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## Three new *Colletes* species from Iran (Hymenoptera, Colletidae)

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**A b s t r a c t :** Three new bee species of the genus *Colletes* LATREILLE, 1802 from the south of Iran are described: *Colletes lutensis* KUHLMANN nov.sp. ♂, *C. rayensis* KUHLMANN nov.sp. ♂ and *C. sirjanensis* KUHLMANN nov.sp. ♂.

**K e y w o r d s :** *Colletes*, new species, bees, Iran.

### Introduction

Iran has a rich but understudied bee fauna and new species are regularly discovered in this country (e.g. WOOD & MONFARED 2022). A similar situation exists with other Aculeata (SCHMID-EGGER et al. 2021). This also applies to the genus *Colletes* where only recently *C. alborzensis* KUHLMANN was described (KUHLMANN 2019) bringing the total number of Iranian species to 42 in this genus.

The deserts and mountains of southern Iran belong to the least explored parts of the country. Thus, it did not come as a surprise when two of us (CSE, WHL) collected three new species in this region (for further details about this trip see SCHMID-EGGER & LIEBIG 2021). Two of them belong to the *C. squamosus* species-group and one to the *C. nanus* group that both have their centers of diversity in xeric environments.

The discovery of three new *Colletes* species in the south of the country is testament to the largely under explored bee diversity of Iran. Only males are known of these species so far but their morphology is so characteristic that they are described here to facilitate further research.

### Material and Methods

Terminology as well as measurements used in the descriptions follows those of MICHENER (2007). Puncture density is expressed as the relationship between puncture diameter (d) and the space between them (i), such as  $i = 1.5d$  or  $i < d$ . T is used as abbreviation of metasomal tergum and S for a metasomal sternum. Body length is measured from the vertex to the apex of the metasoma. The definition of species groups in *Colletes* follows NOSKIEWICZ (1936) and KUHLMANN et al. (2009).

Images were taken with a digital microscope (Keyence VHX-5000) using the VH-Z20R/Z20T (20x to 200x) zoom lens and the OP-42305 super diffused illumination adapter. Images were stacked for extended depth-of-field and processed using Adobe

Photoshop Elements 2021 (Adobe Systems Software Ireland Limited, Republic of Ireland) and then assembled into the figure plates.

## Descriptions of new species

### *Colletes squamosus* species-group

The two new species described below belong to a complex of small bees within the *C. squamosus* species-group that are particularly diverse in deserts and semi-deserts of North Africa, Western and Central Asia. For simplicity and pragmatic reasons, they are here only diagnosed and compared to their closest relatives in Western Asia: *C. alfredjohni* KUHLMANN, *C. askhabadensis* RADOSZKOWSKI, *C. askhabadoides* KUHLMANN & PROSHCHALYKIN, *C. elegans* NOSKIEWICZ, *C. jejunos* NOSKIEWICZ, *C. pseudojejunos* NOSKIEWICZ and *C. salsolae* COCKERELL.

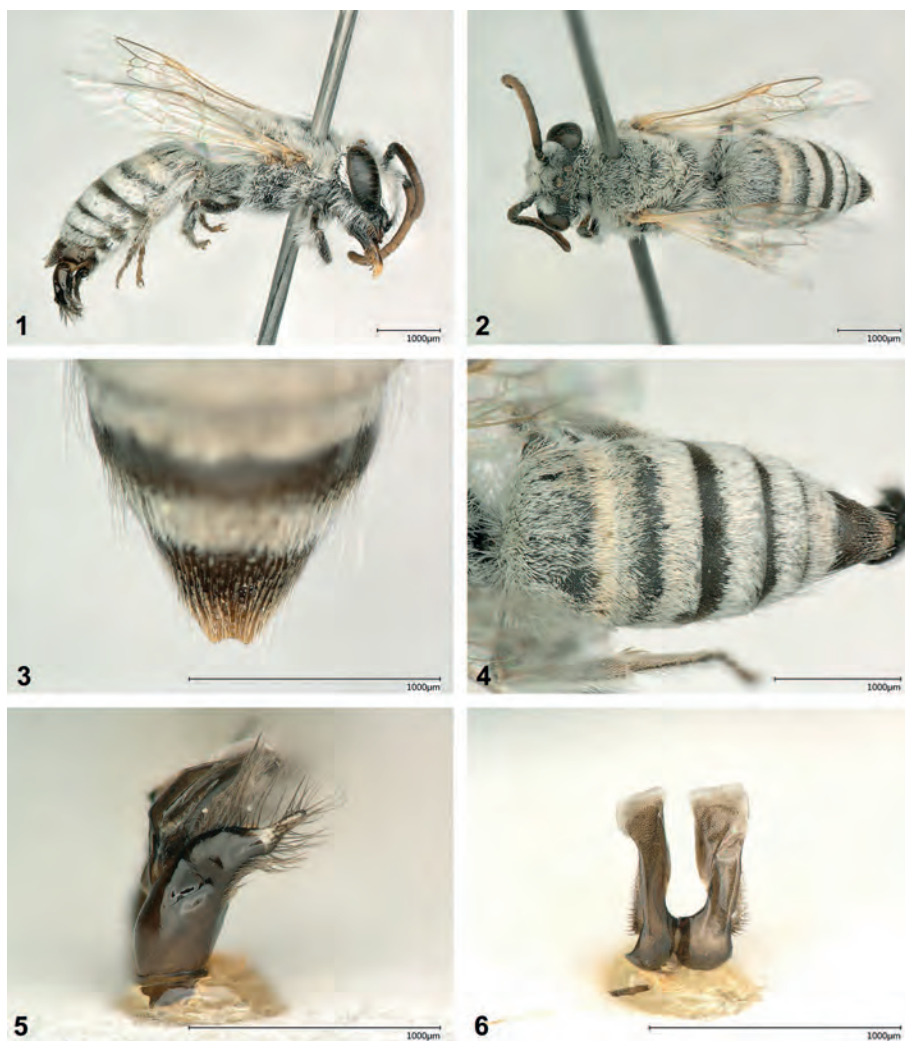
### *Colletes lutensis* KUHLMANN nov.sp. (Figs 1-6)

**Type material:** (6 specimens). **Holotype:** ♂ "Iran, IR-c25, Kerman, Shahdad 7,5 km NE, KF, Wüste, 354m, 30°30'04" N 57°45'06" E, 08.05.2019, W.H. Liebig" (Coll. Kuhlmann, Zoological Museum of Kiel University). **Paratypes:** 4♂♂, same label data as holotype (2♂♂ Coll. Kuhlmann, Zoological Museum of Kiel University, 2♂♂ Coll. Liebig, Bad Muskau); 1♂ "Iran, Kerman prov., 7,5 km NE Shahdad, 30.5011N 57.7518E, 354m, Schmid-Egger lg., 08.05.2019, IR-c25" (Coll. Schmid-Egger, Berlin).

**Diagnosis:** The male of *C. lutensis* is best identified by the specific and characteristic form of S7. It is unique among its relatives by the overall small size and the almost spatulate shape. Here, the apical end of S7 is only slightly wider than its narrowest section near the base (Fig. 6). In all other closely related species S7 is at least slightly larger and its apical end is at least 1.5 times wider than the narrowest section (e.g. Fig. 12).

### Description

**Male:** Body length: 7–8 mm. **Head:** Head wider than long. Integument black except mandible partly dark reddish-brown. Face densely covered with long, white, erect hairs. Malar area medially about 1/3 as long as width of mandible base, finely striate. Antenna black, ventrally yellowish-brown (Fig. 1). **Mesosoma:** Integument black. Mesoscutal disc sparsely ( $i = 1-2d$ ) and finely punctate, between punctures smooth and shiny. Scutellum anteriorly almost impunctate with successively denser punctation posteriorly, surface between punctures smooth and shiny. Mesoscutum, scutellum, metanotum, mesepisternum and propodeum covered with long, greyish-white erect hair (Figs 1, 2). Wings slightly yellowish-brown; wing venation and stigma yellowish-brown, apically dark brown. Integument of legs mostly dark brown, base and end of tibiae mostly reddish-brown, tarsi yellowish-brown. Vestiture white (Fig. 1). **Metasoma:** Integument black except depressed apical tergal margins whitish to yellowish translucent; end of T7 yellowish-brown (Fig. 3). T1 densely covered with long, appressed hairs and few erect slightly yellowish to white hairs, discs of following terga glabrous (Fig. 4). Apical tergal depression and hair bands of T2–3 very broad, much broader than the respective discs and densely covered with long, appressed white hairs, on T4–6 successively narrower; apical tergal depression and hair band of T1 less than half the width of that of T2 (Fig. 4). T1–2 with very fine and dense punctation ( $i = 0.5-1d$ ), between punctures smooth and shiny, punctation on following terga



**Figs 1-6:** *Colletes lutensis* KUHLMANN nov.sp., Holotype male (1) lateral view; (2) dorsal view; (3) metasomal tergum T7; (4) metasoma; (5) gonostylus; (6) metasomal sternum S7.

indistinct. T7 apically narrowly emarginate (Fig. 3). Gonostylus and S7 as illustrated (Figs 5, 6).

**F e m a l e :** Unknown.

**E t y m o l o g y :** The species is named after the Lut Desert (Dasht-e Lut) as it was discovered at the western margin of this region.

**G e n e r a l d i s t r i b u t i o n :** Only known from the north of Kerman Province in the southeast of Iran (Fig. 19).

**F l o r a l h o s t s :** Unknown.



**Figs 7-12:** *Colletes rayensis* KUHLMANN nov.sp., Holotype male (7) lateral view; (8) metasoma; (9) metasomal terga T1-T2; (10) metasomal tergum T7; (11) gonostylus; (12) metasomal sternum S7.

***Colletes rayensis* KUHLMANN nov.sp. (Figs 7-12)**

**Type material:** (1 specimen). **Holotype:** ♂ "Iran, Kerman prov., Rayen, 3 km NE, 29.6220N 57.4590E, 2117m, Schmid-Egger lg., 14.05.2019, IR-c36a" (Coll. Kuhlmann, Zoological Museum of Kiel University).

**Diagnosis:** The male of *C. rayensis* has one of the largest S7 among its relatives and only in *C. elegans* and *C. askhabadensis* it is of similar size. However, in *C. elegans* the overall shape of S7 is different with its narrowest section in the basal third while in *C. rayensis* it is about halfway to the apical end (Fig. 12). *Colletes askhabadensis* clearly is

most closely related to *C. rayensis* and differences are subtle. While in *C. rayensis* the narrow basal section and the widened apical part of S7 are roughly of equal length, in *C. askhabadensis* the narrow basal section is distinctly shorter. In addition, the apical depressions of metasomal terga are broader (Figs 8, 9), the distance between the tips of the apical emargination of T7 wider (Fig. 10) and the gonostylus shorter (Fig. 11) in *C. rayensis* than in *C. askhabadensis*.

### Description

**Male:** Body length: 8 mm. **Head:** Head wider than long. Integument black except mandible partly dark reddish-brown. Face densely covered with long, white, erect hairs. Malar area medially about 1/2 as long as width of mandible base, finely striate. Antenna black, ventrally brown (Fig. 7). **Mesosoma:** Integument black. Mesoscutal disc sparsely ( $i = 1-2d$ ) and finely punctate, between punctures smooth and shiny. Scutellum anteriorly almost impunctate with successively denser punctation posteriorly, surface between punctures smooth and shiny. Mesoscutum, scutellum, metanotum, mesepisternum and propodeum covered with long, greyish-white erect hair (Fig. 7). Wings slightly yellowish-brown; wing venation and stigma yellowish-brown, apically dark brown. Integument of legs mostly dark brown, base and end of tibiae mostly reddish-brown, tarsi yellowish-brown. Vestiture white (Fig. 7). **Metasoma:** Integument black except depressed apical tergal margins whitish to yellowish translucent; end of T7 dark brown (Figs 8–10). T1–2 densely covered with long, appressed hairs and few erect slightly yellowish to white hairs, discs of following terga glabrous (Figs 8, 9). Apical tergal depression and hair bands of T2–3 very broad, much broader than the respective discs and densely covered with long, appressed white hairs, on T4–6 successively narrower; apical tergal depression and hair band of T1 only about 1/3 the width of that of T2 (Fig. 9). T1–2 with very fine and dense punctation ( $i = 0.5-1d$ ), between punctures smooth and shiny, punctation on following terga indistinct. T7 apically broadly emarginate (Fig. 10). Gonostylus and S7 as illustrated (Figs 11, 12).

**Female:** Unknown.

**Etymology:** The species is named after the town Rayen where the only known specimen was found.

**General distribution:** Only known from the type locality in Kerman Province in the southeast of Iran.

**Floral hosts:** Unknown.

### *Colletes nanus* species-group

The new species described below belongs to the *C. nanus* species-group that is particularly speciose in deserts and semi-deserts of North Africa and the Middle East. It is here diagnosed and compared to its relatives in Western Asia that also have a large roundish male S7: *C. arztbergi* KUHLMANN, *C. fuscicornis* NOSKIEWICZ, *C. nanaeformis* NOSKIEWICZ and *C. schwarzi* KUHLMANN. In these species males are very similar in outer morphology and differences are mostly subtle. Thus, the focus is here on the terminalia.

***Colletes sirjanensis* KUHLMANN nov.sp. (Figs 13-18)**

**Type material:** (13 specimens). **Holotype:** ♂ "Iran, IR-c09, Kerman, Sirdschan 45 km S, KF, Steppe, 1725m, 29°00'56''N 55°47'05''E, 05.05.2019, W.H. Liebig" (Coll. Kuhlmann, Zoological Museum of Kiel University). **Paratypes:** 5♂♂, same label data as holotype (1♂ Coll. Kuhlmann, Zoological Museum of Kiel University, 4♂♂ Coll. Liebig, Bad Muskau); 3♂♂ "Iran, Kerman prov., 45 km S Sirdschan, 29.0156N 55.7848E, 1725m, Schmid-Egger lg., 05.05.2019, IR-c09" (2♂♂ Coll. Kuhlmann, Zoological Museum of Kiel University, 1♂ Coll. Schmid-Egger, Berlin; additional 2♂♂ are damaged and not part of the paratype series, Coll. Schmid-Egger, Berlin); 1♂ "Iran, Kerman prov., Rayen, 3 km NE, 29.6220 57.4590E, 2117m, Schmid-Egger lg., 14.05.2019, IR-c36a" (Coll. Schmid-Egger, Berlin); 1♂ "Iran, IR-c26, Kerman, Mahan, Shahzadeh-G., Oase, KF, 354m, 30°01'38''N 57°17'05''E, 09.05.2019, W.H. Liebig" (Coll. Kuhlmann, Zoological Museum of Kiel University); 1♂ "Iran, IR-c35, Kerman, Bam, 40 km NW, 1741m, KF, 29°23'49''N 57°51'02''E, 13.05.2019, W.H. Liebig" (Coll. Kuhlmann, Zoological Museum of Kiel University); 1♂ "Date: 2.IV.2018, Loc: Iran, Busher, Tange eram (29°08'21''N, 51°30'43''E, 935m), Coll: A. Monfared, Code: AM85" (Coll. Kuhlmann, Zoological Museum of Kiel University) (an additional ♂ labelled as "*Colletes cf. schwarzi*" in Coll. Monfared, Yasuj University).

**D i a g n o s i s:** *Colletes sirjanensis* is best characterized and identified by the shape of S7 and the gonostylus (Figs 17, 18). In *C. arztbergi* S7 is distinctly longer than broad and apically truncate (about as broad as long and apically emarginate in *C. sirjanensis*) and tarsi are orange-brown (blackish in *C. sirjanensis*). *Colletes fuscicornis* has a S7 that is about 1.5 times longer and broader, gonostylus is distinctly longer, narrower and parallel-sided. In *C. schwarzi* S7 is almost round while S7 in *C. nanaeformis* has a shape very similar to that of *C. sirjanensis* but is 1/3 smaller and the gonostylus is longer and narrower.

**D e s c r i p t i o n**

**Male:** Body length: 6–8 mm. **Head:** Head wider than long. Integument black except mandible partly dark reddish-brown. Face densely covered with long, white, erect hairs. Malar area medially about 2/3 as long as width of mandible base, finely striate. Antenna black, ventrally yellowish-brown (Fig. 13). **Mesosoma:** Integument black. Mesoscutal disc almost impunctate, smooth and shiny. Scutellum in the anterior half nearly impunctate with a few scattered punctures apically, surface smooth and shiny. Mesoscutum, scutellum, metanotum, mesepisternum and propodeum covered with long, greyish to white erect hairs (Figs 13, 14). Wings slightly yellowish-brown; wing venation and stigma yellowish-brown, apically dark brown. Integument of legs mostly black to dark brown, tarsi partly reddish to yellowish-brown. Vestiture white. **Metasoma:** Integument black except depressed apical tergal margins whitish to yellowish translucent. Anterior half of disc of T1 sparsely covered with short, appressed hairs and disc entirely with few long, erect white hairs (Figs 15, 16); apical tergal depression and hair bands of T2 – T5 about as broad the respective discs and densely covered with short, appressed white hairs; apical tergal depression and hair band of T1 narrower, T2 with broad basal hair band (Figs 15, 16). Terga very finely and densely punctate ( $i < 0.5d$ ), between punctures smooth and shiny (Fig. 16). T7 apically broadly rounded. Gonostylus and S7 as illustrated (Figs 17, 18).

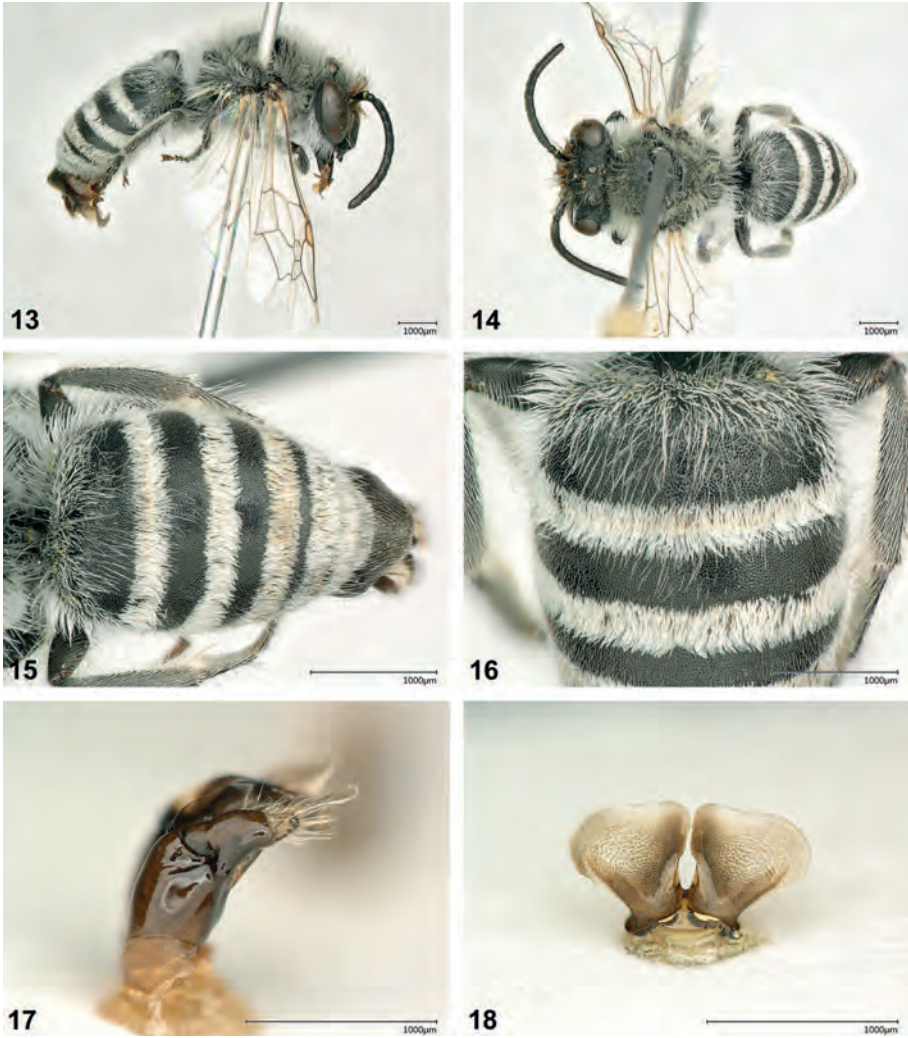
**Female:** Unknown.

**E t y m o l o g y:** The species is named after the city of Sirjan. In the vicinity of Sirjan most of the specimens were collected.

**G e n e r a l d i s t r i b u t i o n:** The species is so far only known from the provinces Kerman and Bushehr in the south of Iran (Fig. 20).

**F l o r a l h o s t s:** Unknown.





**Figs 13-18:** *Colletes sirjanensis* KUHLMANN nov.sp., Holotype male (13) lateral view; (14) dorsal view; (15) metasoma; (16) metasomal terga T1-T2; (17) gonostylus; (18) metasomal sternum S7.



**Figs 19-20:** Habitats of new *Colletes* species. **(19)** Collecting site of *C. lutensis* nov.sp. in desert 7.5 km NE Shahdad ( $30^{\circ}30'04''\text{N}$   $57^{\circ}45'06''\text{E}$ , 8 May 2019); **(20)** Collecting site of *C. sirjanensis* nov.sp. 40 km NW Bam ( $29^{\circ}23'49''\text{N}$   $57^{\circ}51'02''\text{E}$ , 13 May 2019) (Photos W.-H. Liebig).



## Zusammenfassung

Drei neue Bienenarten der Gattung *Colletes* LATREILLE, 1802 werden aus dem Süden Irans erstmals beschrieben: *Colletes lutensis* KUHLMANN nov.sp. ♂, *C. rayensis* KUHLMANN nov.sp. ♂ and *C. sirjanensis* KUHLMANN nov.sp. ♂.

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