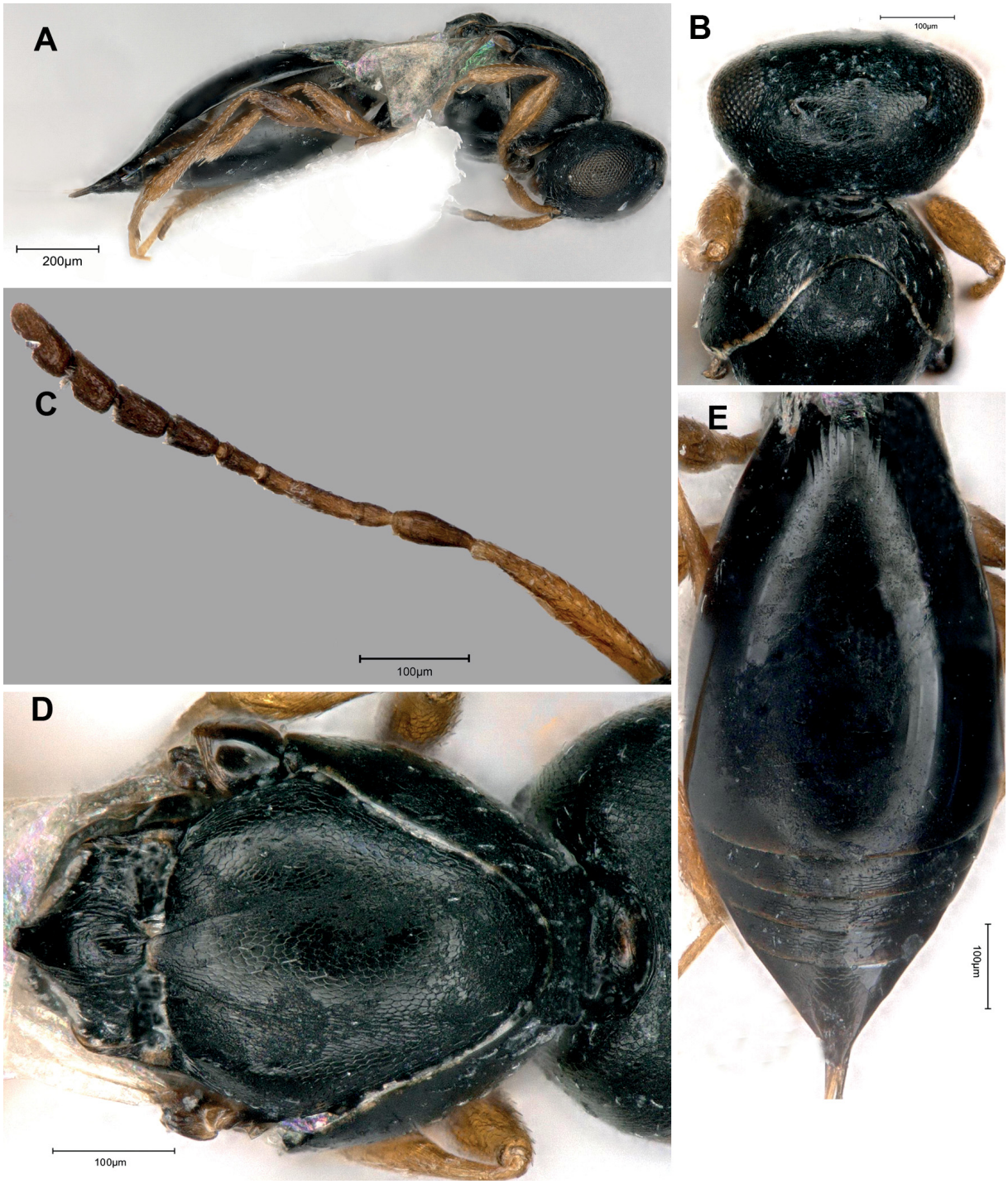

Fig. 4. *Synopeas calecai* Buhl & Asadi sp. nov., holotype, ♀ (HMIM). **A**. Habitus in lateral view. **B**. Head and pronotum in dorsal view. **C**. Antenna. **D**. Mesonotum in dorsal view. **E**. Metasoma in dorsal view. Scale bars: A =200 µm; B–E = 100 µm.

Metasoma. About 1.3 times as long as rest of body, 2.3 times as long as wide, 1.3 times as wide as high, very slightly wider than mesosoma. Length : width of T1–T6 = 4.0 : 9.0; 34.0 : 22.0; 3.0 : 20.5; 2.5 : 18.0; 3.0 : 15.0; 7.0 : 11.0. T1 with numerous fine longitudinal carinae, only laterally with pubescence. T2 anteromedially convex, here longitudinally striate to 0.2 of length, at each side with a longitudinal fovea of similar length, pubescent in basal half. T3–T5 each with a transverse stripe of weak reticulation and about ten inconspicuous setae. T6 with faint reticulation all over, with very few scattered setae.

Remarks

Similar to the hitherto differentiated species *S. latvianum* Buhl, 2009 in shape of the anterior part of T2, but *S. latvianum* has preapical antennal segments transverse (vs distinctly longer than wide in *S. calecai* sp. nov.), and lacks hyperoccipital carina and notauli.

Synopeas cryptus Buhl, 2004

Material examined

IRAN • 1 ♀; East Azarbaijan Province, Marand, Farfar Village; 38°48′ N, 45°68′ E; 1365 m a.s.l.; 5 Jun. 2017; M. Asadi leg.; sweeping net; HMIM.

Distribution

Mongolia (Buhl 2004c); Finland (Koponen *et al.* 2016); Iran (**new record**).

Host

Unknown.

Synopeas euryale (Walker, 1835)

Material examined

IRAN • 1 ♀; East Azarbaijan Province, Khosroshah; 36°58′ N, 46°02′ E; 6 Jun. 2016; M. Asadi leg.; Malaise trap; HMIM • 1 ♂, 1 ♀; West Azarbaijan Province, Urmia University Campus; 37°39′ N, 44°58′ E; 1335 m a.s.l.; Jun. 2016; M. Asadi leg.; Malaise trap; HMIM.

Distribution

Palearctic (West Europe and Mongolia) (Buhl 2004c); Finland (Koponen *et al.* 2016); Germany (Buhl *et al.* 2016); Korean peninsula (Buhl & Choi 2006); Iran (**new record**).

Host

Unknown.

Synopeas inerme Thomson, 1859

Material examined

IRAN – **East Azarbaijan Province** • 21 ♀♀; Khosroshah; 37°58′ N, 46°02′ E; 1357 m a.s.l.; 14 Jun. 2008, Aug. 2008, May 2009, Aug. 2009, 25 Dec. 2009; H. Lotfalizadeh leg.; pan trap; HMIM • 1 ♀; Marand, Yam; 38°48′ N, 45°77′ E; 1810 m a.s.l.; 7 Jul. 2009; H. Lotfalizadeh leg.; Malaise trap; HMIM • 1 ♀; Tasuj; 38°19′ N, 45°21′ E; 1500 m a.s.l.; 23 May 2015; H. Lotfalizadeh leg.; Malaise trap; HMIM. – **West Azarbaijan Province** • 3 ♀♀; Urmia University Campus; 37°39′ N, 44°58′ E;1335 m a.s.l.;

11 Oct. 2016; M. Asadi leg.; Malaise trap; HMIM. – **Fars Province** • 1 ♀; Dasht-e Arzhan; 51°58′ N, 29°38′ E; 2020 m a.s.l.; 30 May 2015; H. Lotfalizadeh leg.; Berlese funnels; HMIM.

Distribution

Ireland (Buhl & O'Connor 2010); England (Buhl & Notton 2009); Fennoscandia and Denmark (Buhl 1999); Iran (**new record**).

Host

Parasitoids of the gall midge *Contarinia medicaginis* Kieffer, 1890 (Diptera: Cecidomyiidae) on lucerne (Vlug 1995; O'Connor & Buhl 2016).

Synopeas* cf. *lugubre Thomson, 1859

Material examined

IRAN • 1 ♀; East Azarbaijan Province, Tikmadash; 37°72′ N, 46°93′ E; 1900 m a.s.l.; 1 Sep. 2015; H. Lotfalizadeh leg.; sweeping net; HMIM.

Distribution

Moderately common in Northwestern Europe (Buhl & Jałoszyński 2016); Germany (Buhl *et al.* 2016); Iran.

Host

Dasyneura brassicae (Winnertz, 1853) (Dip.: Cecidomyiidae) on *Brassica* sp. may be a host (Vlug 1995; O'Connor & Buhl 2016).

Remarks

Our studied specimens are similar to *S. lugubre* but with having the following morphological character can be separated from it: larger, with lighter body appendages, stronger hind lamella on scutellum.

Synopeas pinnei Buhl, 2009

Material examined

IRAN – **East Azarbaijan Province** • 11 ♀♀; Khosroshah; 37°58′ N, 46°02′ E; 1357 m a.s.l.; Jun.– Aug. 2008, 25 Oct. 2009, 16–29 May 2009, 10 Oct. 2007; H. Lotfalizadeh leg.; Malaise trap; HMIM • 1 ♀; Tasuj; 38°19′ N, 45°21 E; 1500 m a.s.l.; 1 Jul. 2015; H. Lotfalizadeh leg.; Malaise trap; HMIM • 5 ♀♀; Maragheh; 37°22′ N, 46°32′ E; 1887 m a.s.l.; Jul. 2010; H. Lotfalizadeh leg.; Malaise trap; HMIM.

Distribution

Latvia (Buhl 2016); Germany (Buhl *et al.* 2016); Iran (**new record**).

Host

Unknown.

Synopeas rhanis Walker, 1836

Material examined

IRAN • 1 ♀; East Azarbaijan Province, Maragheh; 37°22′ N, 46°32′ E; 1887 m a.s.l.; Oct. 2010; H. Lotfalizadeh leg.; Malaise trap; HMIM.

Distribution

England, Ireland (Buhl & Notton 2009); Latvian (Buhl 2016); Korea (Buhl & Choi 2006); Iran (**new record**).

Host

A parasitoid of the gall midges (Dipera: Cecidomyiidae) *Dasineura ulmaria* (Bremi, 1847) on Meadow sweet *Filipendula ulmaria* (L.) Maxim. and *D. urticae* (Perris, 1840) on nettles *Urtica dioica* L. and *U. urens* L. (Vlug 1995).

Key to species of Synopeas found in the northwest of Iran

1. Notauli present (Fig. 4)..... ***Synopeas calecai*** Buhl & Asadi sp. nov.
– Notauli entirely absent 2

2. Occiput with complete carina 3
– Occipital carina incomplete or absent 4

3. Occipital carina strong and complete; scutellum posteriorly with a semitransparent lamella .....
.....***Synopeas lugubre*** Thomson, 1859
– Occipital carina complete; scutellum not as above .....***Synopeas pinnei*** Buhl, 2009

4. Occiput rounded without carina .....***Synopeas cryptus*** Buhl, 2004
– Head with a weak occipital carina 5

5. Mid lobe of mesoscutum clearly situated above level of base of scutellum (a leveled gap present); frons finely coriaceous with some transverse wrinkles above antennae .....***Synopeas rhanis*** Walker, 1836
– Scutellar line continuous with line of mesoscutum (no leveled gap present); frons finely coriaceous 6

6. Scutellum in lateral view slightly sloping downwards to strongly curved propodeal carinae; metasoma as long as head and mesosoma combined .....***Synopeas euryale*** (Walker, 1835)
– Scutellum in lateral view much sloping downwards to a small keel just above the slightly curved propodeal carinae; metasoma shorter than head and mesosoma combined .....
.....***Synopeas inerme*** Thomson, 1859

Genus ***Leptacis*** Förster, 1856

Distribution

Worldwide (Buhl 2011). The two species of *Leptacis* discussed below are both new records for Iran.

Leptacis vlugi Buhl, 1997

Material examined

IRAN • 1 ♀; East Azarbaijan Province, Marand, Farfar Village; 38°48′ N, 45°68′ E; 1365 m a.s.l.; 30 May 2017; M. Asadi leg.; sweep net; HMIM.

Distribution

Norway (Buhl 1997); England and Scandinavia (Buhl 1998); Fennoscandia and Denmark (Buhl 1999); Canary Islands and Madeira (Buhl & Koponen 2003b); Finland (Buhl 2005); Ireland (Buhl & O'Connor 2010); England (Buhl & Notton 2009); Germany (Buhl *et al.* 2016); Iran (**new record**).

Host

Unknown.

Leptacis ozines (Walker, 1835)

Material examined

IRAN • 1 ♀; East Azarbaijan Province, Khosroshah; 36°58′ N, 46°02′ E; Jun. 2008; H. Lotfalizadeh leg.; Malaise trap; HMIM.

Distribution

Fennoscandia and Denmark (Buhl 1999); Canary Islands and Madeira (Buhl & Koponen 2003b); Ireland (Buhl & O'Connor 2010); Korean peninsula (Buhl & Choi 2006); England (Buhl & Notton 2009); Germany (Buhl *et al.* 2016); Iran (**new record**).

Host

Unknown.

Discussion

In neighboring countries of Iran, very limited studies have been conducted on the fauna of the family of Platygastridae, despite their important role as biological control agents in various ecosystems. Most studies have been conducted in the former Soviet Union (Kozlov 1971, 1974, 1977, 1978, 1989; Proshchalykin 2012; Timokhov 2019a, 2019b). More recently, Timokhov (2019a) has reported new data on distributions of nine species of platygastrid wasps in the fauna of Russia. Of them, *Leptacis laodice* (Walker, 1836) is recorded in the fauna of Russia for the first time. Also, three platygastrid species are reported as new for the fauna of Georgia, *Acerotella boter* (Walker, 1838), *Amblyaspis aliena* (Nees, 1834) and *A. nodicornis* (Nees, 1834). In other neighboring countries, *Baryconus graeffei* (Kieffer, 1908) has been reported from Turkey (Popovici *et al.* 2013). Some species of Platygastroidea were reported by Kononova & Kozlov (2008) from Turkey. Three species of *Scelio* Latreille, 1805 (Hymenoptera: Platygastroidea: Scelionidae) (Polaszek *et al.* 2019) and *Platygaster oebalus* Walker, 1835 (Hymenoptera: Platygastridae) (Kareem *et al.* 2020) have been reported from Iraq. A new genus and species of platygastrid flies, namely *Psix abnormis* Kozlov & Le, 1976, were described from Afghanistan (Kozlov & Le 1976). *Odontacolus harteni* Valerio, Masner & Austin, 2010 (Hymenoptera: Platygastridae) has been reared from an unknown spider egg sac from Pakistan (Valerio *et al.* 2010). The study of platygastrid wasps in Iran is in the early stages of development and relatively good results have been obtained from these studies. Hitherto only five species of *Platygaster* have been reported from Iran (Ghahari & Buhl 2011): *Platygaster demades* (Walker, 1836) and *Platygaster laticeps* Thomson, 1859 from Arasbaran Forest; *Platygaster oebalus* Walker, 1835 from East Azarbaijan, Guilan and West

Azarbaijan Provinces; *Platygaster oleae* Szelenyi, 1940 from Mazandaran Province; and *Platygaster pelias* (Walker, 1836) from East Azarbaijan, Golestan and Isfahan Provinces. With three new species and three new records, this paper raises the number of *Platygaster* species from Iran proper to eleven. Only one species of the large cosmopolitan genus *Synopeas* has been reported from Iran: *Synopeas tarsa* (Walker, 1835), from Hormozgan Province (Ebrahimi 2008). In this research, we included one new species and five new records; therefore, the number of Iranian species of *Synopeas* is raised to seven. Also, in the present study a number of species are recorded as 'confer'. More samples are needed to identify them more accurately. Since Iran is very rich in terms of plant, animal, climatic and topographic diversity, it is expected that the number of species of this family will be increased by conducting further studies.

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