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Research article

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Three new species and two new records of the genus *Cotesia* Cameron (Hymenoptera: Braconidae) from Iran

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Abstract. The present study is based on the genus *Cotesia* Cameron, 1891 collected from Khuzestan Province in the Southwestern part of Iran during 2016–2017. Nine species (+200 specimens) of the genus *Cotesia* were collected and identified. We recognised three new species, which we describe and illustrate here: *Cotesia elongata* Zargar & Gupta sp. nov., *C. khuzestanensis* Zargar & Gupta sp. nov. and *C. zagrosensis* Zargar & Gupta sp. nov. Two species are recorded for the first time from Iran: *Cotesia cynthiae* (Nixon, 1974) and *C. glabrata* (Telenga, 1955). A faunistic list with species distribution in Iran, a modified key to include the new species and brief diagnoses for the new records from Iran are provided.

Keywords. *Cotesia*, Khuzestan, faunistic list, modified key.

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Introduction

Braconidae Nees, 1811 is the second largest family of Hymenoptera Linnaeus, 1758, and the subfamily Microgasterinae Förster, 1862 is known with over 2710 described species worldwide (Yu *et al.* 2016).

Microgastrinae is one of the largest groups of parasitoids in terms of both species richness and economic importance (Rodriguez *et al.* 2013). The genus *Cotesia* Cameron, 1891 (Hymenoptera: Braconidae), with 296 described species worldwide, is one of the largest genera of parasitoid wasps in the megadiverse subfamily Microgastrinae (Yu *et al.* 2016). The actual diversity of *Cotesia* has been estimated from 1500 (Mason 1981) to 2500 species around the world (van Achterberg & Polaszek 1996). The genus *Cotesia* was erected by Cameron (1891), but was later synonymized with *Apanteles* Szépligeti, 1904 (Szépligeti 1904) until the generic reclassification of the Microgastrinae by Mason (1981).

Microgastrine genera are either solitary or gregarious endoparasitoids. Small broods with two or three individuals are known in a few cases, e.g., *C. astrarches* (Marshall, 1889) with 3–6 individuals in the host *Aricia* Reichenbach, 1817 (Lepidoptera Linnaeus, 1758: Lycaenidae Leach, 1815) (Shaw 2012; Quicke 2015). Gupta *et al.* (2016a) used the gregarious species of the genus *Glyptapanteles* Ashmead, 1904 to generate accurate boundaries between species/species-groups using an integrated approach with three different sets of data (morphology, host records and mitochondrial cytochrome c oxidase subunit I (COI) nucleotide sequences). Gupta & Fernández-Triana (2014) and Fernández-Triana *et al.* (2014) recorded many gregarious and solitary hosts associated with *Cotesia* from the Oriental and Neotropical regions, respectively. Species of this genus are selected regularly as biological control agents. *Cotesia flavipes* Cameron, 1891 and other closely allied species, such as *C. chilonis* (Munakata, 1912), *C. sesamiae* (Cameron, 1906) and *C. nonagriae* (Olliff, 1893), attack a wide range of sugarcane pests, such as *Chilo partellus* (Swinhoe, 1885) and *C. sacchariphagus* (Bojer, 1856) (Lepidoptera: Crambidae Latreille, 1810) (Quicke 2015). Several species of *Cotesia* have also been applied as model organisms in physiology, ecology and population genetics studies (Michel-Salzat & Whitfield 2004).

Despite the immense species diversity of the genus, the members tend to appear relatively uniform morphologically. *Cotesia* can be identified by the shape of the first and second tergites and propodeum sculpture. The first tergite never narrows apically, is a little longer than wide and broadens apically, but sometimes is wider than long; the width of the second tergite is 1.5 times the apical width of the first tergite or less. The propodeum is rugose and never has an areola, usually with a median longitudinal carina that sometimes becomes partly obscured by rugosity. Until now, only two species, *Cotesia pistrinariae* (Wilkinson, 1929) and *Cotesia trabalae* Gupta, 2016, across the globe are known to have a strongly narrowing first tergite at midlength (Gupta *et al.* 2016b).

The faunal studies on the subfamily Microgastrinae are gaining importance in Iran (Farahani *et al.* 2014, 2016; Gadallah *et al.* 2015; Ghafouri Moghaddam *et al.* 2018; Abdoli *et al.* 2019a, 2019b; Zargar *et al.* 2019a, 2019b). To date, 34 species of the genus *Cotesia* have been reported from Iran (Farahani *et al.* 2016; Samin *et al.* 2018). Considering the species richness and poor number of known species from Iran, detailed taxonomic and faunistic studies on this subfamily are essentially warranted. In the present study on the Microgastrinae fauna of the Khuzestan Province, three new species and two new distributional records are presented along with an updated faunistic list from Iran.

Material and methods

The specimens were collected from different areas of the Khuzestan Province during 2016–2017 using Malaise traps. Khuzestan Province includes mountainous areas located in the north, with plains and sea-level areas in the south. The vegetation of Khuzestan is diverse from oak forests dominated by *Quercus brantii* Lindley, 1840 (Fagales Engler, 1892: Fagaceae Dumort, 1829) in the highlands to marshy lands in the low elevation areas. The specimens were fortnightly removed from the collecting bottle and preserved in 70% alcohol. For mounting on card, the wasps were transferred into 70%, 90%, and 100% alcohol, 20 minutes each for dehydration, respectively. Later, the wasps were placed on the filter paper for drying and finally were card mounted and eventually labelled. Further, the specimens were incubated in 50±5°C for two hours for complete dehydration. The specimens used in the present

study are deposited in the collections of TMUC or ICAR-NBAIR. Photos of the species were taken with a Leica M 205 A stereo microscope with Leica DC 420 inbuilt camera using automontage software (ver. 3.8). Terminology and measurement follows Nixon (1965) and Mason (1981), vein terminology follows van Achterberg (1993). Nixon (1974) and Papp (1986, 1987) were consulted for identification.

Abbreviations:

FLn_{l/w} = ratio of length of flagellomere segment to width
MOD = median ocellar diameter
OOL = ocellar-ocellar line
POL = postocellar line
TI, TII, TIII = first, second and third tergite, respectively

Repositories:

ICAR-NBAIR = National Insect Museum, ICAR-National Bureau of Agricultural Insect Resources, Bengaluru, India
TMUC = Department of Entomology, Tarbiat Modares University, Tehran, Iran

Results

New species

Class Insecta Linnaeus, 1758
Order Hymenoptera Linnaeus, 1758
Superfamily Ichneumonoidea Latreille, 1802
Family Braconidae Nees, 1811
Subfamily Microgastrinae Förster, 1862
Tribe Cotesiini Mason, 1981

Cotesia Cameron, 1891

Cotesia Cameron, 1891: 182–194 (type species: *Cotesia flavipes* (Cameron, 1891)).

Cotesia elongata Zargar & Gupta sp. nov.

[urn:lsid:zoobank.org:act:79D3997B-4118-42F3-A579-2E1B75BB4FE7](https://zoobank.org/urn:lsid:zoobank.org:act:79D3997B-4118-42F3-A579-2E1B75BB4FE7)

Fig. 1

Diagnosis

Penultimate segment of antenna $2.2\times$ as long as wide; mesoscutum densely evenly punctate, in lateral lobes presence of smooth area near tegula; notauli indicated by dense punctations; scutellum sparsely punctate in anterior half, punctation dense in posterior half (Fig. 1C); pterostigma $4.0\times$ as long as wide, light brown; vein 1–R1 $1.4\times$ as long as pterostigma, $3.0\times$ as long as distance from end of vein 1–R1 to tip of radial cell (Fig. 1D); third tergite median length $0.7\times$ as long as second tergite (Fig. 1E).

Etymology

The name is derived from the Latin ‘*elongata*’, meaning ‘elongate’, and referring to the second metasomal tergite, which is longer than third tergite, while in the closely related species, *Cotesia ruficrus* (Haliday, 1834), it is shorter than the third tergite.

Material examined

Holotype

IRAN • ♀; Khuzestan Province, Dezful, Shahrak-e Shahid Mohammad Montazeri; 32°26'83.16" N, 48°37'67.79" E; 97 m a.s.l.; 22 May 2017; M. Zargar leg.; Malaise trap; citrus orchards; ICAR-NBAIR/NIM/MICROG/COT/22517H.

Paratypes

IRAN • 4 ♀♀; Khuzestan Province, Dezful, Qaleh-ye Rob-e Bandbal; 32°17'27.94" N, 48°25'46.98" E; 97 m a.s.l.; 20 Mar.–3 Apr. 2016, 7–21 Jun. 2017; TMUC-HBMC0001-0004 • 3 ♀♀; Shamsabad; 32°29'64.65" N, 48°42'57.45" E; 94 m a.s.l.; 8–22 May 2017, 5–19 Jun. 2017; TMUC-HBMC0005-0007 • 9 ♀♀; Zoviyeh; 31°46'20.56" N, 48°48'01.17" E; 30 m a.s.l.; 5–19 Jun. 2017; TMUC-HBMC0008-0016 • 10 ♀♀; Lali, Taraz; 32°20'49.70" N, 49°05'11.31" E; 390 m a.s.l.; 3–17 Mar. 2016, 4–18 May 2016, 5–19 Mar. 2017, 5–19 May 2017, 22 Jun.–6 Jul. 2017; TMUC-HBMC00017-0026, ICAR-NBAIR/NIM/MICROG/COT/4516 • 5 ♀♀; Andika, Chezi; 32°08'02.78" N, 49°38'30.56" E; 650 m a.s.l.; 20 Apr.–4 May 2016, 4–18 Jun. 2016, 22 May–6 Jun. 2017, 22 Jun.–6 Jul. 2017; TMUC-HBMC00027-0031 • 1 ♀; Doorab; 32°12'23.00" N, 49°26'37.00" E; 760 m a.s.l.; 20 Apr.–4 May 2016; TMUC-HBMC0032 • 1 ♀; same collection data as for preceding; 4–18 Jun. 2016; ICAR-NBAIR/NIM/MICROG/COT/4616 • 1 ♀; same collection data as for preceding; 4–18 Apr. 2017; NBAIR/NIM/MICROG/COT/4417 • 1 ♀; same collection data as for preceding; 5–19 Jun 2017; NBAIR/NIM/MICROG/COT/5617 • 1 ♀; same collection data as for preceding; 22 Jun.–6 Jul. 2017; NBAIR/NIM/MICROG/COT/22617 • 6 ♀♀; Baghmalek, Ghaletol; 31°37'49.70" N, 49°52'53.35" E; 880 m a.s.l.; 3–17 Apr. 2016, 4–18 May 2016, 21 May–5 Jun. 2016, 22 Jun.–6 Jul. 2017; TMUC-HBMC0033-0038 • 1 ♀; same collection data as for preceding; 21 May–5 Jun. 2016; ICAR-NBAIR/NIM/MICROG/COT/21516 • 4 ♀♀; Shang; 31°31'46.00" N, 49°53'14.61" E; 716 m a.s.l.; 20 Mar.–4 Apr. 2016, 4–18 May 2016, 5–19 May 2017, 4–18 Jul. 2017; TMUC-HBMC0039-0042 • 2 ♀♀; Dobagh; 31°31'16.14" N, 49°52'53.00" E; 688 m a.s.l.; 3–17 Apr. 2016, 4–18 Jun. 2016; Malaise trap; citrus orchards; M. Zargar leg.; TMUC-HBMC0043-0044 • 1 ♀; same collection data as for preceding; 3–17 Apr. 2016; ICAR-NBAIR/NIM/MICROG/COT/3416.

Description

Female

MEASUREMENTS. Body length 3 mm, fore wing length 2.9 mm.

HEAD (Fig. 1A–B). Smooth except shallowly punctate on face; width of head in dorsal view $1.8 \times$ as long as height; width of face $1.4 \times$ as long as height; POL:MOD:OOL 4.1 : 2:4.5; gena $0.7 \times$ as long as width of eyes; malar space $1.5 \times$ as long as width of mandibular base; antenna as long as body; flagellomeres finely setose. FL1_{l/w} : 3.5, FL12_{l/w} : 2.4, FL13_{l/w} : 2.3, FL14_{l/w} : 2.2, FL15_{l/w} : 2.2.

MESOSOMA (Fig. 1C). Mesoscutum densely evenly punctate, in lateral lobes presence of smooth area near tegula; notauli indicated by dense punctation; scutellum weakly punctate in anterior half, densely punctate in posterior half; scutellar sulcus crenulate; postscutellum crenulate and shiny; prepectal carina absent; propodeum coarsely rugose to scabrous.

WINGS (Fig. 1D). Areolet absent, vein r arising little after middle of pterostigma; vein 1–R1 $1.4 \times$ as long as pterostigma, $2.8 \times$ as long as distance from end of vein 1–R1 to tip of radial cell, $4.0 \times$ as long as vein r; pterostigma $4.0 \times$ as long as wide; vein r as long as 2–SR; vein 1–cu1 as long as vein 2–cu1; width of discoidal cell $1.1 \times$ as long as height.

LEGS (Fig. 1F). Metacoxa $1.3 \times$ as long as first tergite; metafemur length $4.0 \times$ as long as median width; inner and outer spur of metatibia equal, $0.4 \times$ as long as basitarsus.

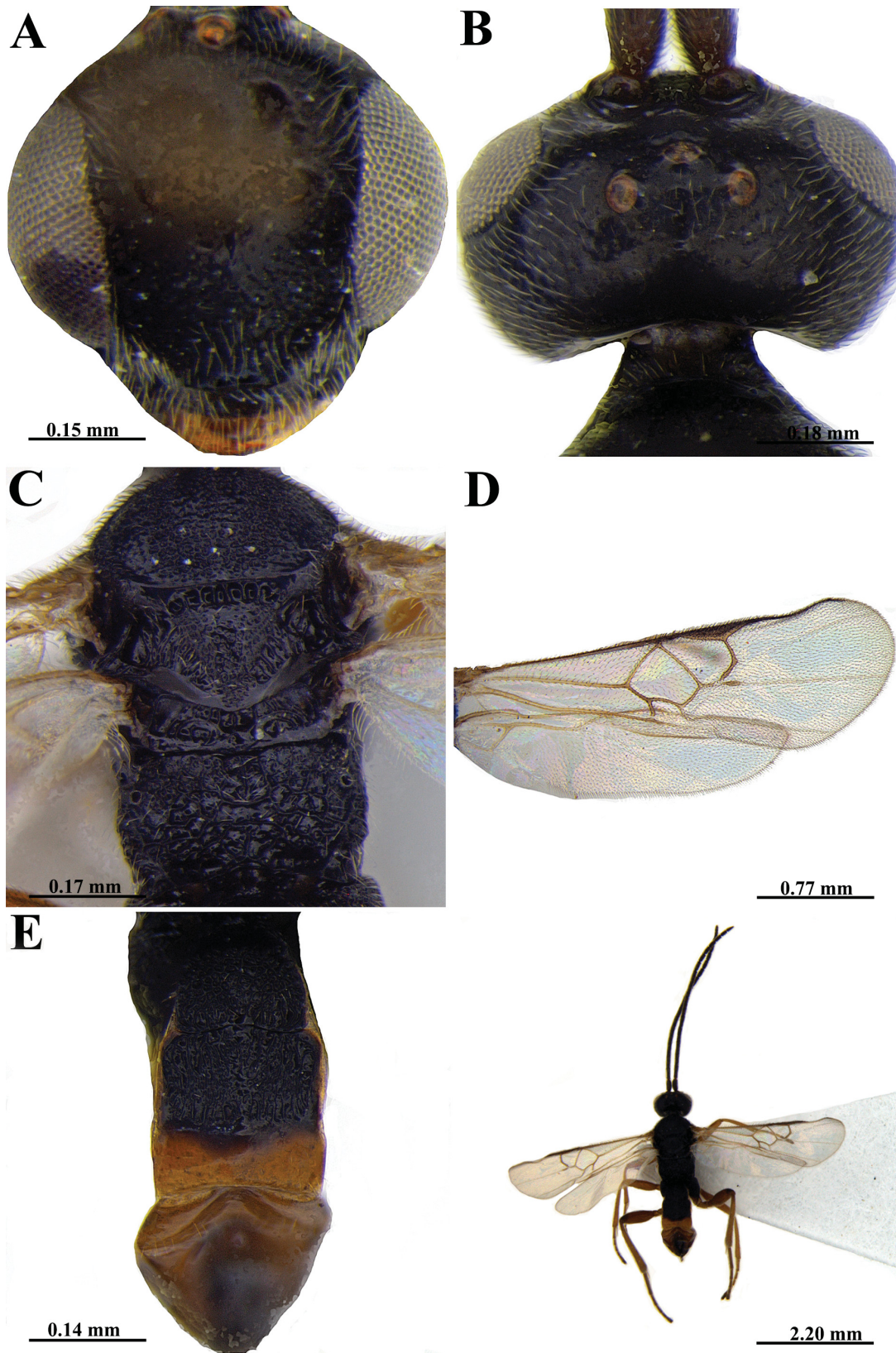


Fig. 1. *Cotesia elongata* Zargar & Gupta sp. nov., ICAR-NBAIR/NIM/MICROG/COT/22517H. A. Head, frontal view. B. Head, dorsal view. C. Mesosoma, dorsal view. D. Fore wing. E. Metasoma, dorsal view. F. Habitus, dorsal view.

METASOMA (Fig. 1E). TI slightly widening toward apex, $1.1 \times$ longer than apical width; apical width $1.7 \times$ as long as basal width, rugose. TII apical width $1.9 \times$ longer than median length. TIII median length $0.7 \times$ as long as TII; tergites posterior to TII smooth and shiny with single row of setae near hind margin; ovipositor sheath $0.5 \times$ as long as metabasitarsus; hypopygium $0.7 \times$ as long as metatibia, truncated apically.

COLOUR. Antenna, head, mesosoma black; metasoma yellowish brown except first and second tergite; labial palp and maxillary palp testaceous; tegula yellowish brown; profemur, mesofemur reddish brown; metafemur reddish brown except black spot at apex; tibiae reddish brown; protarsus and mesotarsus reddish brown, metatarsus dark brown; pterostigma light brown.

Male

Unknown.

Host

Unknown.

Biology

Unknown.

Comment

In the keys provided by Nixon (1974), Papp (1986) and van Achterberg & Polaszek (1996), *Cotesia elongata* sp. nov. runs close to *Cotesia ruficrus* (Haliday, 1834); it can, however, be separated from the latter by the following characters: (1) penultimate segment of antenna $2\text{--}2.2$ ($\text{--}2.3$) \times as long as wide vs 1.5 and $1.7 \times$ in Nixon (1974) and van Achterberg & Polaszek (1996), respectively, (2) third tergite $0.7\text{--}0.8 \times$ as long as second tergite (Fig. 1E) vs $1.2\text{--}1.4$ in Papp (1986).

The new species can be included in the identification key of *Cotesia* compiled by Nixon (1974), which is modified below:

- 14. Antenna short, rather thick, preapical segment about one-and-a-quarter \times as long as wide; legs dark brownish or obscurely brownish yellow throughout; mesopleuron anterior to and ventral to sternaulus, very shiny and with sharp discrete punctation *C. amabilis* (Nixon, 1974)
- Antenna longer and decidedly thin A
- A. Preapical segment of antenna fully one-and-a-half \times as long as wide; mesopleuron anterior to and ventral to sternaulus, tending to be dull and evenly rugose *C. ruficrus* (Haliday, 1834)
- Preapical segment of antenna $2\text{--}2.2$ ($\text{--}2.3$) \times as long as wide; mesopleuron anterior to and ventral to sternaulus, tending to be punctate *C. elongata* Zargar & Gupta sp. nov.

The new species can be included in the identification key of *Cotesia* compiled by Papp (1974), which is modified below:

- 10. First tergite at most as long as wide at hind, usually slightly shorter; second tergite slightly shorter than, or sometimes as long as third tergite; head in dorsal view somewhat less rounded behind eyes; hind coxa always reddish yellow *C. kariyai* (Watanabe, 1937)
- First tergite usually slightly longer than wide at hind A
- A. Second tergite one-fourth to one-fifth shorter than third tergite; third tergite usually more or less and fourth tergite less usually with yellow to reddish yellow pattern; tegulae yellow to vivid yellow *C. ruficrus* (Haliday, 1834)
- Second tergite $1.2\text{--}1.3 \times$ as long as third tergite; third and fourth tergite yellowish brown (Fig. 1E); tegulae yellow *C. elongata* Zargar & Gupta sp. nov.

Cotesia khuzestanensis Zargar & Gupta sp. nov.

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Fig. 2

Diagnosis

Penultimate segment of antenna $1.5\times$ as long as wide; mesoscutum densely evenly punctate to rugose (Fig. 2C); notauli densely punctate; scutellum punctate, interspaces as wide as diameter of punctation (Fig. 2C); metacoxa punctate and rugulose; pterostigma $3\times$ as long as wide, brown (Fig. 2D); 1–R1 $1.3\times$ as long as pterostigma, $3.5\times$ as long as distance from end of 1–R1 to tip of radial cell; first tergite parallel sided, $1.3\times$ longer than apical width, rugose (Fig. 2E).

Etymology

The name *khuzestanensis* refers to the name of Khuzestan Province in southwestern Iran, which is also the distribution range of this species.

Material examined

Holotype

IRAN • ♀; Khuzestan Province, Lali, Taraz; $32^{\circ}20'49.70''$ N, $49^{\circ}05'11.31''$ E; 390 m a.s.l.; 4–18 May 2016; M. Zargar leg.; Malaise trap; citrus orchards; ICAR-NBAIR/NIM/MICROG/COT/45161H.

Paratypes

IRAN • 3 ♀♀; same collection data as for holotype; TMUC-HBMC0045-0047.

Description

Female

MEASUREMENTS. Body length 2.5 mm, fore wing length 2.5 mm.

HEAD (Fig. 2A–B). Smooth except with shallow punctations on face; width of head in dorsal view $1.8\times$ as long as height; width of face as long as height; POL:MOD:OOL 5 : 2:4.4; gena $0.6\times$ as long as width of eye; malar space $1.3\times$ as long as width of mandibular base; antenna as long as body; flagellomeres finely setose. FL1_{l/w}:3, FL12_{l/w}:1.9, FL13_{l/w}:1.5, FL14_{l/w}:1.5, FL15_{l/w}:1.4–1.5.

MESOSOMA (Fig. 2C). Mesoscutum densely evenly punctate to rugose, dull; notauli indicated by dense punctations, posteriorly merging to rugose sculpture; scutellum punctate and shiny, interspace as wide as diameter of punctate; scutellar sulcus crenulate; postscutellum crenulate and dull; prepectal carina absent; propodeum coarsely rugose to scabrous.

WINGS (Fig. 2D). Areolet absent, vein r arising little after middle of pterostigma; 1–R1 $1.3\times$ as long as pterostigma, $3.5\times$ as long as distance from end of 1–R1 to tip of radial cell, $4.0\times$ as long as r; pterostigma $3.0\times$ as long as wide; r as long as 2–SR; 1–cu1 as long as 2–cu1; width of discoidal cell $1.1\times$ as long as height.

LEGS (Fig. 2F). Metacoxa $1.3\times$ as long as first tergite; metafemur length $4.0\times$ as long as median width; inner spur of metatibia slightly longer than outer, as long as half of basitarsus.

METASOMA (Fig. 2E). TI parallel sided, $1.3\times$ as long as apical width, rugose. TII apical width $2.5\times$ as long as median length, rugose. TIII median length $1.5\times$ as long as TII; tergites posterior to TII smooth and shiny; ovipositor sheath $0.7\times$ as long as metabasitarsus. Hypopygium $0.5\times$ as long as metatibia, truncated apically.

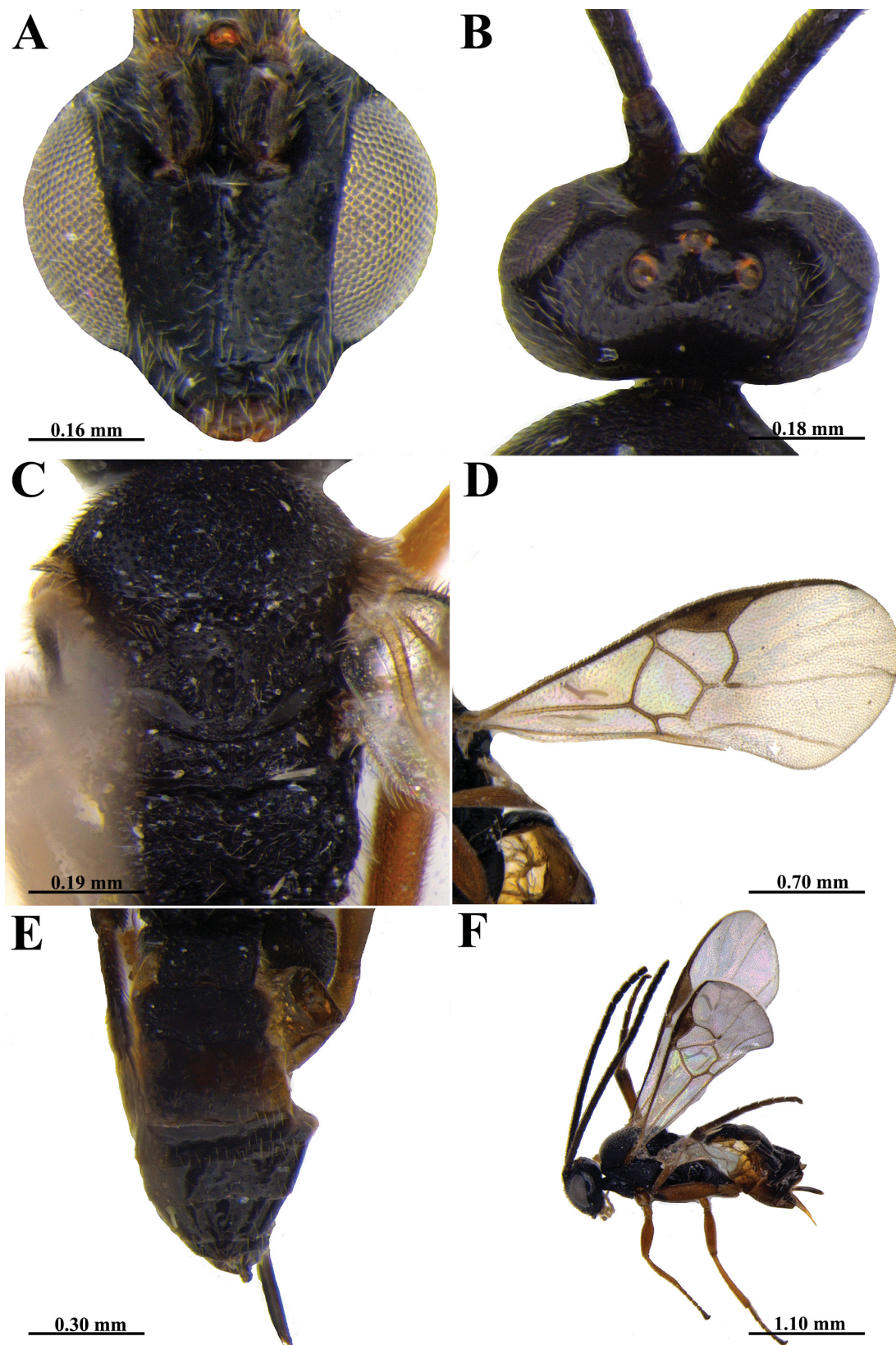


Fig. 2. *Cotesia khuzestanensis* Zargar & Gupta sp. nov., ICAR-NBAIR/NIM/MICROG/COT/451611. A. Head, frontal view. B. Head, dorsal view. C. Mesosoma, dorsal view. D. Fore wing. E. Metasoma, dorsal view. F. Habitus, lateral view.

COLOUR. Antenna dark brown; head and mesosoma black; metasoma black except brown third tergite and basal sternites; labial palp and maxillary palp yellow; tegula yellowish brown; profemur and mesofemur reddish brown; metafemur reddish brown except black spot at apex; tibia reddish brown; protarsus and mesotarsus reddish brown; metatarsus dark brown; pterostigma brown.

Male

Unknown.

Host

Unknown.

Biology

Unknown.

Remarks

In the key provided by Nixon (1974) this new species runs close to *Cotesia setebis* (Nixon, 1974); it can, however, be separated by the following characters: (1) first tergite parallel-sided, 1.3 × as long as apical width (Fig. 2E) vs as long as apical width in *C. setebis*, (2) inner spur of metatibia slightly longer than outer reaching middle of basitarsus (Fig. 2F) vs distinctly longer than outer one and longer than half of basitarsus, (3) metafemur reddish brown (Fig. 2F) vs black in *C. setebis*. In recent years, two species were described that are close to *C. setebis*: *Cotesia adippevora* Shaw, 2009 and *C. acerbiae* Shaw & Vikberg, 2015. For both these species the length of the first tergite is as long as its apical width.

The new species can be included in the identification key of *Cotesia* compiled by Nixon (1974), which is modified below:

- 3. Inner spur of metatibia conspicuously to marginally longer than outer, clearly reaching or crossing beyond middle of basitarsus 4
 - Inner spur of metatibia not longer than outer and shorter than half of basitarsus 5
- 4. Preapical segment about twice as long as wide; mesoscutum on the whole coarsely rugose-punctate, without a contrasting dull area posteriorly..... *C. callimone* (Nixon, 1974)
 - Preapical segment about 1.5 × as long as wide; mesoscutum on the whole dull, with punctuation of variable intensity; notaulic bands uniting posteriorly to form a large zone of dull area A
- A. First tergite parallel-sided, 1.3 × as long as its apical width (Fig. 2E); inner spur of metatibia slightly longer than outer, as long as half of basitarsus (Fig. 2F); metafemur reddish brown except black spot at apex (Fig. 2F) *C. khuzestanensis* Zargar & Gupta sp. nov.
 - First tergite as long as apical width; inner spur distinctly longer than outer and slightly longer than half of hind basitarsus; metafemur black..... *C. setebis* (Nixon, 1974)

The new species runs in the key of Papp (1986) reaching to couplet number 34 which was later modified (Papp 1987). Further modifications to fit this species in Papp (1987) are suggested as below:

- 34. Inner spur of metatibia shorter than half basitarsus; first tergite distinctly broadening posteriorly, about as long as wide at hind; head in dorsal view less transverse, 1.8 times as broad as long *C. analis* (Nees, 1834)
 - Inner spur of metatibia as long as or longer than half basitarsus..... A
- A. First tergite as long as wide at hind *C. setebis* (Nixon, 1974) and *C. callimone* (Nixon, 1974)
 - First tergite 1.3–1.5 × as long as wide at hind B

- B. Inner spur of metatibia slightly longer than outer, as long as half of basitarsus (Fig. 2F); penultimate segment of antenna $1.4\times$ as long as wide; r oblique to fore margin of pterostigma (Fig. 2D) *C. khuzestanensis* Zargar & Gupta sp. nov.
– Inner spur of metatibia distinctly longer than half of basitarsus; penultimate segment of antenna $2.0\times$ as long as wide..... *C. setebis* (Nixon, 1974) and *C. callimone* (Nixon, 1974)

Cotesia zagrosensis Zargar & Gupta sp. nov.

urn:lsid:zoobank.org:act:2E7929F1-339D-4354-A27A-80F87E99EB7B

Fig. 3

Diagnosis

Penultimate segment of antenna $1.5\times$ as long as wide; mesoscutum subshiny, more or less with traces of punctations (Fig. 3C); scutellum smooth and shiny; pterostigma $2.6\times$ as long as wide, light brown (Fig. 3D); first tegite sub-parallel sided, strongly rounded apically, $1.3\times$ as long as apical width, smooth, light brown (Fig. 3E); apical width of second tergite $4\times$ as long as median length, smooth, light brown (Fig. 3E); third tergite $1.6\times$ as long as second tergite (Fig. 3E).

Etymology

The name refers to the Zagros mountain range, which is also the distribution range of the species.

Material examined

Holotype

IRAN • ♀; Khuzestan, Lali, Taraz; $32^{\circ}20'49.70''$ N, $49^{\circ}05'11.31''$ E; 390 m a.s.l.; 6–20 Jul. 2017; Malaise trap; citrus orchards; M. Zargar leg.; ICAR-NBAIR/NIM/MICROG/COT/6717H.

Paratype

IRAN • 1 ♀; same collection data as for holotype; TMUC-HBMC0048.

Description

Female

MEASUREMENT. Body length 2.5 mm, fore wing length 2.5 mm.

HEAD (Fig. 3A–B). Smooth except shallowly punctate on face; width of head in dorsal view $1.8\times$ as long as height; width of face $1.3\times$ as long as height; POL:MOD:OOL 4.1 : 2:3.5; gena $0.4\times$ as long as width of eyes; malar space $1.3\times$ as long as width of mandibular base; antenna shorter than body; flagellomeres finely setose. $FL1_{l/w}:2.8$, $FL12_{l/w}:1.6$, $FL13_{l/w}:1.5$, $FL14_{l/w}:1.5$, $FL15_{l/w}:1.5$.

MESOSOMA (Fig. 3C). Mesoscutum subshiny more or less with traces of punctations; notauli indistinct; scutellum smooth and shiny; scutellar sulcus crenulate; postscutellum crenulate and shiny; prepectal carina absent; propodeum rugose with median carina.

WINGS (Fig. 3D). Areolet absent, vein r arising from middle of pterostigma; 1–R1 $1.3\times$ as long as pterostigma, $3.5\times$ as long as distance from end of 1–R1 to tip of radial cell, $3.7\times$ as long as r; pterostigma $2.6\times$ as long as wide; r $1.4\times$ as long as 2–SR; 1–cu1 $0.8\times$ as long as 2–cu1; width of discoidal cell $1.2\times$ as long as height.

LEGS (Fig. 3F). Metacoxa $1.5\times$ as long as first tergite; metafemur length $3.1\times$ as long as median width; inner and outer spur of metatibia equal, $0.4\times$ as long as basitarsus.

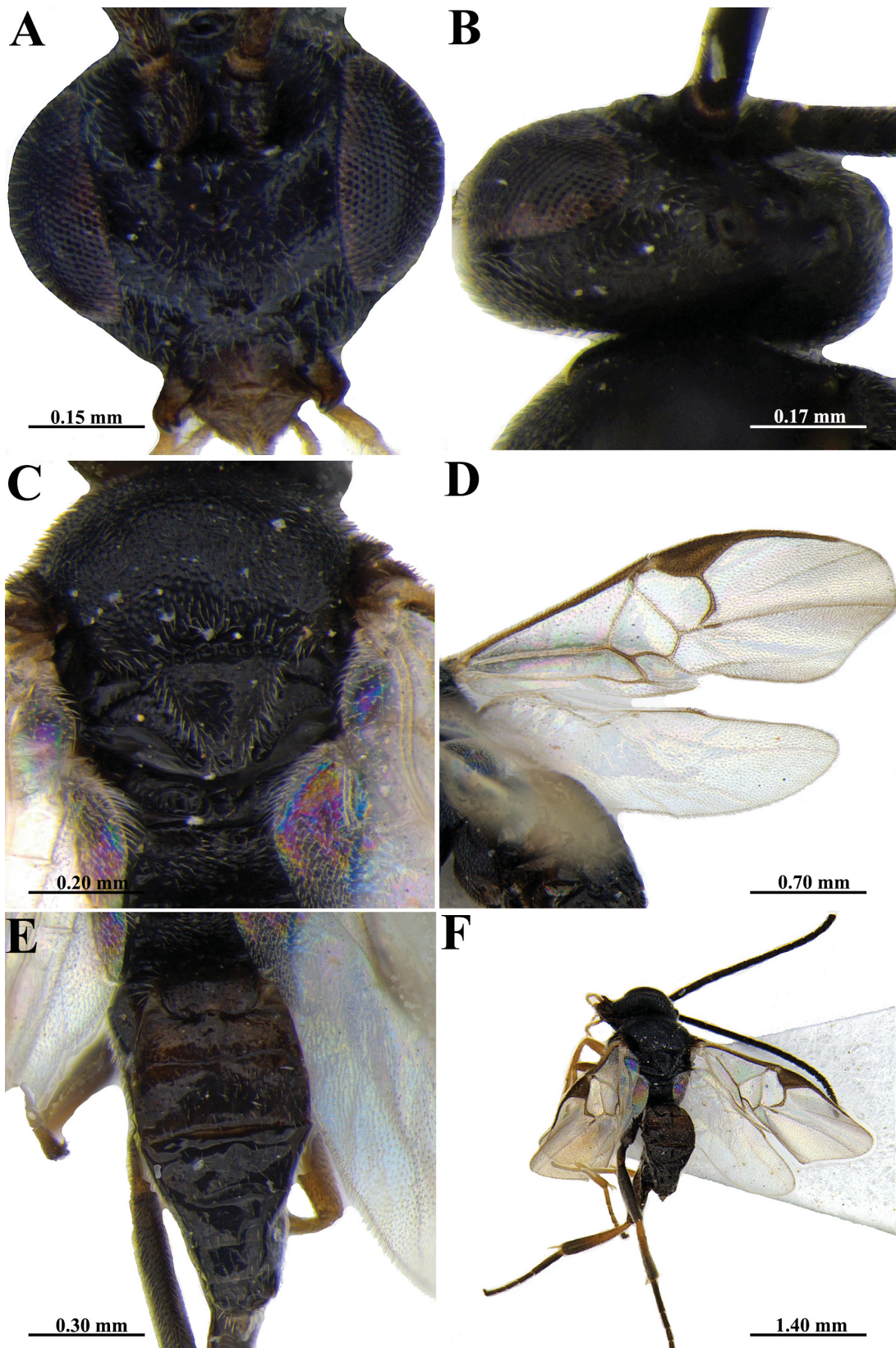


Fig. 3. *Cotesia zagrosensis* Zargar & Gupta sp. nov., ICAR-NBAIR/NIM/MICROG/COT/6717. A. Head, frontal view. B. Head, dorsal view. C. Mesosoma, dorsal view. D. Fore wing. E. Metasoma, dorsal view. F. Habitus, dorsal view.

METASOMA (Fig. 3E). TI parallel sided, $1.3\times$ as long as apical width, shallowly rugolose at apex near hind margin, remaining smooth, shiny. TII apical width $4\times$ as long as median length, smooth. TIII median length $1.6\times$ as long as TII; tergites posterior to TI smooth and shiny; ovipositor sheath $0.7\times$ as long as metabasitarsus; hypopygium $0.7\times$ as long as metatibia, truncated apically.

COLOUR. Antenna dark brown; head, mesosoma black; metasoma, first and second tergite light brown, third tergite dark brown, remaining black; labial palp and maxillary palp yellow; tegula dark brown; profemur reddish brown, mesofemur dark brown in anterior half, reddish brown in posterior half; metafemur dark brown; protibia, mesotibia yellowish brown, metatibia reddish brown except black infuscations at apex; protarsus and mesotarsus yellowish brown; metatarsus dark brown. Pterostigma light brown.

Male

Unknown.

Host

Unknown.

Biology

Unknown.

Distribution

Khuzestan Province (Iran).

Comments

In the key of Nixon (1974) the new species runs smoothly to *Cotesia onaspis* (Nixon, 1974) from which it can be easily separated by: (1) second tergite conspicuously transverse and $4\times$ as long as median length (Fig. 3E) vs $2.5\times$ in *C. onaspis*, (2) phragma of scutellum not visible (Fig. 3C) vs narrowly visible in *C. onaspis*, (3) metafemur dark brown (Fig. 3F) vs reddish yellow in *C. onaspis*.

The new species can be included in the identification key of *Cotesia* compiled by Nixon (1974), which is modified below:

- 55. Gaster blackish; first tergite (as also basal field) dull, densely rather finely rugose all over; metacarp hardly three times as long as its distance from apex of radial cell. Basella meeting submediella almost at right-angle *C. notha* (Marshall, 1885)
- Gaster frequently pale brownish with tergites 3–5 showing broad dark apical bands; first tergite shiny, sculpture of apical part consisting of coarse rugose-punctuation that tends to fade out along middle line; metacarp nearly four times as long as its distance from apex of radial cell. Basella curved; fringe of vannal lobe hardly noticeable A
- A. Second tergite conspicuously transverse, 4.0 times as long as median length (Fig. 3E); phragma of scutellum not visible (Fig. 3C); metafemur dark brown (Fig. 3F)
..... *C. zagrosensis* Zargar & Gupta sp. nov.
- Second tergite less transverse, 2.5 times as long as median length; phragma of scutellum narrowly visible; metafemur reddish yellow *C. onaspis* (Nixon, 1974)

In Papp's key, this species runs to *Cotesia notha* (Marshall, 1885). The key can be modified as follows:

- 175. Second tergite conspicuously less transverse, 1.9–2.2 times, usually twice as wide as long medially; first tergite sometimes less broadening posteriorly; pterostigma rather wide, 2–2.3 times as long as wide *C. juniperatae* (Bouché, 1834) [valid name: *C. sessilis* (Geoffroy, 1785)]
- Second tergite transverse, at least 2.5 times as wide as long medially A

- A. Metacarp relatively short, about thrice as long as distance between its distal end and tip of radial cell; first tergite less rounded behind; nervellus (of hind wing) almost straight; metafemur black or blackish, sometimes light brown to brownish yellow, rarely with rusty suffusion *C. notha* (Marshall, 1885)
- Metacarp long, 3.7 as long as distance between its distal end and tip of radial cell (Fig. 3D); first tergite strongly rounded behind (Fig. 3E); nervellus curved; metafemur dark brown (Fig. 3F) *C. zagrosensis* Zargar & Gupta sp. nov.

New records of Cotesia from Iran

Cotesia cynthiae (Nixon, 1974)

Fig. 4

Apanteles cynthiae Nixon, 1974: 499.

Diagnosis

Antenna $1.1\times$ as long as body, penultimate segment of antenna $2.0\times$ as long as wide; width of face $1.2\times$ as long as height (Fig. 4A); POL:MOD:OOL 25:13:25; width of head in dorsal view $1.9\times$ as long as height (Fig. 4B); mesonotum coarsely reticulate-punctate to rugose (Fig. 4C); scutellum rugose-punctate; 1–R1 $1.5\times$ as long as pterostigma, $3.0\times$ as long as distance from end of 1–R1 to tip of radial cell; pterostigma $3.2\times$ as long as wide (Fig. 4D); metacoxa coarsely rugose; metasoma posteriorly compressed laterally (Fig. 4F); first tergite broadening posteriorly, medial length as long as apical width, rugose; second tergite as long as third tergite, rugose (Fig. 4E); ovipositor sheath $0.3\times$ as long as metabasitarsus; hypopygium $0.5\times$ as long as metatibia (Fig. 4F); legs reddish brown; body black except third tergite.

Material examined

IRAN – **Khuzestan Province** • 3 ♀♀; Lali, Taraz; 32°20'49.70" N, 49°05'11.31" E; 390 m a.s.l.; 4–18 Mar. 2016, 3–17 Apr. 2016; Malaise trap; citrus orchards; M. Zargar leg.; TMUC-HBMC0049-0051 • 1 ♀; same collection data as for preceding; 3–17 Apr. 2016; ICAR-NBAIR/NIM/MICROG/COT/3416.

Distribution in Iran

Khuzestan (present study). New record for Iran.

General distribution

Austria, Bulgaria, France, Hungary, Switzerland, Turkey (Yu *et al.* 2016).

Host record

Lepidoptera: Nymphalidae Rafinesque, 1815 (Yu *et al.* 2016).

Cotesia glabrata (Telenga, 1955)

Fig. 5

Apanteles glabratus Telenga, 1955: 132.

Diagnosis

Antenna shorter than body 0.8, penultimate segment $1.4\times$ as long as wide; width of face $1.4\times$ as long as height (Fig. 5A); POL:MOD:OOL 15:6:11; width of head in dorsal view $2.1\times$ as long as height

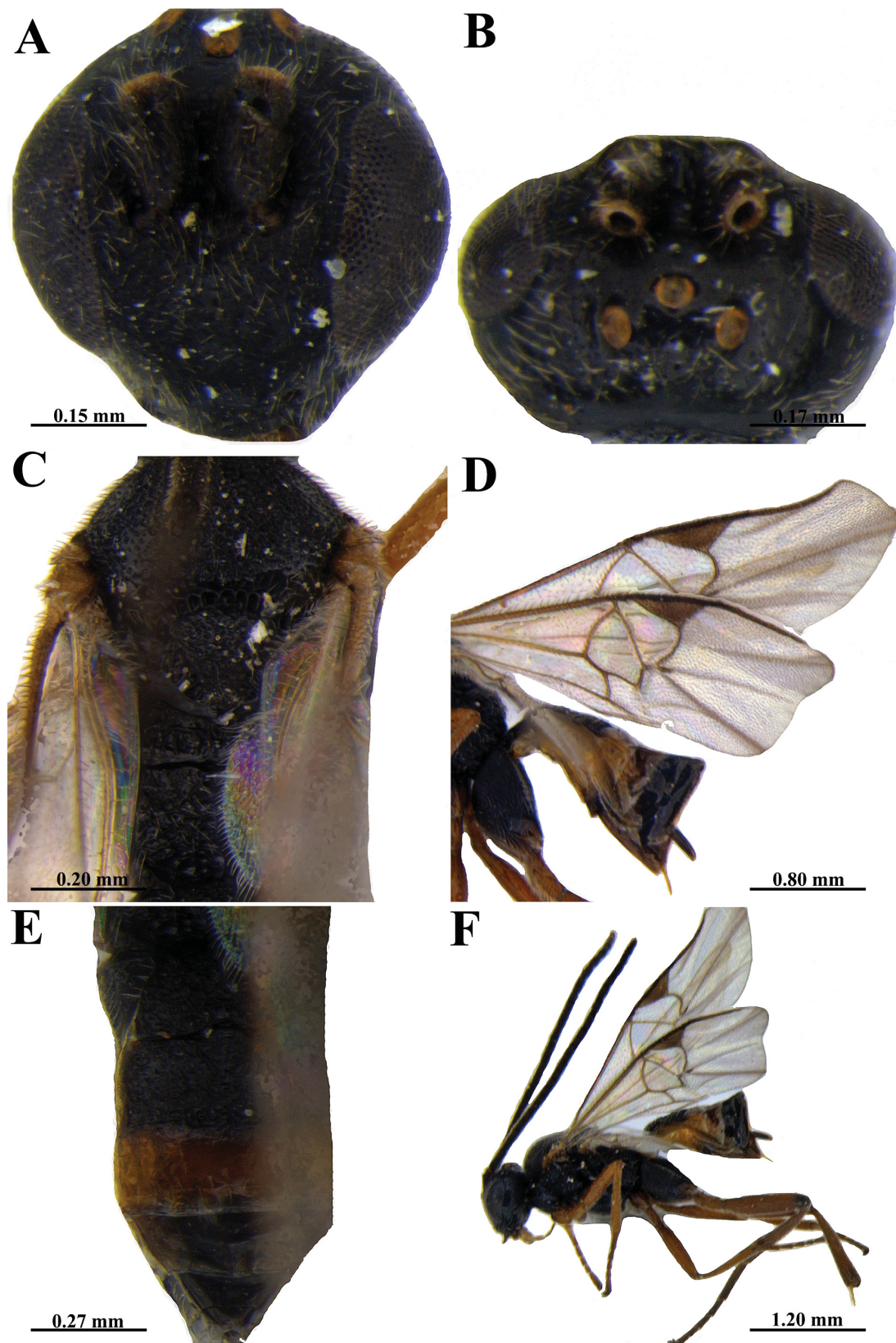


Fig. 4. *Cotesia cynthiae* (Nixon, 1974). A. Head, frontal view., ICAR-NBAIR/NIM/MICROG/COT/3416. B. Head, dorsal view. C. Mesosoma, dorsal view. D. Fore wing. E. Metasoma, dorsal view. F. Habitus, lateral view.

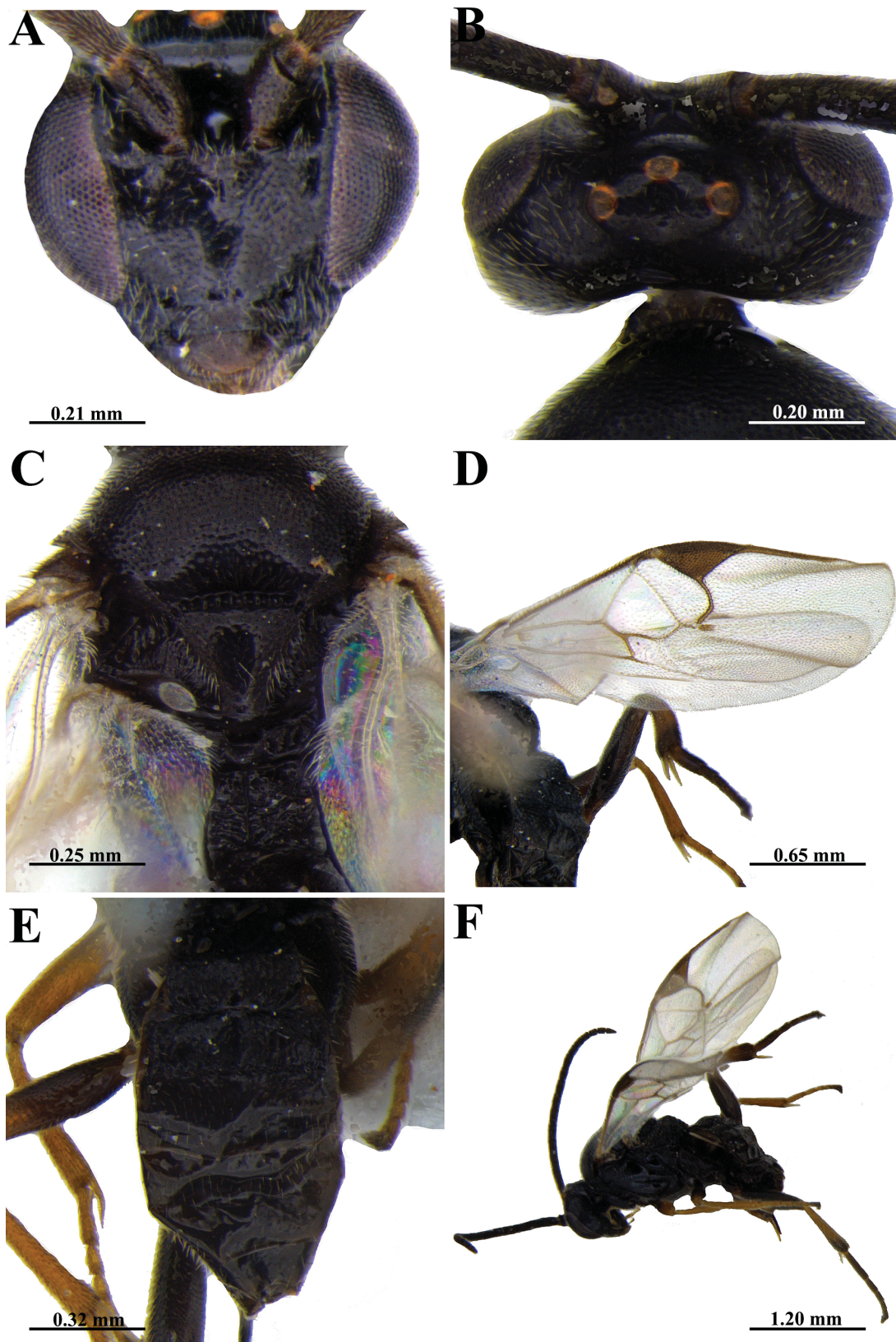


Fig. 5. *Cotesia glabrata* (Telenga, 1955), ICAR-NBAIR/NIM/MICROG/COT/20416. A. Head, frontal view. B. Head, dorsal view. C. Mesosoma, dorsal view. D. Fore wing. E. Metasoma, dorsal view. F. Habitus, lateral view.

(Fig. 5B); mesonotum shallowly punctuate, shiny; scutellum smooth, shiny (Fig. 5C); 1–R1 $1.3\times$ as long as pterostigma, $3.4\times$ as long as distance from end of 1–R1 to tip of radial cell; pterostigma $2.4\times$ as long as wide (Fig. 5D); metacoxa smooth; first tergite distinctly broader posteriorly, medial length $0.8\times$ as long as apical width, rugose; second tergite in middle smooth and laterally rugose, $3\times$ wider than long medially (Fig. 5E); ovipositor sheath $0.5\times$ as long as metabasitarsus; hypopygium $0.6\times$ as long as metatibia (Fig. 5F); body black.

Material examined

IRAN – **Khuzestan Province** • 4 ♀♀; Shooshtar, Ferdows; $31^{\circ}58'42.89''$ N, $48^{\circ}47'16.24''$ E; 37 m a.s.l.; 20 Apr.–4 May 2016, 5–19 Jun. 2017, 22 Jun.–6 Jul. 2017; Malaise trap; citrus orchards; M. Zargar leg.; TMUC-HBMC0052-0055 • 1 ♀; same collection data as for preceding; 20 Apr.–4 May 2016; ICAR-NBAIR/NIM/MICROG/COT/20416.

Distribution in Iran

Khuzestan (present study). New record for Iran.

General distribution

Bulgaria, Georgia, Germany, Hungary, Israel, Kazakhstan, Russia, Turkey, Ukraine (Yu *et al.* 2016).

Host records

Lepidoptera: Geometridae Leach, 1815, Hesperiiidae Latreille, 1809, Pieridae Swainson, 1820 (Yu *et al.* 2016).

New records of Cotesia from Khuzestan Province of Iran

Cotesia jucunda (Marshall, 1885)

Apanteles jucundus Marshall, 1885: 182.

Microgaster nigrinervis Thomson, 1895: 2260.

Material examined

IRAN – **Khuzestan Province** • 1 ♀; Andika, Doorab; $32^{\circ}12'23.00''$ N, $49^{\circ}26'37.00''$ E; 760 m a.s.l.; 6–20 Mar. 2017; TMUC-HBMC0056 • 1 ♀; Chezi; $32^{\circ}08'02.78''$ N, $49^{\circ}38'30.56''$ E; 650 m a.s.l.; 4–20 May 2016; ICAR-NBAIR/NIM/MICROG/COT/4516 • 2 ♀♀; Lali, Taraz; $32^{\circ}20'49.70''$ N, $49^{\circ}05'11.31''$ E; 390 m a.s.l.; 5–19 May 2017, 5–19 Jun. 2017; TMUC-HBMC0057-0058 • 1 ♀; Dobagh; $31^{\circ}31'16.14''$ N, $49^{\circ}52'53.00''$ E; 688 m a.s.l.; 4–18 May 2016; Malaise trap; citrus orchards; M. Zargar leg.; TMUC-HBMC0059.

Distribution in Iran

Guilan (Ghahari *et al.* 2012a), Markazi (Ghahari *et al.* 2011d), Khuzestan (present study).

General distribution

Armenia, Austria, Bulgaria, Croatia, Czechoslovakia, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iran, Ireland, Moldova, Mongolia, Poland, Romania, Russia, Serbia, Spain, Sweden, Switzerland, Turkey, United Kingdom, Yugoslavia (Yu *et al.* 2016).

Host records

Lepidoptera: Geometridae (Shenefelt 1972; Capek 1972; Yu *et al.* 2016), Nymphalidae, Pieridae (Yu *et al.* 2016).

***Cotesia praepotens* (Haliday, 1834)**

Microgaster praepotens Haliday, 1834: 252.

Microgaster placida Haliday, 1834: 251.

Apanteles memnon Nixon, 1974: 465, fig. 39.

Apanteles acutivalvis Balevski, 1980: 97.

Apanteles beshtai Tobias, 1986: 716, fig. 232:18.

Material examined

IRAN – **Khuzestan Province** • 2 ♀♀; Baghmalek, Dobagh; 31°31'16.14" N, 49°52'53.00" E; 688 m a.s.l.; 4–18 May 2016; ICAR-NBAIR/NIM/MICROG/COT/4516 • 1 ♀; Ghale tol; 31°37'49.70" N, 49°52'53.35" E; 880 m a.s.l.; 22 Jun.–6 Jul. 2017; ICAR-NBAIR/NIM/MICROG/COT/22617 • 1 ♀; Andika, Doorab; 32°12'23.00" N, 49°26'37.00" E; 760 m a.s.l.; 5–19 May 2017; TMUC-HBMC0060 • 1 ♀; Lali, Taraz; 32°20'49.70" N, 49°05'11.31" E; 390 m a.s.l.; 6–20 Jul. 2016; Malaise trap; citrus orchards; M. Zargar leg.; TMUC-HBMC0061.

Distribution in Iran

Qazvin (Ghahari *et al.* 2011c), Khuzestan (present study).

General distribution

Afghanistan, Armenia, Azerbaijan, Bulgaria, Croatia, Czech Republic, Finland, Germany, Greece, Hungary, Iran, Ireland, Italy, Kazakhstan, Lithuania, Macedonia, Moldoava, Mongolia, Poland, Romania, Russia, Slovakia, Spain, Sweden, Switzerland, Tajikistan, Turkey, Turkmenistan, United Kingdom, Uzbekistan, Yugoslavia (Yu *et al.* 2016).

Host records

Lepidoptera: Elachistidae Bruand, 1851 (Yu *et al.* 2016), Geometridae (Shenefelt 1972; Nixon 1974; Yu *et al.* 2016), Gracillariidae Stainton, 1854, Lymantriidae Hampson, 1893, Notodontidae Hampson, 1893, Yponomeutidae Stephens, 1829 (Yu *et al.* 2016).

***Cotesia risilis* (Nixon, 1974)**

Apanteles risilis Nixon, 1974: 471, fig. 27.

Material examined

IRAN – **Khuzestan Province** • 1 ♀; Baghmalek, lalab; 31°32'53.70" N, 49°57'37.00" E; 843 m a.s.l.; 6–20 Mar. 2017; Malaise trap; citrus orchards; M. Zargar leg.; TMUC-HBMC0062.

Distribution in Iran

Ilam (Ghahari *et al.* 2011b), West Azarbaijan (Samin 2015), Khuzestan (present study).

General distribution

Czechoslovakia, Greece, Hungary, Iran, Italy, Mongolia, Montenegro, the Netherlands, Romania, Slovakia, Turkey, United Kingdom, Yugoslavia (Yu *et al.* 2016).

Host records

Lepidoptera: Pieridae (Nixon 1974; Yu *et al.* 2016).

Cotesia vestalis (Haliday, 1834)

Microgaster vestalis Haliday, 1834: 253.

Apanteles plutellae Kurdjumov, 1912: 226.

Material examined

IRAN – **Khuzestan Province** • 10 ♀♀; Baghmalek, Ghaletol; 31°37'49.70" N, 49°52'53.35" E; 880 m a.s.l.; 4–18 May 2016, 4–18 Jun. 2016, 5–19 Jun. 2017, 22 Jun.–6 Jul. 2017; TMUC-HBMC0063-0072 • 1 ♀; same collection data as for preceding; 3–17 Apr. 2016; ICAR-NBAIR/NIM/MICROG/COT/3416 • 1 ♀; same collection data as for preceding; 4–18 May 2016; ICAR-NBAIR/NIM/MICROG/COT/4516 • 12 ♀♀; Shang; 31°31'46.00" N, 49°53'14.61" E; 716 m a.s.l.; 20 Mar.–4 Apr. 2016, 4–18 May 2016, 4–18 Apr. 2017, 5–19 May 2017, 4–18 Jul. 2017; TMUC-HBMC0073-0084 • 11 ♀♀; Dobagh; 31°31'16.14" N, 49°52'53.00" E; 688 m a.s.l.; 3–17 Apr. 2016, 3–17 May 2016, 4–18 Jun. 2017; Malaise trap; citrus orchards; TMUC-HBMC0085-0095 • 11 ♀♀; Behbahan, Dodangeh; 30°42'08.38" N, 50°10'41.81" E; 300 m a.s.l.; 4–18 Apr. 2016, 3–17 Jun. 2016, 5–19 Mar. 2017, 5–19 May 2017, 22 Jun.–6 Jul. 2017; Malaise trap; palm orchards; TMUC-HBMC0096-0106 • 9 ♀♀; Dezful, Qaleh-ye Rob-e Bandbal; 32°17'27.94" N, 48°25'46.98" E; 97 m a.s.l.; 3–17 May 2016, 22 May–6 Jun. 2017, 4–18 Jun. 2017; TMUC-HBMC0107-0115 • 16 ♀♀; Shamsabad; 32°29'64.65" N, 48°42'57.45" E; 94 m a.s.l.; 3–17 Apr. 2016, 3–17 May 2016, 22 May–6 Jun. 2017; TMUC-HBMC0116-0131 • 26 ♀♀; Zoviyeh; 31°46'20.56" N, 48°48'01.17" E; 30 m a.s.l.; 4–18 Apr. 2016, 20 Apr.–4 May 2016, 22 May–6 Jun. 2016, 5–19 Jun. 2017, 22 Jun.–6 Jul. 2017; Malaise trap; citrus orchards; TMUC-HBMC0132-0157 • 12 ♀♀; Khoramshahr, Sheneh; 30°25'32.24" N, 48°11'20.83" E; 2 m a.s.l.; 20 Apr.–4 May 2016, 4–18 Jun. 2016, 4–18 Apr. 2017, 5–19 Jun. 2017, 22 Jun.–6 Jul. 2017; Malaise trap; palm orchards; TMUC-HBMC0158-0169 • 7 ♀♀; Lali, Taraz; 32°20'49.70" N, 49°05'11.31" E; 390 m a.s.l.; 3–17 Apr. 2016, 4–18 May 2016, 5–19 Mar. 2017, 5–19 May 2017, 22 Jun.–6 Jul. 2017; TMUC-HBMC0170-0176 • 7 ♀♀; Andika, Chezi; 32°08'02.78" N, 49°38'30.56" E; 650 m a.s.l.; 20 Apr.–4 May 2016, 4–18 Jun. 2016, 22 May–6 Jun. 2017, 22 Jun.–6 Jul. 2017; TMUC-HBMC0177-0183 • 9 ♀♀; Doorab; 32°12'23.00" N, 49°26'37.00" E; 760 m a.s.l.; 20 Apr.–4 May 2016, 4–18 Jun. 2016, 4–18 Apr. 2017, 22 Jun.–6 Jul. 2017; Malaise trap; citrus orchards; TMUC-HBMC0184-0192 • 7 ♀♀; Ramhormoz, Gharabad; 30°59'37.73" N, 49°46'50.63" E; 126 m a.s.l.; 5–19 Jun. 2017, 22 Jun.–6 Jul. 2017; Malaise trap; olive orchards; M. Zargar leg.; TMUC-HBMC0193-0199.

Distribution in Iran

Alborz (Golizadeh *et al.* 2007), East Azarbaijan (Rastegar *et al.* 2012), Isfahan (Ghahari *et al.* 2011a), Tehran (Hassanshahi *et al.* 2012), Khuzestan (present study).

General distribution

Afghanistan, Argentina, Armenia, Azerbaijan, Bangladesh, Belgium, Benin, Brazil, Bulgaria, Cape Verde Islands, China, Czech Republic, Finland, France, Germany, Greece, Hungary, India, Iran, Ireland, Israel, Italy, Japan, Kazakhstan, Kenya, Korea, Kyrgyzstan, Latvia, Libya, Macedonia, Malaysia, Moldova, Mongolia, Morocco, the Netherlands, New Zealand, Pakistan, Papua New Guinea, Philippines, Poland, Portugal, Romania, Russia, Serbia, Singapore, South Africa, Spain, Sri Lanka, Sweden, Switzerland, Tajikistan, Thailand, Turkey, Turkmenistan, USA, Ukraine, UK, Uzbekistan, Vietnam, former Yugoslavia (Yu *et al.* 2016); Australia (Shenefelt 1972); Réunion (Rousse & Gupta 2013).

Host records

Lepidoptera: Arctiidae Leach, 1815 (Yu *et al.* 2016), Lasiocampidae Harris, 1841 (Nixon 1974; Yu *et al.* 2016), Lymantriidae Hampson, 1893 (Shenefelt 1972; Yu *et al.* 2016), Nymphalidae, Pieridae,

Table 1 (continued on next page). Updated list of *Cotesia* Cameron, 1891 species occurring in Iran.

Species of <i>Cotesia</i>	Distribution in Iran (Province)	References
<i>C. abjecta</i> (Marshall, 1885)	Lorestan	Ghahari <i>et al.</i> 2012a
<i>C. ancilla</i> (Nixon, 1974)	Isfahan, Kermanshah	Ghahari <i>et al.</i> 2011a; Ghahari & Fischer 2012
<i>C. callimone</i> (Nixon, 1974)	Lorestan, Mazandaran, Semnan	Ghahari <i>et al.</i> 2012a; Sakenin <i>et al.</i> 2012; Naderian <i>et al.</i> 2012
<i>C. chilonis</i> (Munakata, 1910)	Not defined	Rassipour 1983; Modarres Awal 1997
<i>C. cuprea</i> (Lyle, 1925)	Lorestan	Ghahari <i>et al.</i> 2012a
<i>C. cynthiae</i> (Nixon, 1974)	Khuzestan	Present study
<i>C. elongata</i> Zargar & Gupta sp. nov.	Khuzestan	Present study
<i>C. euryale</i> (Nixon, 1974)	Ilam	Ghahari <i>et al.</i> 2011b
<i>C. flavipes</i> Cameron, 1891	Mazandaran	Ghahari <i>et al.</i> 2009
<i>C. geryonis</i> (Marshall, 1885)	Kermanshah	Ghahari & Fischer 2012
<i>C. glabrata</i> (Telenga, 1955)	Khuzestan	Present study
<i>C. glomerata</i> (Linnaeus, 1758)	Fars, Guilan, West Azarbaijan	Lashkari Bod <i>et al.</i> 2011; Ghahari <i>et al.</i> 2012b; Alizadeh & Moghaddam 2004; Khanjani 2006; Razmi <i>et al.</i> 2011
<i>C. hyphantriae</i> (Riley, 1887)	Qazvin	Ghahari <i>et al.</i> 2011c
<i>C. jucunda</i> (Marshall, 1885)	Guilan, Khuzestan, Markazi	Ghahari <i>et al.</i> 2012a; present study; Ghahari <i>et al.</i> 2011d
<i>C. kazak</i> (Telenga, 1949)	Tehran	Davatchi & Chodjai 1969; Modarres Awal 1997
<i>C. khuzestanensis</i> Zargar & Gupta sp. nov.	Khuzestan	Present study
<i>C. melanoscela</i> (Ratzeburg, 1844)	East Azarbaijan	Ghahari <i>et al.</i> 2010
<i>C. notha</i> (Marshall, 1885)	Golestan, Lorestan	Ghahari <i>et al.</i> 2011b; Ghahari <i>et al.</i> 2012a
<i>C. ofella</i> (Nixon, 1974)	Mazandaran, West Azarbaijan	Ghahari <i>et al.</i> 2010; Karimpour <i>et al.</i> 2001
<i>C. ordinaria</i> (Ratzeburg, 1844)	Golestan, Lorestan	Sakenin <i>et al.</i> 2012; Ghahari <i>et al.</i> 2012a
<i>C. praepotens</i> (Haliday, 1834)	Khuzestan, Qazvin	Present study; Ghahari <i>et al.</i> 2011c
<i>C. risilis</i> (Nixon, 1974)	Ilam, Khuzestan, West Azarbaijan	Ghahari <i>et al.</i> 2011b; Present study; Samin 2015
<i>C. rubecula</i> (Marshall, 1885)	Hamadan	Khanjani 2006
<i>C. ruficrus</i> (Haliday, 1834)	Fars, Mazandaran Sistan and Baluchestan	Lashkari Bod <i>et al.</i> 2011; Abbasipour & Taghavi 2002; 2004; Khajeh <i>et al.</i> 2014
<i>C. salebrosa</i> (Marshall, 1885)	Kermanshah	Ghahari & Fischer 2012
<i>C. saltator</i> (Thunberg, 1922)	Sistan and Baluchestan	Khajeh <i>et al.</i> 2014
<i>C. scabricula</i> (Reinhard, 1880)	Guilan	Ghahari <i>et al.</i> 2012b
<i>C. setebis</i> (Nixon, 1974)	Golestan	Ghahari <i>et al.</i> 2011d
<i>C. sessilis</i> (Geoffroy, 1785)	Ardabil, Mazandaran	Ghahari <i>et al.</i> 2011d; Ghahari <i>et al.</i> 2010

Table 1 (continued). Updated list of *Cotesia* Cameron, 1891 species occurring in Iran.

Species of <i>Cotesia</i>	Distribution in Iran (Province)	References
<i>C. specularis</i> (Szépligeti, 1896)	Qazvin	Ghahari <i>et al.</i> 2011c
<i>C. spuria</i> (Wesmael, 1837)	Qazvin	Ghahari <i>et al.</i> 2011c
<i>C. telengai</i> (Tobias, 1972)	Ilam	Ghahari <i>et al.</i> 2011b
<i>C. tenebrosa</i> (Wesmael, 1837)	Lorestan	Ghahari <i>et al.</i> 2012a
<i>C. tibialis</i> (Curtis, 1830)	Golestan	Ghahari <i>et al.</i> 2011b
<i>C. vanessae</i> (Reinhard, 1880)	Sistan & Baluchestan, West Azarbaijan	Khajeh <i>et al.</i> 2014; Karimpour <i>et al.</i> 2001
<i>C. vestalis</i> (Haliday, 1834)	Alborz, East Azarbaijan, Isfahan, Khuzestan, Tehran	Golizadeh <i>et al.</i> 2007; Rastegar <i>et al.</i> 2012; Ghahari <i>et al.</i> 2011a; present study; Hassanshahi <i>et al.</i> 2012
<i>C. villana</i> (Reinhard, 1880)	Qazvin	Ghahari <i>et al.</i> 2011c
<i>C. zagrosensis</i> Zargar & Gupta sp. nov.	Khuzestan	Present study
<i>C. zygaenarum</i> (Marshall, 1885)	Golestan, Ilam, Mazandaran	Samin <i>et al.</i> 2015; Ghahari <i>et al.</i> 2011b; Ghahari <i>et al.</i> 2010

Plutellidae Guenee, 1845, (Long & Belokobylskij 2003; Yu *et al.* 2016), Pterophoridae Zeller, 1841, Pyralidae Latreille, 1803 (Shenefelt 1972), Tortricidae Latreille, 1803 (Yu *et al.* 2016).

Discussion

In total, nine species of the genus *Cotesia* are identified, of which three are new and described and illustrated here: *C. elongata* sp. nov., *C. khuzestanensis* sp. nov. and *C. zagrosensis* sp. nov. Moreover, *C. cynthiae* (Nixon, 1974) and *Cotesia glabrata* (Telenga, 1955) are recorded for the first time from Iran. Of all the species identified, *Cotesia vestalis* (Haliday, 1834) and *C. elongata* sp. nov. are the most predominant species, with almost 90% of all specimens collected in different parts of Khuzestan Province.

Of the three newly described species, *C. khuzestanensis* sp. nov. and *C. elongata* sp. nov. belong to the *tibialis* subgroup based on the following distinctive characters: outer side of metacoxa evenly rugose (in *C. elongata* sp. nov.) and punctuate-rugulose (in *C. khuzestanensis* sp. nov.). *Cotesia khuzestanensis* sp. nov., when compared with the congeneric Palearctic *C. setebis*, can be easily separated by the predominant character: first tergite being parallel sided and about 1.3 times as long as its apical width; it can be separated from the other congenics *C. ordinaria* (Ratzeburg, 1844) (distributed in the Palearctic and Oriental regions) and *C. orestes* (Nixon, 1974) (distributed in the Palearctic region) by the following combination of characters: inner spur of metatibia slightly longer than outer, as long as half of metabasitarsus; penultimate segment of antenna 1.4 times as long as wide and r oblique to fore margin of pterostigma. *Cotesia elongata* can be separated from the closely allied species *C. ruficrus* by the penultimate segment of the antenna 2–2.2 (–2.3) times as long as wide and the third tergite 0.7–0.8 times as long as the second tergite. *Cotesia zagrosensis* sp. nov. belongs to the *glomeratus* subgroup based on the outer side of the metacoxa being smooth with no evident sculpture. *Cotesia zagrosensis* sp. nov. can be easily separated from *C. onaspis* and *C. notha* by the predominant character: the second tergite is conspicuously transverse and four times as long as the median length.

The majority of the taxonomic or biological studies on the genus *Cotesia* include the central and northern parts of Iran (Davatchi & Chodjai 1969; Modarres Awal 1997; Karimpour *et al.* 2001; Abbasipour &

Taghavi 2002, 2004; Alizadeh & Moghaddam 2004; Ghahari *et al.* 2009, 2011a, 2011b, 2011c, 2011d, 2012a, 2012b; Lashkari Bod *et al.* 2011; Naderian *et al.* 2012; Ghahari & Fischer 2012; Sakenin *et al.* 2012; Khajeh *et al.* 2014; Samin 2015; Farahani *et al.* 2016; Samin *et al.* 2018). Prior studies reported 34 species of *Cotesia* from Iran. With three new species and two new records in the present study, the total number of species is raised to 39 (Table 1). Additionally, with the description of three new species, the total number of species of *Cotesia* across the globe reaches approximately three hundred.

Despite the current species diversity of the genus in Iran now being 39 species, more species can be expected to be found in the future when more comprehensive collections and studies are done. Further integrated taxonomic, molecular and faunistic research along with the host association is essentially required for this genus to better understand its species complexity. When compared with other geographical regions of the world, the known diversity of *Cotesia* in Iran is still preliminary. Many new taxa are likely to be discovered from Iran in the future, and thus this checklist will need to be periodically updated.

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