

# The cuckoo bee genus *Sphecodes* Latreille, 1804 (Hymenoptera, Halictidae) in Iran

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## Abstract

An overview is provided of the Iranian fauna of cleptoparasitic bee species in the genus *Sphecodes* Latreille (Halictinae: Halictini: Sphecodina). In total, 25 species are recorded from Iran, eight of which are newly recorded for the country: *Sphecodes anatolicus* Warncke, 1992, *S. croaticus* Meyer, 1922, *S. haladai* Warncke, 1992, *S. pectoralis* Morawitz, 1876, *S. rubicundus* Hagens, 1875, *S. rufiventris* (Panzer, 1798), *S. saxicolus* Warncke, 1992, and *S. tadschicus* Blüthgen, 1935. A new species *S. ebmeri* Astafurova & Proshchalykin, **sp. n.** (Mazandaran) is described and illustrated. For many species of *Sphecodes* the distribution data within Iran are enlarged.

## Keywords

taxonomy, new species, new records, fauna, Palaearctic region

## Introduction

*Sphecodes* Latreille, 1804 is a large genus of family Halictidae distributed worldwide except in the Polar Regions. Most *Sphecodes* species are cleptoparasites of *Lasioglossum* Curtis and *Halictus* Latreille (Halictidae), but some attack nests of other pollen-collecting

short-tongued bees, *Nomioides* Schenck (Halictidae), *Andrena* Fabricius, *Calliopsis* Smith, *Melitturga* Latreille, and *Perdita* Smith (Andrenidae), *Colletes* Latreille and *Lonchopria* Vachal (Colletidae), and perhaps *Dasypoda* Latreille (Melittidae) (Michener 2007).

The present paper is part of a series of works dealing with the bees of the genus *Sphcodes* of the territory of the Palaearctic region (Astafurova and Proshchalykin 2014, 2015a, b, c, 2016a, b, 2017a, b, c, 2018, Astafurova et al. 2014, 2015, 2018a, b, c). Currently 77 species are known from this region, but the *Sphcodes* fauna of Iran is particularly under-recorded.

There are currently 862 species of bee known from Iran (Ascher and Pickering 2018), but new records and species continue to be added (e.g., Khodaparast and Monfared 2012, Khaghaninia et al. 2013, Nadimi et al. 2014; Kuhlmann and Proshchalykin 2015, Safi et al. 2018, Proshchalykin and Kuhlmann 2018). The genus *Sphcodes* has been one of the more overlooked taxa partly due to the complexity of positively identifying material. Only one species – *Sphcodes persicus* Blüthgen, 1924 (= *S. pinguius* Pérez, 1903) of this genus has been described from Iran (Blüthgen 1924) so far, and in total only 16 species have been recorded for the country (Warncke 1992, Ascher and Pickering 2018). Records of *Sphcodes* from Iran in other published sources (Bogusch and Straka 2012, Özbek et al. 2015, Astafurova and Proshchalykin 2017b) were not original and referenced from a previous paper (Warncke 1992).

Here we have attempted to build a survey of Iranian material available and to provide an overview of the 25 species found across Iran. Of these species, eight are recorded for the first time for the Iranian fauna and one species is described as new. For each species we provide a list of Iranian localities from the material examined and give previously published occurrences along with a summary of the wider distribution.

## Materials and methods

The results presented in this paper are based on 324 specimens collected in Iran and currently housed in the Zoological Institute (St. Petersburg, Russia) and private collection of Maximilian Schwarz (Ansfelden, Austria). Acronyms for collections from which specimens were borrowed or are deposited are as follows: OÖLM – Oberösterreichisches Landesmuseum, Linz, Austria; PCMS – private collection of Maximilian Schwarz, Ansfelden, Austria; ZISP – Zoological Institute, Russian Academy of Sciences, St. Petersburg, Russia.

The taxonomy and distribution of species generally follows that of Warncke (1992), Bogusch and Straka (2012), Astafurova and Proshchalykin (2017b), and Özbek et al. (2015). A detailed current synonymy of the species has been given by Astafurova and Proshchalykin (2017b). Morphological terminology employed below follows that of Michener (2007) and Engel (2001). The ventral surfaces of some flagellomeres bear a distinctive patch or zone of sensilla trichodea A (sensu Årgent and Svensson 1982), and we refer to these as the “tyloids”, easily observable under light microscopy. The abbreviations F, T, and S are used for flagellomere, metasomal tergum, and metasomal

sternum, respectively. The density of integumental punctures is described using the following formula: puncture diameters (in  $\mu\text{m}$ ) / ratio of distance between punctures to average puncture diameter, e.g., 15–20  $\mu\text{m}$  / 0.5–1.5. Integumental sculpturing, aside from distinctive surface punctation, is described as follows: reticulate: superficially net-like or made up of a network of raised lines; rugose: irregular, nonparallel, wrinkled raised lines (rugae); tessellate: a regular network of shallow grooves with flat interspaces.

Specimens were studied with the use of a Leica M205A stereomicroscope and photographs taken with a combination of stereomicroscope Olympus SZX10 and digital camera Canon EOS70D. Final images representing a composite of several photographs taken at different focal planes and combined using Helicon Focus 6. All images were post-processed for contrast and brightness using Adobe Photoshop.

The species are presented alphabetically and those that could not be inspected in this paper are quoted from published sources. Provinces are presented in alphabetical order and the names of provinces are given in bold type. New distributional records are noted with an asterisk (\*).

## Taxonomy

### *Sphecodes albilabris* (Fabricius, 1793)

**Published records.** Warncke 1992: 50 (map); Ascher and Pickering 2018 (Alborz, Tehran).

**Material examined.** Golestan: 70 km E Minudasht, 1050 m, 12.VI.2010, (1 ♀), leg. M. Halada [PCMS]. Semnan: 10 km W Damghan, 10.VI.2010, (1 ♀), leg. M. Halada [PCMS].

**Distribution.** Europe (north to Finland and Sweden), North Africa, Caucasus, Turkey, Iran (Alborz, \*Golestan, Tehran, Semnan), Central Asia, Syria, Israel, Russia (east to Far East), China (Liaoning, Inner Mongolia, Hebei, Beijing, Shanxi, Gansu).

### *Sphecodes alternatus* Smith, 1853

**Published records.** Warncke 1992: 47 (map); Ascher and Pickering 2018 (Isfahan, Tehran).

**Material examined.** East Azerbaijan: 10 km E Shabeslar, 1540 m, 19.VI.2010, (1 ♂), leg. M. Halada [PCMS]. Golestan: 70 km E Minudasht, 1050 m, 12.VI.2010, (1 ♂), leg. M. Halada [PCMS]. Kerman: 30 km S Sirjan, 1730 m, 7.VI.2010, (3 ♂), leg. M. Halada [PCMS]. Mazandaran: 20 km S Amoi, 430 m, 6.VI.2014, (4 ♂), leg. J. Halada [PCMS]; 10 km S Chaloos, 380 m, 15.VI.2010, (5 ♂), leg. M. Halada [PCMS].

**Distribution.** South and Central Europe, North Africa, Caucasus, Turkey, Iran (\*East Azerbaijan, \*Golestan, Isfahan, \*Kerman, \*Mazandaran, Tehran), Central Asia, Russia (east to Khakass Republic), China (Gansu, Xinjiang).

***Sphecodes anatolicus* Warncke, 1992**

**Material examined.** East Azerbaijan: 10 km E Shabeslar, 1540 m, 19.VI.2010, (1 ♂), leg. M. Halada [PCMS].

**Distribution.** Italy (Sicily), Georgia, Armenia, Turkey, \*Iran (East Azerbaijan), Central Asia.

***Sphecodes crassus* Thomson, 1870**

**Published records.** Ascher and Pickering 2018 (Mazandaran).

**Material examined.** Mazandaran: Elbrus, 50 km S Chalus, 2800 m, 26.VII.1977, (1 ♀, 8 ♂), leg. A. Ebmer [PCMS]. West Azerbaijan: Serou, 1650 m, 28.V.2010, (2 ♀), leg. M. Halada [PCMS].

**Distribution.** Europe (north to 64°), Russia (east to Far East), North Africa, Caucasus, Turkey, Iran (Mazandaran, \*West Azerbaijan), Central Asia, Mongolia, China (Inner Mongolia, Shanxi), Japan (Hokkaido, Honshu).

**Variation.** Specimens from Iran differ from specimens from the rest of the range by having an entirely dark metasoma with distinctly punctate T2 in male.

***Sphecodes croaticus* Meyer, 1922**

**Material examined.** East Azerbaijan: 10 km E Shabestar, 1540 m, 19.VI.2010, (1 ♂), M. Halada [PCMS].

**Distribution.** South and Central Europe, Russia (European part), Caucasus, Turkey, \*Iran (East Azerbaijan), Turkmenistan.

***Sphecodes ebmeri* Astafurova & Proshchalykin, sp. n.**

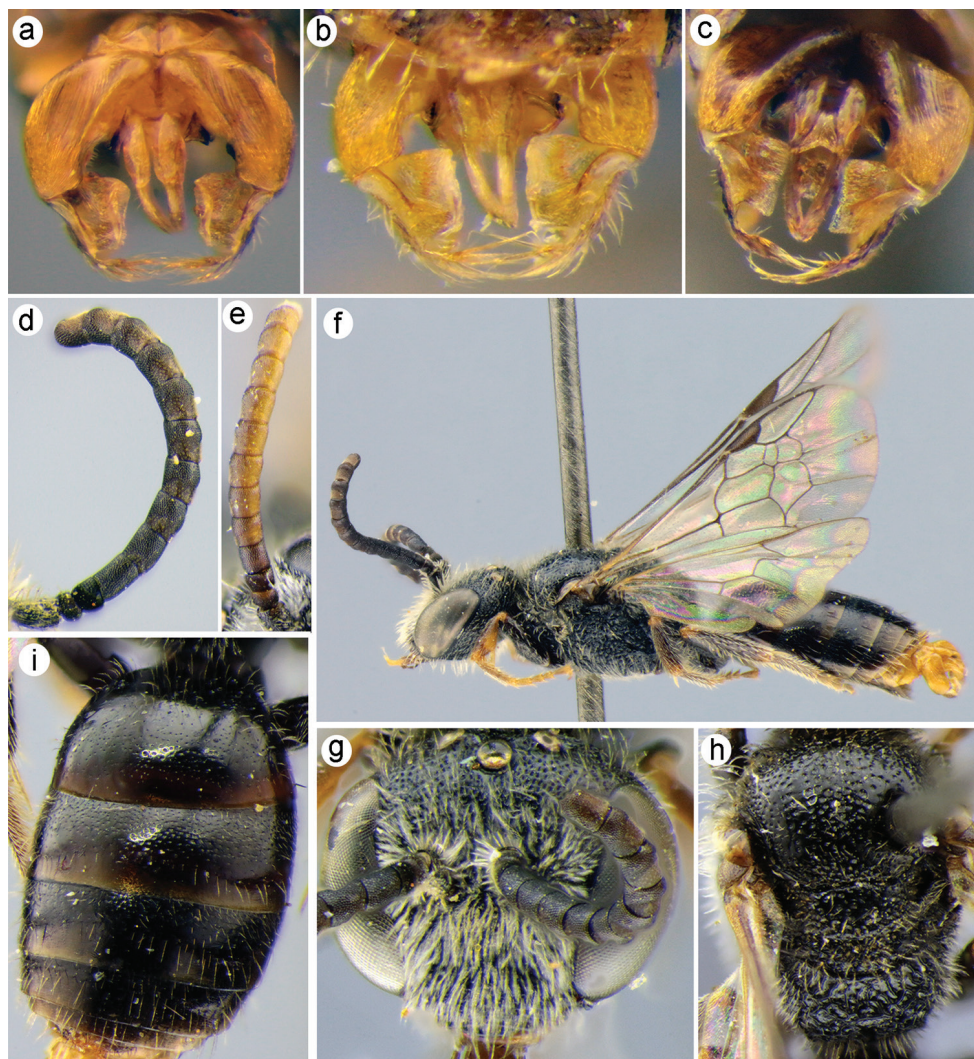
<http://zoobank.org/3F92729D-F60F-4655-8DA6-F3D4ECDF7BC>

Figure 1 a–e, g

**Material examined.** Holotype ♂: Iran, Mazandaran, Elbrus, 50 km S (90 km Straße) Chalus, 2800 m, 26.VII.1977, leg. A.W. Ebmer [OÖLM].

**Diagnosis.** The male is close to *Sphecodes nomioideis* Pesenko, 1979 owing to similar structure, sculpture of the body including distinctly punctate metasomal terga and similar small trapezoidal gonostylar shape (Fig. 1a, b). In gonostylar shape the new species is also close to *S. geoffrellus* (Kirby, 1802) (Fig. 1c), but differs from both species by having less developed tyloids covering about 1/2 ventral surface of flagellomeres (Fig. 1d) (covering at least 4/5 ventral surface of flagellomeres in *S. nomioideis* and *S. geoffrellus*) (Fig. 1e).

**Description.** (Male). (Fig. 1f). Total body length 5.5 mm. Head (Fig. 1g) black (except brown mouthparts and antenna); weakly transverse, at most 1.1 times as wide as long; vertex not elevated, distance from top of head to upper margin of a lateral ocellus



**Figure 1.** *Sphecodes ebmeri* Astafurova & Proshchalykin, sp. n., holotype, male (**a, d, f–i**), *S. nomioides* Pesenko, male (**b, e**), and *S. geoffrellus* (Kirby), male (**c**): **a–c** genitalia, dorsal view **d, e** antennae, lateral view **f** habitus, lateral view **g** head, frontal view **h** mesosoma, dorsal view **i** metasoma, dorsal view.

about 2 lateral ocellar diameters as seen in dorsal view; antenna attain middle of mesoscutum, F1 transverse, 0.75 times as long as wide, F2 1.3 times as long as wide, remaining flagellomeres about 1.2 times as long as wide; tyloids (from F3 onwards) covering about 1/2 ventral surface of flagellomeres; clypeus, paraocular area and frons with confluent punctures (15–25  $\mu$ m); area between ocellus and eye with punctures separated at most by 1.5 of a puncture diameter; vertex behind ocellus and gena rugose; face below antennal toruli with snow-white, plumose pubescence, obscuring the underlying integument.

Mesosoma black; mesoscutum and mesoscutellum with coarse punctures (20–30  $\mu$ m) separated by 0.5–2 puncture diameters (Fig. 1h); mesepisternum and hy-

poepimeral area shiny, reticulate-rugose, with sparse, erect, plumose pubescence; propodeal triangle (metapostnotum) and remainder of propodeum shiny, coarsely rugose; femur dark brown, tibia and tarsi brownish with yellow. Hind wing with basal vein strongly curved; costal margin with 5 hamuli.

Metasoma (Fig. 1i) dark-brown; terga distinctly punctate (ca 10  $\mu\text{m}$  / 2–4); marginal zones impunctate, smooth on T1 and T2 and finely tessellate on T3 and T4; sterna finely tessellate with sparse microscopic setae pores; gonocoxite dorsally with impression; membranous part of gonostylus small, trapezoidal.

**Female** unknown.

**Etymology.** This species is dedicated to the Austrian hymenopterist Andreas W. Ebmer in recognition of his outstanding contributions to bee researches.

**General distribution.** Only known from the type locality in Iran (Mazandaran).

### *Sphecodes ephippius* (Linnaeus, 1767)

**Published records.** Warncke 1992: 42 (map); Ascher and Pickering 2018 (Mazandaran, Zanjan).

**Material examined.** Golestan: 40 km Minudasht, 750 m, 1.VI.2014, (1 ♂), leg. J. Halada [PCMS]. Mazandaran: 10 km N Gashar, 2300 m, 7.VI.2014, (1 ♀), leg. J. Halada [PCMS].

**Distribution.** Europe (north to 62°), Caucasus, Turkey, Iran (\*Golestan, Mazandaran, Zanjan), Central Asia, Mongolia, Russia (east to Irkutsk Prov.), China (Xinjiang).

### *Sphecodes gibbus* (Linnaeus, 1758)

**Published records.** Warncke 1992: 49 (map); Ascher and Pickering 2018 (Alborz, Mazandaran, Qazvin, Tehran).

**Material examined.** East Azerbaijan: 10 km E Shabeslar, 1540 m, 19.VI.2010, (1 ♀, 7 ♂), leg. M. Halada [PCMS]. Gilan: 15 km SE Tutkaban, 1100 m, 9.VI.2014, (2 ♀), leg. J. Halada [PCMS]; Tulkaban near Roodbar, 16.VI.2010, (1 ♂), leg. M. Halada [PCMS]. Fars: 10 km E Kazerum, 1990 m, 23.V.2014, (2 ♀, 2 ♂), leg. J. Halada [PCMS]. Golestan: 70 km E Minudasht, 1050 m, 12.VI.2010, (2 ♀, 97 ♂), leg. M. Halada [PCMS]. Kerman: 30 km S Sirjan, 1730 m, 7.VI.2010, (21 ♂), leg. M. Halada [PCMS]; Deh Bakri, 1640 m, 3.VI.2010, (1 ♂), leg. M. Halada [PCMS]; 8 km N Bardsir, 2050 m, 6.VI.2010, (1 ♂), leg. M. Halada [PCMS]; 25 km E Jiroft (Mijan), 1650 m, 27.V.2014, (1 ♀, 1 ♂), leg. M. Halada [PCMS]. Razavi Khorasan: Gerirud[=Tedzhen] River, Khorasan, 9.IV.1898, (1 ♀), leg. N. Zarudny [ZISP]. West Azerbaijan: Serou, 1650 m, 28.V.2010, (1 ♀), leg. M. Halada [PCMS].

**Distribution.** Europe (north to 63°), North Africa, Turkey, Iran (Alborz, \*East Azerbaijan, \*Fars, \*Gilan, \*Golestan, \*Kerman, Mazandaran, Qazvin, \*Razavi Kho-

rasan, Tehran, \*West Azerbaijan), Pakistan, Israel, Central Asia, Mongolia, Russia (east to Yakutia), China (Xinjiang), India (Assam, Sikkim).

### *Sphecodes haladai* Warncke, 1992

**Material examined.** Kerman: 20 km E Ghobria, 1780 m, 5.VI.2010, (1 ♀), leg. M. Halada [PCMS].

**Distribution.** \*Iran (Kerman), Central Asia.

### *Sphecodes longulus* Hagens, 1882

**Published records.** Ascher and Pickering 2018 (Zanjan).

**Material examined.** East Azerbaijan: Tavriz [=Tebriz], 6.VI.1914, (1 ♀), leg. Andrievskiy [ZISP].

**Distribution.** Europe (north to Finland, Sweden, Denmark and England), Turkey, Iran (\*East Azerbaijan, Zanjan), Syria, Central Asia, China (Gansu, Shanxi, Hebei, Inner Mongolia), Russia (east to Far East), Japan (Hokkaido, Kyushu, Honshu, Okinawa).

### *Sphecodes majalis* Pérez, 1903

**Published records.** Ascher and Pickering 2018 (Alborz).

**Material examined.** Hamadan: 100 km NE Hamadan, 2100 m, 22.V.1975, (1 ♂), leg. Y. Ressler [PCMS]. Lorestan: Dorud, Laninabad, 670 m, 11.V.2016, (1 ♀), leg. M. Kafka [PCMS]. West Azerbaijan: Serou, 1650 m, 28.V.2010, (3 ♂), leg. M. Halada [PCMS]; Ilam pr. Ada Man, Dinar Gaouh, 1830 m, 12.V.2016, (2 ♀, 3 ♂), leg. M. Kafka [PCMS].

**Distribution.** Europe (north to the Netherlands), Russia (European part), North Africa, Caucasus, Turkey, Iran (Alborz, \*Hamadan, \*Lorestan, \*West Azerbaijan).

### *Sphecodes monilicornis* (Kirby, 1802)

**Published records.** Warncke 1992: 44 (map); Ascher and Pickering 2018 (Alborz, East Azerbaijan, Mazandaran, Zanjan).

**Material examined.** East Azerbaijan: Sis, 10 km E Shabestar, 1540 m, 19.VI.2010, (1 ♂), leg. M. Halada [PCMS]. Fars: Pab E Neyriz, 2060 m, 18.V.1978, (1 ♀), leg. K. Warncke [PCMS]; 15 km SE Sarvestan, 1800 m, 17.V.1978, (1 ♀), leg. M. Kraus [PCMS]. Gilan: Tulkabon near Roodbar, 16.VI.2010, (2 ♂), leg. M. Halada [PCMS]; 15 km SE Tulkabon, 1100 m, 9.VI.2014, (1 ♀), leg. M. Halada [PCMS]. Golestan: 70 km E Minudasht, 1050 m, 12.VI.2010, (1 ♀), leg. M. Halada [PCMS]. Kerman:

50 km N Sabzavaran, 2170 m, 24.V.1978, (1 ♀, 1 ♂), leg. K. Warncke [PCMS]; 25 km E Jiroft (Mijan), 1650 m, 27.V.2014, (1 ♀, 3 ♂), leg. J. Halada [PCMS]; 40 km S Sirjan, 1870 m, 29.V.2014, (6 ♂), leg. J. Halada [PCMS]. Kohgiluyeh and Boyer-Ahmad: Kuh Gol near Sisakht, 9.VI.2010, (1 ♀), leg. M. Halada [PCMS]. Mazandaran: 10 km S Chaloos, 380 m, 15.VI.2010, (5 ♀, 21 ♂), leg. M. Halada [PCMS]; 20 km S Amoi, 430 m, 6.VI.2014, (1 ♂), leg. J. Halada [PCMS]. North Khorasan: 10 km W Raz, Kopet Dag, 1200 m, 27.V.2014, (1 ♀, 1 ♂), leg. J. Halada [PCMS]. Sistan and Baluchestan: Khash, Iranshekhr, 21.V.1955, (1 ♀), leg. D. Steinberg [ZISP]. South Khorasan: Birjand, 18.VI.1896, (1 ♂), leg. N. Zarudny [ZISP].

**Distribution.** Europe (north to 64°), North Africa, Caucasus, Turkey, Iran (Alborz, East Azerbaijan, \*Fars, \*Gilan, \*Golestan, \*Kerman, \*Kohgiluyeh and Boyer-Ahmad, Mazandaran, \*North Khorasan, \*Sistan and Baluchestan, \*South Khorasan, Zanjan), Pakistan, Central Asia, Mongolia, China (Heilongjiang), Russia (east to Far East), India (Jammu, Kashmir).

### *Sphecodes olivieri* Lepeletier de Saint Fargeau, 1825

**Published records.** Warncke 1992: 46 (map); Ascher and Pickering 2018 (Hamadan, Isfahan, Tehran).

**Material examined.** Golestan: 70 km E Minudasht, 1050 m, 12.VI.2010, (1 ♀, 3 ♂), M. Halada [PCMS]. Kerman: Jupar, 1900 m, 1.VI.2010, (1 ♀), leg. M. Halada [PCMS]; Raziabad, 1160 m, 4.VI.2010, (2 ♂), leg. M. Halada [PCMS]; 20 km E Ghobria, 1780 m, 5.VI.2010, (2 ♀, 6 ♂), leg. M. Halada [PCMS]; 8 km N Bardsir, 2050 m, 6.VI.2010, (1 ♀, 3 ♂), leg. M. Halada [PCMS]; 30 km S Sirjan, 1730 m, 7.VI.2010, (3 ♂), leg. M. Halada [PCMS]. Khuzestan: Half Tapeh, 300 km N di Abadan, Canale Dario, 30.VI.1965, (2 ♂), leg. Giordani Soika, Mavromoustakis [PCMS].

**Distribution.** South Europe, Russia (South of European part), North Africa, Caucasus, Turkey, Iran (\*Golestan, Hamadan, Isfahan, \*Kerman, \*Khuzestan, Tehran), Pakistan, Israel, Arabian Peninsula, Central Asia, China (Gansu, Xinjiang), India (Gujarat).

### *Sphecodes pectoralis* Morawitz, 1876

**Material examined.** Razavi Khorasan: "Khorasan", 3–4.VIII.1901, (1 ♀), leg. N. Zarudny [ZISP].

**Distribution.** \*Iran (Razavi Khorasan), Central Asia, China (Gansu, Xinjiang).

### *Sphecodes pellucidus* Smith, 1845

**Published records.** Ascher and Pickering 2018 (Isfahan, Kermanshah, Mazandaran, Tehran).

**Material examined.** East Azerbaijan: Sis, 10 km E Shabeslar, 1540 m, 19.VI.2010, (15 ♂), leg. M. Halada [PCMS]. Gilan: 15 km SE Tutkabon, 1100 m, 9.VI.2014, (1 ♀), leg. J. Halada [PCMS]. Kerman: Jupar, 1900 m, 1.VI.2010, (1 ♀), leg. M. Halada [PCMS]; 20 km E Ghobria, 1780 m, 5.VI.2010, (8 ♂), leg. M. Halada [PCMS]. West Azerbaijan: Serou, 1650 m, 28.V.2010, (1 ♀), leg. M. Halada [PCMS].

**Distribution.** Europe (north to 66°), North Africa, Turkey, Iran (\*East Azerbaijan, Isfahan, Kermanshah, Mazandaran, Tehran), Central Asia, Mongolia, Russia (east to Far East), China (Gansu, Xinjiang, Sichuan).

### *Sphecodes pinguiculus* Pérez, 1903

**Published records.** Blüthgen 1924: 509, as *Sphecodes persicus*; Warncke 1992: 52 (map); Ascher and Pickering 2018 (Iran, without province).

**Material examined.** Fars: Monti steppici, 5 km N Di Persepolis, 6.VII.1965, (1 ♀), leg. Giordani Soika, Mavromoustakis [PCMS]. Hamadan: Hamadan, 10.VIII.1964, (1 ♂), leg. G. Bohart [PCMS]. Khuzestan: Half Tapeh, 300 km N di Abadan, Canale Dario, 30.VI.1965, (1 ♀), leg. Giordani Soika, Mavromoustakis [PCMS]. Tehran: Elburz, Pulour, 22 km N di Ab Ali, 11.VII.1965, (1 ♀), leg. Giordani Soika, Mavromoustakis [PCMS].

**Distribution.** South Europe, North Africa, Turkey, Israel, Iran (\*Fars, Hamadan, \*Khuzestan, Tehran), Central Asia, Mongolia, China (Gansu, Inner Mongolia), Russia (east to Buryatia), Cape Verde Islands.

### *Sphecodes puncticeps* Thomson, 1870

**Published records.** Ascher and Pickering 2018 (Alborz, Hamadan, Tehran).

**Material examined.** East Azerbaijan: Sis, 10 km E Shabeslar, 1540 m, 19.VI.2010, (1 ♀, 13 ♂), leg. M. Halada [PCMS]. Fars: 10 km E Kazerum, 1990 m, 23.V.2014, (1 ♀), leg. J. Halada [PCMS]; Dasht Arjan, 2040 m, 6.V.2016, (1 ♀), leg. M. Kafka [PCMS].

**Distribution.** Europe (north to Finland and Sweden), North Africa, Turkey, Iran (Alborz, \*East Azerbaijan, \*Fars, Hamadan, Tehran), Israel, Central Asia, Mongolia, Russia (east to Far East).

### *Sphecodes reticulatus* Thomson, 1870

**Published records.** Ascher and Pickering 2018 (Alborz).

**Material examined.** No material examined.

**Distribution.** Turkey, Iran (Alborz), Central Asia, Russia (east to Irkutsk Prov.).

***Sphecodes rubicundus* Hagens, 1875**

**Material examined.** West Azerbaijan: Serou, 1650 m, 28.V.2010, (1 ♀), leg. M. Halada [PCMS].

**Distribution.** Europe (north to 56°), Russia (European part), North Africa, Caucasus, Turkey, \*Iran (West Azerbaijan).

***Sphecodes rufiventris* (Panzer, 1798)**

**Material examined.** Fars: 10 km E Kazerum, 1990 m, 23.V.2014, (2 ♀), leg. J. Halada [PCMS]. Gilan: 15 km SE Tutkabon, 1100 m, 9.VI.2014, (1 ♂), leg. J. Halada [PCMS]. Mazandaran: 15 km S Alamdeh, 530 m, 7.VI.2014, (1 ♂), leg. J. Halada [PCMS].

**Distribution.** Europe (north to 57°), North Africa, Turkey, \*Iran (Fars, Mazandaran), Central Asia, Russia (east to Khakass Republic).

***Sphecodes saxicolus* Warncke, 1992**

**Material examined.** Kerman: Zurabad, 3.IV.1898, (1 ♀), leg. N. Zarudny [ZISP].

**Distribution.** \*Iran (Kerman), Central Asia.

***Sphecodes scabricollis* Wesmael, 1835**

**Published records.** Ascher and Pickering 2018 (Mazadaran).

**Material examined.** No material examined.

**Distribution.** Europe (north to southern England and Latvia), Caucasus, Turkey, Iran (Mazadaran), Central Asia, China (Heilongjiang, Liaoning, Beijing, Shaanxi, Qinghai, Zhejiang), Russia (east to Far East), South Korea, Japan (Hokkaido, Honshu, Shikoku, Kyushu), India (Tamil Nadu).

***Sphecodes schenckii* Hagens, 1882**

**Published records.** Warncke 1992: 48 (map); Bogusch and Straka 2012: 17 (Iran, without province); Ascher and Pickering 2018 (Alborz).

**Material examined.** No material examined.

**Remark.** We examined some specimens determined by K. Warncke, P. Bogusch, J. Starka and M. Schwarz from Iran deposited in PCMS and concluded that *Sphecodes schenckii* has been confused with *S. tadschicus* Blüthgen in Popov, 1935. The specimen recorded from Alborz Province (Ascher and Pickering 2018) probably also belongs to

*S. tadschicus* Blüthgen in Popov, 1935. Nevertheless records of this species in north-western provinces of Iran are certain in the future as it is known from Caucasus and Turkey.

**Distribution.** Europe (north to Germany), Russia (European part), Caucasus, Turkey, Iran (?), Israel.

### *Sphecodes spinulosus* Hagens, 1875

**Published records.** Ascher and Pickering 2018 (Alborz, Mazandaran).

**Material examined.** Lorestan: 10 km Dorud, 1520 m, 27.V.2014, (1 ♀), leg. J. Halada [PCMS].

**Distribution.** Europe (north to 56°), North Africa, Turkey, Iran, Central Asia, Russia (east to Altai).

### *Sphecodes tadschicus* Blüthgen in Popov, 1935

*Sphecodes schenkii*: Warncke 1992: 48, part.; Bogusch and Straka 2012: 17, part.

**Material examined.** East Azerbaijan: Sis, 10 km E Shabestar, 1540 m, 19.VI.2010, (1 ♂), leg. M. Halada [PCMS]. Gilan: 15 km SE Tutkabon, 1100 m, 9.VI.2014, (1 ♀), leg. J. Halada [PCMS]. Golestan: 70 km E Minudasht, 1050 m, 12.VI.2010, (2 ♀, 1 ♂), leg. M. Halada [PCMS]. Semnan: Chashm, 2232 m, 5-7.VII.2011, (1 ♂), leg. A. Timokhov [ZISP]. Mazandaran: Bastam, 27.VI.1965, (1 ♀), leg. Matile [PCMS]; Damavand, 2800 m, 7-8.VII.2011, (1 ♀), leg. A. Timokhov [ZISP]; 20 km S Amol, 430 m, 6.VI.2014, (1 ♀), J. Halada [PCMS]. Yazd: Sanij, 1-4.VI.2011, (1 ♂), leg. A. Timokhov [ZISP].

**Distribution.** \*Iran, Central Asia.

## Discussion

Iran is a mostly mountainous country, with a landscape dominated by mountain ranges that separate various basins or plateaux from one another. A great variety of terrestrial ecosystems are situated on the territory of Iran: desert, semi-desert, steppe, forest steppe, forests and woodlands. However, dry biotopes occupy the majority of the Country and only 7% of the surface area is forested (most forest is found on the mountain slopes). Landscape and biotope diversity have a great effect on the diversity of bees, observable in the *Sphecodes* fauna of Iran, which includes forest species of temperate zoneas well as steppe and desert species of subtropics and endemic mountain species.

The majority of the *Sphecodes* fauna of Iran is formed by 14 widespread species, distributed from Europe to West Siberia or even to the Russian Far East and Japan: These are *S. albilabris*, *S. alternatus*, *S. crassus*, *S. ephippius*, *S. gibbus*, *S. longulus*, *S. monilicornis*,

**Table 1.** List of *Sphecodes* species recorded in Iran, Turkey, Caucasus and Central Asia.

|               | <i>Sphecodes</i> species                               | Iran      | Turkey    | Caucasus  | Central Asia |
|---------------|--------------------------------------------------------|-----------|-----------|-----------|--------------|
| 1             | <i>Sphecodes albilabris</i> (Fabricius, 1793)          | +         | +         | +         | +            |
| 2             | <i>S. alternatus</i> Smith, 1853                       | +         | +         | +         | +            |
| 3             | <i>S. anatolicus</i> Warncke, 1992                     | +         | +         | +         | +            |
| 4             | * <i>S. armeniacus</i> Warncke, 1992                   | –         | +         | –         | +            |
| 5             | <i>S. barbatus</i> Blüthgen, 1923                      | –         | +         | –         | –            |
| 6             | * <i>S. crassanus</i> Warncke, 1992                    | –         | +         | –         | –            |
| 7             | <i>S. crassus</i> Thomson, 1870                        | +         | +         | +         | +            |
| 8             | * <i>S. cristatus</i> Hagens, 1882                     | –         | +         | +         | +            |
| 9             | <i>S. croaticus</i> Meyer, 1922                        | +         | +         | +         | +            |
| 10            | * <i>S. dusmeti</i> Blüthgen, 1924                     | –         | +         | –         | +            |
| 11            | <i>S. ebmeri</i> Astafurova & Proshchalykin, sp. n.    | +         | –         | –         | –            |
| 12            | <i>S. ephippius</i> (Linné, 1767)                      | +         | +         | +         | +            |
| 13            | * <i>S. ferruginatus</i> Hagens, 1882                  | –         | +         | +         | +            |
| 14            | * <i>S. geoffrellus</i> (Kirby, 1802)                  | –         | +         | +         | +            |
| 15            | <i>S. gibbus</i> (Linnaeus, 1758)                      | +         | +         | +         | +            |
| 16            | * <i>S. hakkariensis</i> Warncke, 1992                 | –         | +         | –         | +            |
| 17            | <i>S. haladai</i> Warncke, 1992                        | +         | –         | –         | +            |
| 18            | <i>S. hyalinatus</i> Hagens, 1882                      | –         | –         | +         | +            |
| 19            | * <i>S. intermedius</i> Blüthgen, 1923                 | –         | +         | +         | +            |
| 20            | <i>S. longulus</i> Hagens, 1882                        | +         | +         | +         | +            |
| 21            | <i>S. majalis</i> Pérez, 1903                          | +         | +         | +         | –            |
| 22            | <i>S. miniatus</i> Hagens, 1882                        | –         | –         | +         | +            |
| 23            | <i>S. monilicornis</i> (Kirby, 1802)                   | +         | +         | +         | +            |
| 24            | * <i>S. niger</i> Hagens, 1874                         | –         | +         | +         | –            |
| 25            | * <i>S. nomioideis</i> Pesenko, 1979                   | –         | +         | –         | –            |
| 26            | * <i>S. nurekensis</i> Warncke, 1992                   | –         | –         | –         | +            |
| 27            | <i>S. olivieri</i> Lepeletier de Saint Fargeau, 1825   | +         | +         | +         | +            |
| 28            | <i>S. pectoralis</i> Morawitz, 1876                    | +         | –         | –         | +            |
| 29            | <i>S. pellucidus</i> Smith, 1845                       | +         | +         | +         | +            |
| 30            | <i>S. pesenkoi</i> Astafurova & Proshchalykin, 2018    | –         | –         | –         | +            |
| 31            | <i>S. pinguiculus</i> Pérez, 1903                      | +         | +         | +         | +            |
| 32            | <i>S. pseudofasciatus</i> Blüthgen, 1925               | –         | +         | +         | –            |
| 33            | <i>S. puncticeps</i> Thomson, 1870                     | +         | +         | +         | +            |
| 34            | <i>S. reticulatus</i> Thomson, 1870                    | +         | +         | +         | +            |
| 35            | <i>S. rubicundus</i> Hagens, 1875                      | +         | +         | +         | –            |
| 36            | <i>S. ruficrus</i> (Erichson, 1835)                    | –         | +         | +         | –            |
| 37            | <i>S. rufiventris</i> (Panzer, 1798)                   | +         | +         | +         | +            |
| 38            | <i>S. sandykachi</i> Astafurova & Proshchalykin, 2018  | –         | –         | –         | +            |
| 39            | <i>S. saxicolus</i> Warncke, 1992                      | +         | –         | –         | +            |
| 40            | <i>S. scabricollis</i> Wesmael, 1835                   | +         | +         | +         | +            |
| 41            | <i>S. schenckii</i> Hagens, 1882                       | +         | +         | +         | –            |
| 42            | <i>S. schwarzi</i> Astafurova & Proshchalykin, 2015    | –         | –         | –         | +            |
| 43            | <i>S. spinulosus</i> Hagens, 1875                      | +         | +         | +         | +            |
| 44            | <i>S. tadschicus</i> Blüthgen, 1935                    | +         | –         | –         | +            |
| 45            | <i>S. trjapitzini</i> Astafurova & Proshchalykin, 2018 | –         | –         | –         | +            |
| 46            | <i>S. turanicus</i> Astafurova & Proshchalykin, 2017   | –         | –         | –         | +            |
| 47            | <i>S. zangherii</i> Noskiewicz, 1931                   | –         | +         | –         | –            |
| <b>Total:</b> |                                                        | <b>25</b> | <b>34</b> | <b>29</b> | <b>36</b>    |

\* – species probably could be found in Iran; Caucasus – Armenia, Georgia, Azerbaijan, and South European part of Russia; Central Asia – Kazakhstan, Kyrgyzstan, Uzbekistan, Turkmenistan, Tajikistan. The number of *Sphecodes* species are given according to Özбек et al. 2015 (Turkey), Astafurova and Proshchalykin 2017b, and Astafurova et al. 2018 (Central Asia) and Astafurova and Proshchalykin 2016a, b (Caucasus).

*S. pellucidus*, *S. pinguiculus*, *S. puncticeps*, *S. reticulatus*, *S. rufiventris*, *S. scabricollis*, and *S. spinulosus*. Some of these species (*S. ephippius*, *S. reticulatus*, *S. scabricollis*, *S. crassus*) occur in the mountains of Iran where their ranges follow their host ranges from the temperate zone of Palaearctic region. *Sphecodes pinguiculus* is distributed in steppe and desert zones of the Palaearctic region and does not occur above mountain steppe in Iran. Such species as *S. alternatus*, *S. monilicornis*, *S. pellucidus*, *S. albilabris*, *S. gibbus*, *S. longulus*, and *S. puncticeps* are widespread from north to south of Palaearctic region and occur in different native zones from forest to desert. *Sphecodes majalis*, *S. croaticus* and *S. rubicundus* are steppe species, distributed in central and south Europe and reaching north-western Iran through Turkey and the Caucasus. *Sphecodes haladai*, *S. pectoralis*, *S. saxicolus* and *S. tadschicus* are desert and steppe Irano-Turanian species distributed in Central Asia and Iran. *Sphecodes anatolicus* is a rare mountain species known from Mediterranean and Caucasian Regions to Central Asia. *Sphecodes olivieri* is widespread in semi-desert and desert of the Western Palaearctic. *Sphecodes ebmeri* sp. n. is a mountain endemic of Elbrus which also could be found in mountain Turkey and the Caucasus.

In total, 25 species of *Sphecodes* are recorded from Iran. This is distinctly less in comparison with the adjacent fauna of Turkey, Caucasus and Central Asia (Table 1). However this number will probably increase at least by a third and could be richer owing to eleven Western Palaearctic species which could be found in Iran: *S. cristatus*, *S. hakkariensis*, *S. ferruginatus*, *S. nomioidis*, *S. dusmeti*, *S. niger*, *S. nurekensis*, *S. intermedius*, *S. armeniacus*, *S. crassus*, and *S. geoffrellus*. There are some species distributed in southern Europe, Turkey and the Caucasus that could be found in north-western Iran, whereas species mostly distributed in Central Asia could be recorded in central and eastern Iran. Because of these species the Iranian fauna of *Sphecodes* may be more diverse than those of Turkey or Central Asia.

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