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A Taxonomic Study of the Genus *Exallonyx* (Hym.: Proctotrupidae) in Northern Iran, with Six New Records for Iranian Fauna

M. Izadizadeh¹, A. A. Talebi^{1*}, V. A. Kolyada², and E. Rakhshani³

ABSTRACT

A survey on the genus *Exallonyx* Kieffer, 1904 (Hymenoptera: Proctotrupidae) was conducted in northern Iran. The specimens were collected using Malaise traps during 2010–2011. The genus *Exallonyx* and six species were collected and identified for the first time from Iran: *Exallonyx ater* (Gravenhorst, 1807), *E. brevicornis* (Haliday, 1839), *E. formicarius* Kieffer, 1904, *E. ligatus* (Nees, 1834), *E. minor* Townes, 1981 and *E. nixonii* Townes, 1981. A key is presented for identification of *Exallonyx* species occurring in northern Iran.

Keywords: Diagnostic characters, Identification key, Parasitoids wasps.

INTRODUCTION

The Proctotrupidae are a medium family of parasitoids wasps. The latest revision of this family was prepared by Townes and Townes (1981) who listed 310 species belonging to 25 genera in the world. Later, two new genera have been described from Taiwan (Lin, 1988) and two new genera from China (Fan and He, 1993; He and Xu, 2007). Currently, the family Proctotrupidae include two subfamilies (Austroserphinae Kozlov, 1970 and Proctotrupinae Latreille, 1802), four tribes, 29 genera, and about 404 species in the world (Xu and He, 2010; He and Xu, 2011a, b; Liu *et al.*, 2011; Choi *et al.*, 2012; Kolyada, 2012). Members of the subfamily Proctotrupinae are classified in three tribes: Disogmini Kozlov, 1970, Cryptoserphini Kozlov, 1970 and Proctotrupini Latreille, 1802 (Townes and Townes, 1981). The tribe Proctotrupini consists of nine genera and about 270 species in the world (Xu and He, 2010; He

and Xu, 2010, 2011a, b; Liu *et al.*, 2011; Choi *et al.*, 2012; Kolyada, 2012).

The genus *Exallonyx* Kieffer, 1904 with about 200 species is the largest genus of the family Proctotrupidae and has a worldwide distribution (Townes and Townes, 1981; Fan and He, 2003; He and Fan, 2004; Kolyada *et al.*, 2004; He *et al.*, 2006; Liu *et al.*, 2006a, b, c; Xu *et al.*, 2007 a, b). Species of this genus are larval parasitoids of rove beetles (Coleoptera: Staphylinidae) (Hedqvist, 1963; Hoebeke, 1978; Townes and Townes, 1981). The genus *Exallonyx* consists of two subgenera *Eocodrus* Pschorn-Walcher, 1958 and *Exallonyx* (*s. str.*) Kieffer, 1904. The subgenus *Eocodrus* includes five species in the world, all species being reported from the West Palearctic region (Townes and Townes, 1981). Species of the subgenus *Exallonyx* (*s. str.*) are classified in 11 species-groups (Townes and Townes, 1981). Only 16 species (belonging to four species-groups) have been reported from the West Palearctic region: *Ater* group (two species),

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Formicarius group (11 species), *Obsoletus* group (two species) and *Wasmanni* group (single species) (Townes and Townes, 1981; Hedqvist, 2007; Wall, 2011).

Only two species of the family Proctotrupidae (e. g. *Proctotrupes gravidator* (Linnaeus, 1758) and *Phaneroserphus punctibasis* Townes, 1981) have recently been reported from Iran (Izadizadeh et al., 2014, 2015). Up to now, no data are available on the genus *Exallonyx* in Iran. In this study, we aimed to collect and present data on the occurrence of *Exallonyx* species in northern Iran.

MATERIALS AND METHODS

Sampling surveys were conducted using Malaise traps at different locations in northern provinces of Iran (Alborz, Guilan, Mazandaran, and Qazvin). Eight Malaise traps were placed in each province in different habitats such as forests, rangelands, and orchards. The specimens were extracted from the traps and sorted weekly, transferred to ethyl alcohol 70% and then stored in the freezer, for further studies. For the preparation of samples, they were transferred to a mixture of 40% xylene and 60% alcohol 96%, after two days to amyl acetate for one day, and finally placed on a piece of absorbing paper for drying (AXA method, van Achterberg, 2009). The dried specimens were card mounted and labeled. Relevant literatures (Townes and Townes, 1981; Kolyada, 1998) were used for identification of the specimens. Illustrations were taken using an OlympusTM SZX9 stereomicroscope equipped with a BMZ-04-DZTM digital imaging system (Behin Pajouhesh Co., Iran). A series of 4–5 captured images were merged into a single in-focus image using the image-stacking software, Combine ZP1.0. The terminology for morphological characters follows Townes and Townes (1981) and Kolyada (1998). All specimens are deposited in the insect

collection of the Department of Entomology, Tarbiat Modares University, Tehran (TMUC).

Abbreviations used in the key and diagnosis are: OOL (distance between posterior ocellus and eye margin), POL (distance between posterior ocelli), epomia (a carina on the side of the pronotum, obliquely crossing the trough in the side of the pronotum).

RESULTS

Six species of the genus *Exallonyx* were collected and identified from various locations in northern Iran. All species are new records for the fauna of Iran and include the followings:

Family Proctotrupidae Latreille, 1802

Subfamily Proctotrupinae Latreille, 1802

Tribe Proctotrupini Latreille, 1802

Genus *Exallonyx* Kieffer, 1904

Type Species: *Exallonyx formicarius* Kieffer, 1904

Description

Front of head with a ridge or carina between antennal sockets; mandible with a single tooth; lateral aspect of pronotum smooth, except for a carina that parallels margin of collar and its upper part is continuous with epomia (if epomia is present), upper margin of pronotum with a setal band that is 1–5 setae wide and expanded on hind corner of pronotum, pronotum with setae in front of carina on collar, sometimes a few setae behind epomia and upper end of carina on collar, and sometimes with setae between middle and lower part of carina on collar and the pronotal sulcus, elsewhere the pronotum is always smooth and glabrous; front and middle tarsal claws stramineous to light brown, with a long black divergent tooth near base, hind tarsal claws sometimes with a short black tooth basally, apical segments of front and middle tarsi

unusually small; length of fore wing 1.6–5.8 mm., costal side of radial cell 1.0 to 2.0 times as long as width of pterostigma, radius descending briefly from lower corner of pterostigma then turned at a right angle towards costa; metasomal stalk (petiole) 0.5 to 3.5 times as long as its width; setae on syntergite usually very sparse, sometimes moderately dense; length of ovipositor sheath 0.2 to 0.7 times as long as hind tibia, tapered from base, decurved, its surface punctate, striate, or both punctate and striate.

Key to Species of the Genus *Exallonyx* in North of Iran (Female Base)

- 1- Ovipositor sheath with sparse punctures **2**
 - Ovipositor sheath with longitudinal striations. **5**
- 2- Distance between lowest setae on syntergite below the second thyridia from lower edge of syntergite more than 3.0 times longer than setae (Figure 5-c); setae on sides of syntergite very sparse (Figure 5c) .. **Exallonyx minor Townes, 1981**
 - Distance between lowest setae on syntergite below second thyridia from lower edge of syntergite 2.0 times as long as setae or less (Figures 1-c, 2-c, 6-c). **3**
- 3- Distance between lowest setae on syntergite below second thyridia from lower edge of syntergite about 2.0 times as long as setae (Figure 6-c) and distance between lowest setae below third thyridia from lower edge of syntergite about 3.0 times as long as setae (Figure 6-c) **Exallonyx nixonii Townes, 1981**
 - Distance between lowest setae on syntergite below second and third thyridia from lower edge of syntergite about 1.0 times as long as setae or less (Figures 1-c and 2-c) **4**
- 4- Sides of syntergite with short setae (Figure 1-c), distance between lowest setae on syntergite below second and third thyridia from lower edge of syntergite

about 1.0 times as long as setae (Figure 1-c) **Exallonyx ater (Gravenhorst, 1807)**

- Sides of syntergite with long setae (Figure 2-c), distance between lowest setae on syntergite below second and third thyridia from lower edge of syntergite very short, setae close to lower edge of syntergite (Figure 2-c) **Exallonyx brevicornis (Haliday, 1839)**

5- Length of head 1.1 times as long as its width in dorsal view (Figure 3-a), POL shorter than OOL (Figure 3-a), metapleuron and posterior face of propodeum finely rugose (Figure 3-c) **Exallonyx formicarius Kieffer, 1904**

-Length of head 0.9 times as long as its width in dorsal view (Figure 4-a), POL longer than OOL (Figure 4-a), metapleuron and posterior face of propodeum coarsely rugose (Figure 4-c) **Exallonyx ligatus (Nees, 1834)**

Exallonyx (Exallonyx) ater (Gravenhorst, 1807) (Figure 1)

Synonyms: *Codrus ater* Gravenhorst, 1807: Gravenhorst (1807: 263)

Proctotrypes aterrimus Dalla Torre, 1898: Dalla Torre (1898: 462)

Exallonyx xanthocerus Kieffer, 1908: Kieffer (1908: 332)

Exallonyx syriacus Kieffer, 1908: Kieffer (1908: 334)

Exallonyx filicornis Kieffer, 1908: Kieffer (1908: 341)

Exallonyx ligatus var. *coxalis* Kieffer, 1908: Kieffer (1908: 345)

Exallonyx gracilis Nixon, 1938: Nixon (1938: 435, 439)

Material Examined: Qazvin Province, Zereskh Road (36° 25' 23.88" N, 50° 06' 37.68" E, 1,926 m asl), 06-vii-2011, 1 ♀; leg. A. Nadimi.

Diagnosis: Length of body 3.8 mm; clypeus nearly flat, 2.5 times as wide as long (Figure 1-b); pronotum with epomia strong, with a few setae behind it and upper end of carina on collar; metasomal stalk (petiole) 0.75 times as long as its height in lateral view (Figure 1-c);

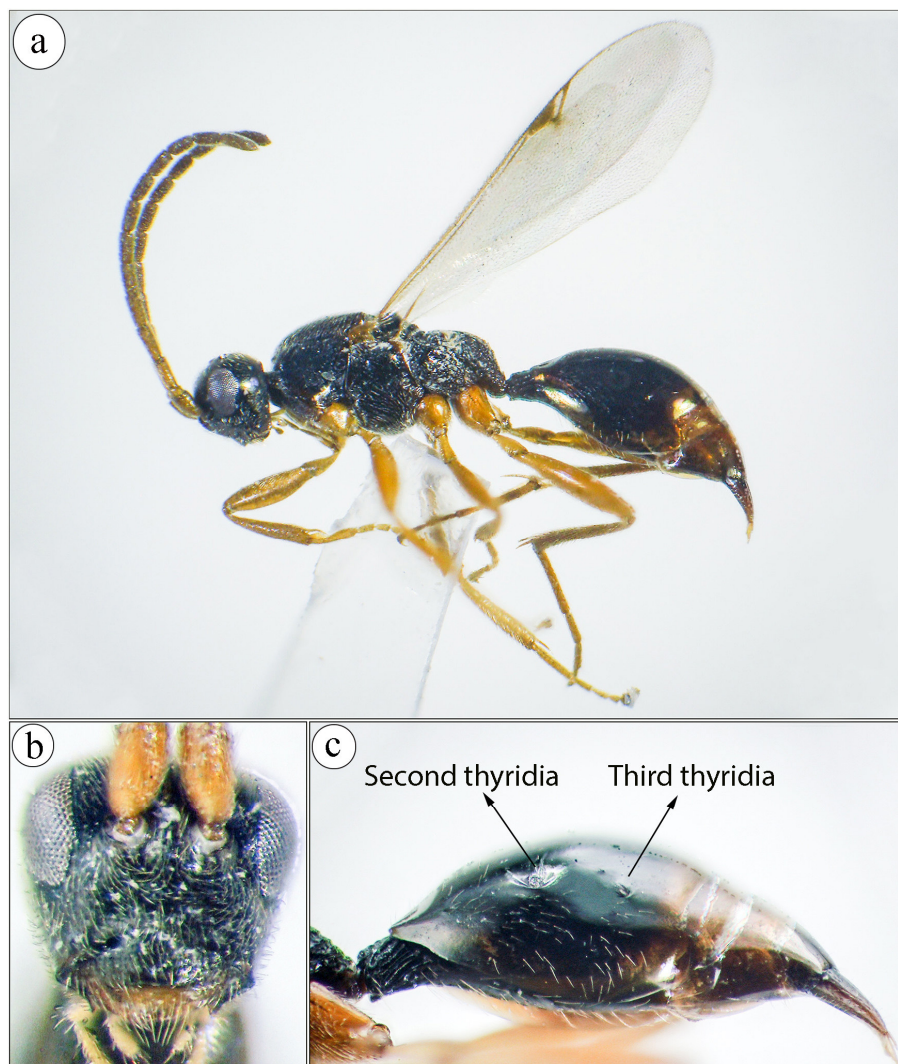


Figure 1. *Exallonyx ater*: (a) Lateral habitus of female; (b) Head front view, (c) Metasoma, lateral view

distance between lowest setae on syntergite below second and third thyridia from lower edge of syntergite almost equal to setal length (Figure 1-c); ovipositor sheath with sparse punctures, its length 0.38 times as long as hind tibia.

Biology: This species has been reported as larval parasitoid of *Ocytus olens* (Muller, 1764) and *Creophilus maxillosus* (Linnaeus, 1758) (Coleoptera: Staphylinidae) (Hedqvist, 1963; Hoebeke, 1978).

Distribution: Europe (Townes and Townes, 1981) and Iran (new record).

***Exallonyx (Eocodrus) brevicornis*
(Haliday, 1839) (Figure 2)**

Synonyms: *Proctotrupes brevicornis* Haliday, 1839: Haliday (1839: 9) *Codrus (Eocodrus) brevicornis* (Haliday, 1839): Pschorn-Walcher (1958: 62)

Material Examined: Mazandaran Province, Noor, Chamestan, Tangehvaz (36° 18' 51.42" N, 52° 07' 48.00" E, 1,353 m asl), 16-viii-2011, 1 ♀; leg. M. Khayrandish.

Diagnosis: Length of body 3.4 mm; width



Figure 2. *Exallonyx brevicornis*: (a) Lateral habitus of female; (b) Antennae, (c) Metasoma, lateral view.

of clypeus 2.5 times its median height; flagellum short, second flagellar segment 2.0 times longer than its maximum width (Figure 2-b); stalk of metasoma (petiole) with scattered setae, its length 0.5 times as long as its height in lateral view (Figure 2-c); side of syntergite with moderately dense setae (Figure 2-c), lowest setae below second and third thyridia closer to lower edge of syntergite (Figure 2-c); ovipositor sheath with sparse punctures, its length 0.25

times as long as hind tibia.

Biology: This species has been reported as larval parasitoid of *Quedius vexans* Eppelsheim, 1881 (Coleoptera: Staphylinidae) (Hoebeke, 1978; Townes and Townes, 1981).

Distribution: Holarctic region (Pschorn-Walcher, 1964; Townes and Townes, 1981), Iran (new record).



***Exallonyx (Exallonyx) formicarius*
Kieffer, 1904 (Figure. 3)**

Synonym: *Codrus formicarius* (Kieffer, 1904): Dessart (1975: 8)

Material Examined: Guilan Province, Roodsar, Rahimabad, Ziaz ($36^{\circ} 52' 27.18''$ N, $50^{\circ} 13' 24.78''$ E, 490 m asl), 09-viii-2010, 1 ♀; leg. M. Khayrandish.

Diagnosis: Length of body 2.6 mm; clypeus 3.0 times as wide as long; length of head 1.1 times as long as its width in dorsal view (Figure 3-a), POL shorter

than OOL (Figure 3-a); pronotum without epomia, with a few setae behind position of epomia; metapleuron and posterior face of propodeum finely rugose (Figure 3-c); length of metasomal stalk (petiole) 0.85 times as long as its height in lateral view (Figure 3-c); ovipositor sheath with longitudinal striate, its length 0.55 times as long as hind tibia.

Biology: Unknown.

Distribution: Europe (Townes and Townes, 1981) and Iran (new record).

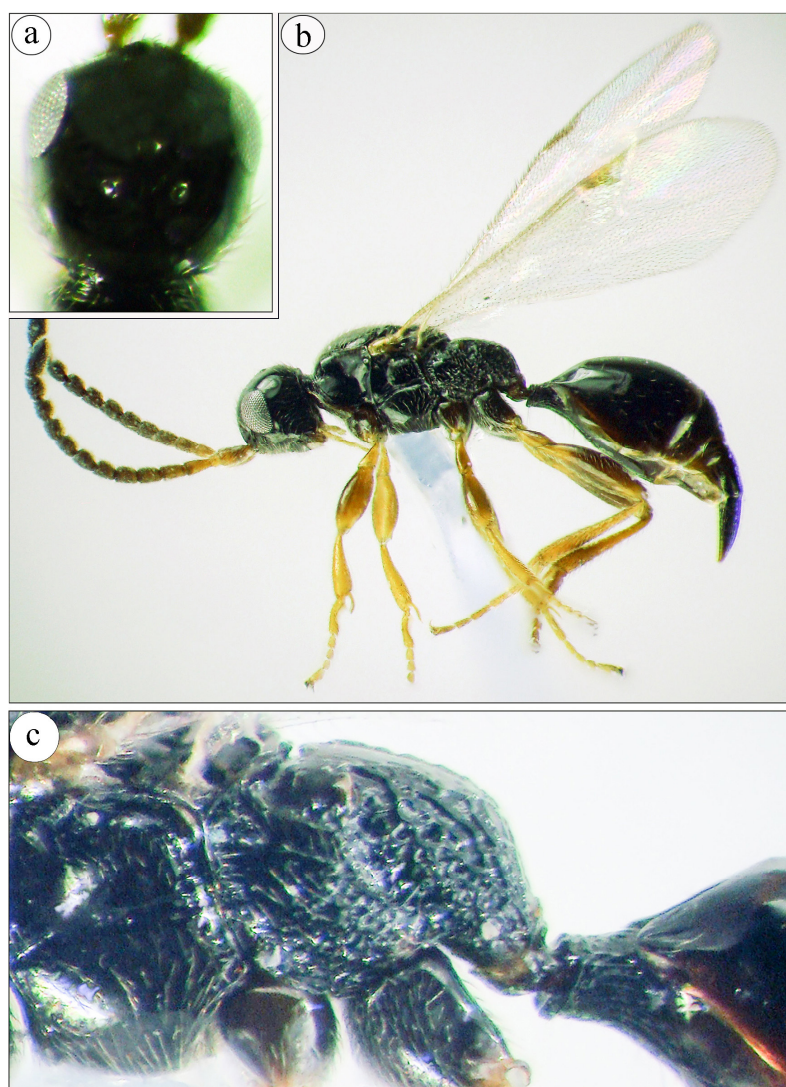


Figure 3. *Exallonyx formicarius*: (a) Head, dorsal view; (b) Lateral habitus of female, (c) Metapleuron, propodeum and metasomal stalk (petiole), lateral view.

***Exallonyx (Exallonyx) ligatus* (Nees, 1834) (Figure 4)**

Synonyms: *Codrus ligatus* Nees, 1834: Nees (1834: 359)

Proctotrupes ligatus (Nees, 1834): Haliday (1839: 8)

Codrus (Codrus) ligatus Nees, 1834: Pschorn-Walcher (1958: 62)

Material Examined: Alborz Province, Chalous Road, Arangeh (35° 55' 07.20" N,

51° 05' 09.24" E, 1,891m asl), 06-vii-2010, 1 ♀, 16-viii, 2010, 1 ♀, 31-viii-2010, 1 ♀, Alborz province, Chalous Road, Shahrestanak (35° 57' 34.98" N, 51° 22' 20.34" E, 2,305 m asl), 28-vii-2010, 1 ♀; leg. A. Nadimi.

Diagnosis: Length of body 3.4–4.0 mm; clypeus 2.7 times as wide as long; length of head 0.9 times as long as its width in dorsal view (Figure 4-a), POL longer than OOL (Figure 4-a); 2nd flagellar segment 1.6 times

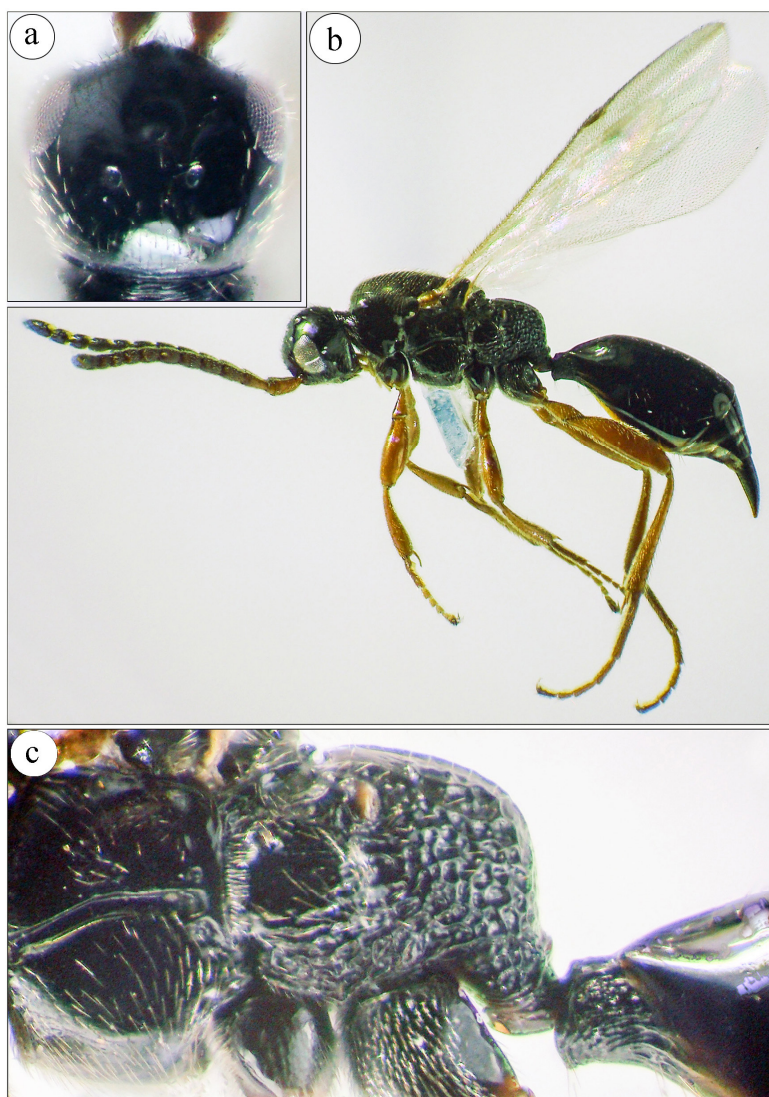


Figure 4. *Exallonyx ligatus*: (a) Head, dorsal view; (b) lateral habitus of female, (c) Metapleuron, propodeum and metasomal stalk (petiole), lateral view.



longer than its maximum width, 10th flagellar segment 1.4 times longer than its maximum width; pronotum with epomia absent or weak, with a few hairs behind position of epomia and upper end of carina on collar; metapleuron and posterior face of propodeum coarsely rugose (Figure 4-c); length of metasomal stalk (petiole) 0.6 times as long as its height in lateral view (Figure 4-c); ovipositor sheath with longitudinal striate, its length 0.5 times as long as hind tibia.

Biology: This species has been reported as larval parasitoid of *Quedius vexans* Eppelsheim, 1881, *Q. simplicifrons* Fairmaire, 1861, *Aleochara bilineata* Gyllenhaal, 1810, *Xantholinus* sp. and *Philonthus* sp. (Coleoptera: Staphylinidae)

(Hedqvist, 1963; Hoebeke, 1978).

Distribution: Europe, Japan (Pschorn-Walcher, 1964; Townes and Townes, 1981) and Iran (new record).

***Exallonyx (Exallonyx) minor* Townes, 1981 (Figure 5)**

Material Examined: Guilan Province, Roodsar, Rahimabad, Ziaz (36° 52' 34.44" N, 50° 13' 17.40" E, 537 m asl), 19-iv-2010, 1 ♀, Mazandaran Province, Noor, Faculty of Natural Resources and Marine Sciences (36° 34' 52.98" N, 52° 02' 45.78" E, -14 m bsl), 26-v-2011, 1 ♀; leg. M. Khayrandish.

Diagnosis: Length of body 2.4–2.6 mm; clypeus 2.4 times as wide as long; scape and

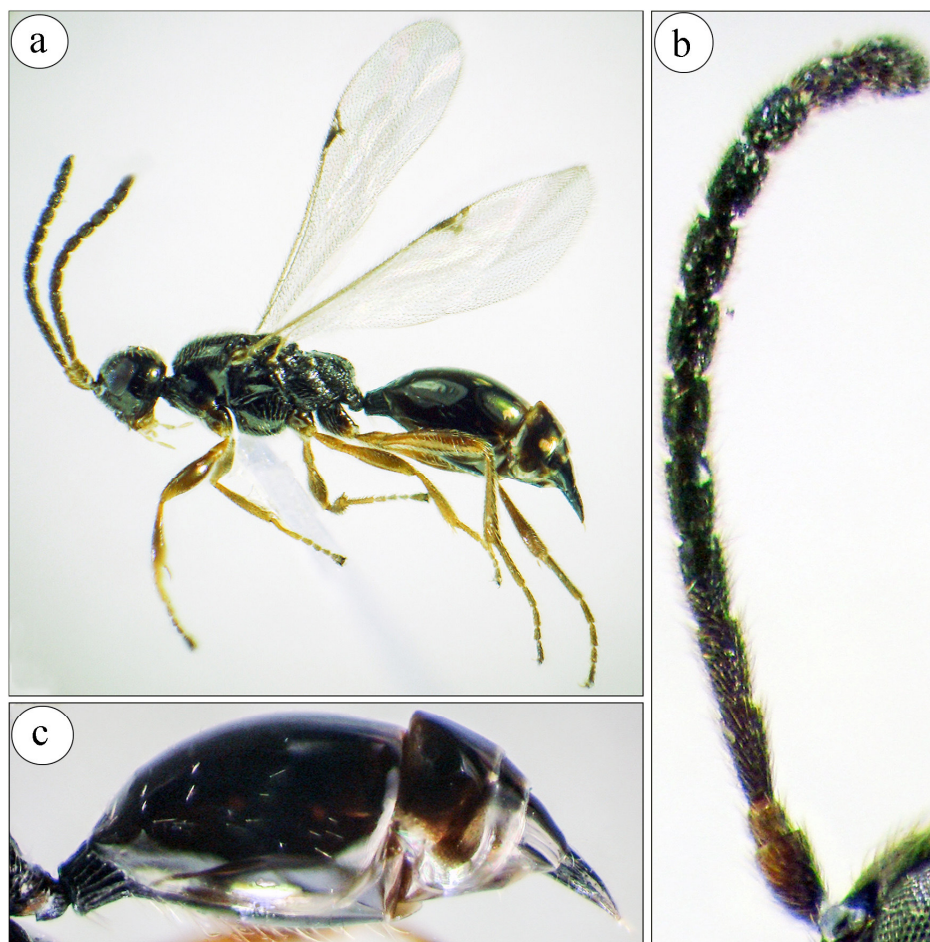


Figure 5. *Exallonyx minor*: (a) Lateral habitus of female; (b) Antennae, (c) Metasoma, lateral view.

pedicel yellow, flagellum dark brown (Figure 5-b); pronotum with epomia strong, no setae behind epomia and upper end of carina on collar; length of metasomal stalk (petiole) 0.6 times as long as its height in lateral view (Figure 5-c); base of syntergite with median groove, its length 0.5 times as long as the distance between base of syntergite to first thyridia; distance between lowest setae on syntergite below second thyridia from lower edge of syntergite about 3.0 times as long as setae (Figure 5-c); ovipositor sheath with sparse punctures, its length 0.45 times as long as hind tibia.

Biology: Unknown.

Distribution

Europe, Nearctic region (Townes and Townes, 1981) and Iran (new record).

Exallonyx (Exallonyx) nixon Townes, 1981 (Figure 6)

Material Examined: Alborz Province, Chalous Road, Arangeh (35° 55' 07.20" N, 51° 05' 09.24" E, 1,891 m asl), 20-vii-2010, 2 ♀♀; leg. A. Nadimi.

Diagnosis: Length of body 3.1–3.3 mm; clypeus 2.5 times as wide as long, with a narrow apical truncation that is concave



Figure 6. *Exallonyx nixon*: (a) Lateral habitus of female; (b) Head, front view, (c) Metasoma, lateral view.



beneath and bordered anteriorly by a ridge (Figure 6-b); pronotum with epomia strong, with a few setae behind epomia and upper end of carina on collar, and a few setae between lower half of carina on collar and the pronotal sulcus; length of metasomal stalk (petiole) 0.9 times as long as its height in lateral view (Figure 6-c); base of syntergite with median groove, its length 0.6 times as long as the distance between base of syntergite to first thyridia; distance between lowest setae on syntergite below second thyridia from lower edge of syntergite about 2.0 times as long as setae and below third thyridia from lower edge of syntergite about 3.0 times as long as setae (Figure 6-c); ovipositor sheath with sparse punctures, its length 0.32 times as long as hind tibia.

Biology: Unknown.

Distribution: Europe (Townes and Townes, 1981) and Iran (new record).

DISCUSSION

Eighteen species of the genus *Exallonyx* are known from Europe (Pschorn-Walcher, 1971; Townes and Townes, 1981; Hedqvist, 2007; Wall, 2011). During the first study in Iran, we found six species of this genus in the northern provinces. Concerning the neighboring countries, only two (*E. brevicornis* and *E. formicarius*) are also recorded from Russia (Townes and Townes, 1981). In this study, the *Exallonyx* specimens were collected using Malaise traps and, therefore, their hosts are unknown. However, previous studies revealed that the species of the genus *Exallonyx* are larval parasitoid of rove beetles of the genera *Quedius*, *Ocypus*, *Xantholinus* and *Philonthus* (Staphylinidae) (Hedqvist, 1963; Hoebeke, 1978). Some species of the above mentioned genera of rove beetles have recently been reported from north of Iran (Samin et al., 2011), where we have collected the *Exallonyx* species.

Due to the rich general biological diversity in Iran, we expect that many more species of *Exallonyx* occur in Iran. So far, only a small part of the country has been explored for this purpose and major parts with highly variable climatic conditions and vegetations remain to be explored. Therefore, further studies are needed to clarify the distribution of the family Proctotrupidae in other parts of Iran.

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مطالعه تاکسونومیک زنبورهای جنس *Exallonyx* (Hym.: Proctotrupidae) در شمال ایران، با شش گزارش جدید برای فون ایران

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چکیده

این تحقیق در مورد زنبورهای جنس *Exallonyx* Kieffer, 1904 (Hymenoptera: Proctotrupidae) در شمال ایران انجام شد. نمونه برداری با استفاده از تله مالیز در طی سالهای ۱۳۸۹-۱۳۹۰ صورت گرفت. جنس *Exallonyx* و شش گونه از این جنس جمع آوری و برای اولین بار از ایران گزارش شد. گونه های شناسایی شده عبارتند از: *Exallonyx ater* (Gravenhorst, 1807)، *E. formicarius* Kieffer, 1904، *E. brevicornis* (Haliday, 1839) و *E. nixoni* Townes, 1981 و *E. minor* Townes, 1981، *ligatus* (Nees, 1834). کلید شناسایی گونه های جنس *Exallonyx* در شمال ایران ارائه گردید.