

New and little-known bees of the genus *Sphecodes* Latreille, 1804 (Hymenoptera, Apoidea, Halictidae) from Southern and South-Western China

Yulia V. Astafurova¹, Maxim Yu. Proshchalykin², Ze-Qing Niu³,
Michael C. Orr³, Chao-Dong Zhu^{3,4,5}

1 Zoological Institute, Russian Academy of Sciences, Saint Petersburg 199034, Russia **2** Federal Scientific Center of the East Asia Terrestrial Biodiversity, Far East Branch of the Russian Academy of Sciences, Vladivostok 690022, Russia **3** Key Laboratory of Zoological Systematics and Evolution, Institute of Zoology, Chinese Academy of Sciences, Chaoyang District, Beijing 100101, China **4** State Key Laboratory of Integrated Pest Management, Institute of Zoology, Chinese Academy of Sciences, Chaoyang District, Beijing, 100101, China **5** College of Life Sciences, University of Chinese Academy of Sciences, Shijingshan District, Beijing 100049, China

Corresponding author: Maxim Yu. Proshchalykin (proshchalykin@biosoil.ru)

Academic editor: Michael Ohl | Received 5 August 2020 | Accepted 6 September 2020 | Published 30 October 2020

<http://zoobank.org/613B1ED3-4100-401B-B632-E9B4AFE71AC0>

Citation: Astafurova YuV, Proshchalykin MYu, Niu Z-Q, Orr MC, Zhu C-D (2020) New and little-known bees of the genus *Sphecodes* Latreille, 1804 (Hymenoptera, Apoidea, Halictidae) from Southern and South-Western China. Journal of Hymenoptera Research 79: 145–162. <https://doi.org/10.3897/jhr.79.57276>

Abstract

Continuing prior studies on Chinese *Sphecodes*, we here report further records of twelve rarely collected and little known species from mountainous regions of Southern and South-Western China (Xizang, Sichuan, Yunnan). Forty two species are currently known from China, yet until now only two species were known from Southern and South-Western China. We report six entirely new records for China, including *Sphecodes discoverlifei* Astafurova & Proshchalykin, 2020, *S. fumipennis* Smith, 1853, *S. montanus* Smith, 1879, *S. nipponicus* Yasumatsu & Hirashima, 1951, *S. simlaensis* Blüthgen, 1924, and *S. turneri* Cockerell, 1916, and another four are new regional records. Two are new species that we describe and illustrate: *Sphecodes holgeri* Astafurova & Proshchalykin, **sp. nov.** (Yunnan), and *S. tibeticus* Astafurova & Niu, **sp. nov.** (Xizang). The male of *Sphecodes sikkimensis* Blüthgen, 1927 is described for the first time.

Keywords

Anthophila, Apiformes, cleptoparasites, fauna, new species, taxonomy

Introduction

There are currently 328 bee species of the family Halictidae known from China (Niu et al. 2018), but new records and species continue to be added (Niu et al. 2020; Zhang et al. 2020).

The genus *Sphecodes* Latreille, 1804 has been one of the more overlooked taxa partly due to the complexity of identifying material. However, in last two years, significant progress has been made towards bettering our knowledge of the Chinese *Sphecodes*. Through the publication of our first paper dealing with *Sphecodes* from the Palaearctic part of China (Astafurova et al. 2018), the number of known species of the genus increased from 18 to 34. However, the *Sphecodes* fauna of the mountainous regions of Southern and South-Western China (Xizang, Sichuan, Yunnan) remains poorly known. For example, only one species of this genus – *Sphecodes grahami* Cockerell, 1922 – has been described from Sichuan so far, and in total only two species have been previously recorded for this part of country (Astafurova et al. 2018).

In the present paper, based on a comprehensive study of specimens held in various collections, we report twelve new species distributional records, with two species described as new and six species recorded from China for the first time, resulting in a total number of 42 *Sphecodes* species known from this country (Table 1). In addition, we describe the male of *Sphecodes sikkimensis* Blüthgen, 1927 for the first time.

Cleptoparasitic bees are often rare and research was consequently hindered by the small number of specimens stored in collection and the unusually wide intraspecific morphological variation of the studied taxa. Many species are known only from type series or from a single sex, and a several primary types could not be found or are confirmed to have been lost. Despite these challenges, this contribution represents a significant step towards a better documentation of the species of *Sphecodes* and their distributional patterns in China, an essential foundation for advancing faunal investigations into the Palaearctic and Oriental regions and the biogeographic division between the two.

Materials and methods

The results presented in this paper are based on 92 specimens collected in mountainous regions of Southern and South-Western China (Xizang, Sichuan, Yunnan) that are currently housed in the Institute of Zoology, Chinese Academy of Sciences, Beijing, China (**IZCAS**); the Zoological Institute, Russian Academy of Sciences, St. Petersburg, Russia (**ZISP**); and the private collection of Maximilian Schwarz, Ansfelden, Austria (**PCMS**). The following acronyms are used for the collections where type specimens are deposited: **ELKU** – Entomological Laboratory, Faculty of Agriculture, Kyushu University, Fukuoka, Japan; **MNHAH** – Museum of Nature and Human Activities, Sanda, Japan; **NHMUK** – Natural History Museum, London, UK; **USNM** – National Museum of Natural History, Smithsonian Institution, Washington, DC, USA; **ZMNB** – Museum für Naturkunde, Berlin, Germany.

Table 1. Checklist of the *Sphecodes* species of China including distribution by provinces.

N	Species	Province	Published data	Type of areal
1	<i>S. albilabris</i> (Fabricius, 1793)	Gansu, Liaoning, Inner Mongolia, Shanxi	Astafurova et al. 2018	P
2	<i>S. alternatus</i> Smith, 1853	Xinjiang, Gansu	Astafurova et al. 2018	P
3	<i>S. chinensis</i> Meyer, 1922	China (exactly locality is unknown)	Meyer 1922	?
4	<i>S. crassus</i> Thomson, 1870	Inner Mongolia, Shanxi	Astafurova et al. 2018	P
5	<i>S. cristatus</i> Hagens, 1882	Xinjiang, Inner Mongolia, Ningxia, Liaoning, Hebei, Shandong, Shanxi, Shanxi, Heilongjiang, Jilin, Beijing, Tianjin	Meyer 1922; Blüthgen 1927; Astafurova et al. 2018; Ascher and Pickering 2020	P
6	<i>S. discoverlifei</i> Astafurova & Proshchalykin, 2020	Yunnan	First record	O
7	<i>S. ephippius</i> (Linné, 1767)	Xinjiang	Astafurova et al. 2018	P
8	<i>S. ferruginatus</i> Hagens, 1882	Shanxi, Beijing	Astafurova et al. 2018	P
9	<i>S. formosanus</i> Cockerell, 1911	Taiwan	Cockerell 1911	O
10	<i>S. fumipennis</i> Smith, 1853	Sichuan, Yunnan	First record	O
11	<i>S. galeritus</i> Blüthgen, 1927	Guandong	Blüthgen 1927	O
12	<i>S. gibbus</i> (Linnaeus, 1758)	Xinjiang [the records from Heilongjiang, Liaoning, Hebei, Jilin Beijing by Wu, 1965 refer to <i>S. nippon</i>]	Meyer 1920; Astafurova et al. 2018	P
13	<i>S. geoffrellus</i> (Kirby, 1802)	Shanxi, Inner Mongolia	Astafurova et al. 2018	P
14	<i>S. grahami</i> Cockerell, 1922	Shanxi, Shaanxi, Shanghai, Sichuan [the records by Wu 1965, Wu et al. 1988 from Jilin, Hebei, Zhejiang, Anhui, Jiangsu, Yunnan, Xizang, Guandong are misidentification, mostly refer to <i>S. pueli</i>]	Cockerell 1922; Astafurova et al. 2018; Ascher and Pickering 2020 (part)	PO
15	<i>S. holgeri</i> Astafurova & Proshchalykin, sp. nov.	Yunnan	First record	O
16	<i>S. howardi</i> Cockerell, 1922	Guandong	Cockerell 1922; Blüthgen 1924	O
17	<i>S. intermedius</i> Blüthgen, 1923	Gansu	Astafurova et al. 2018	P
18	<i>S. kershawi</i> Perkins, 1921	Guandong	Meyer 1927	O
19	<i>S. kozlovi</i> Astafurova & Proshchalykin, 2015	Inner Mongolia, Ningxia, Shanxi	Astafurova et al. 2018	P
20	<i>S. laticaudatus</i> Tsuneki, 1983	Hebei	Astafurova et al. 2018	P
21	<i>S. laticeps</i> Meyer, 1920	Sichuan, Yunnan, Taiwan	Meyer 1920, current data	O
22	<i>S. longulus</i> Hagens, 1882	Gansu, Shanxi, Hebei, Inner Mongolia	Blüthgen 1934; Astafurova et al. 2018	P
23	<i>S. manchurianus</i> Strand & Yasumatsu, 1938	Liaoning	Strand and Yasumatsu 1938	P
24	<i>S. monilicornis</i> (Kirby, 1802)	Heilongjiang	Astafurova et al. 2018	P
25	<i>S. montanus</i> Smith, 1879	Yunnan, Sichuan, Xizang	First record	O
26	<i>S. nippon</i> Meyer, 1922	Gansu, Inner Mongolia, Shaanxi, Heilongjiang, Liaoning, Hebei, Jilin, Beijing, Gansu	Blüthgen 1934; Wu 1965; Astafurova et al. 2018	P
27	<i>S. nipponicus</i> Yasumatsu & Hirashima, 1951	Sichuan, Yunnan	First record	PO
28	<i>S. nurekensis</i> Warncke, 1992	Xinjiang	Astafurova et al. 2018	P
29	<i>S. olivieri</i> Lepeletier de Saint-Fargeau, 1825	Xinjiang, Gansu	Astafurova et al. 2018	P
30	<i>S. pueli</i> Cockerell, 1931	Sichuan, Yunnan, Shanghai, Shanxi, Hebei, Beijing, Zhejiang, Jiangsu	Cockerell 1931; Wu 1965; Astafurova et al. 2018; current data	PO
31	<i>S. pinguiculus</i> Pérez, 1903	Gansu, Inner Mongolia	Astafurova et al. 2018	P
32	<i>S. pectoralis</i> Morawitz, 1876	Xinjiang, Gansu	Astafurova et al. 2018	P
33	<i>S. pellucidus</i> Smith, 1845	Xinjiang, Gansu, Jiangsu [the indication of <i>S. pellucidus</i> var. <i>gibridus</i> Blüthgen, 1924 in Sichuan by Astafurova et al. 2018 is wrong]	Blüthgen 1924; Meyer 1922, 1925; Astafurova et al. 2018	P
34	<i>S. sauteri</i> Meyer, 1925	Taiwan	Meyer 1925	O
35	<i>S. scabricollis</i> Wesmael, 1835	Qinghai, Zhejiang, Shaanxi, Heilongjiang, Beijing	Astafurova et al. 2018	P
36	<i>S. sikkimensis</i> Blüthgen, 1927	Sichuan, Yunnan, Fujian, Guandong	Blüthgen 1927, current data	O
37	<i>S. simlaensis</i> Blüthgen, 1924	Sichuan, Yunnan	First record	O
38	<i>S. takaensis</i> Blüthgen, 1927	Taiwan	Blüthgen 1927	O
39	<i>S. tertius</i> Blüthgen, 1927	Guandong	Blüthgen 1927	O
40	<i>S. turanicus</i> Astafurova & Proshchalykin, 2017	Gansu	Astafurova et al. 2018	P
41	<i>S. tibeticus</i> Astafurova & Niu, sp. nov.	Xizang	First record	?PO
42	<i>S. turneri</i> Cockerell, 1916	Yunnan	First record	O

P – Palearctic species; O – Oriental species; PO – Palearctic and Oriental species

The taxonomy and distribution of species follows that of Astafurova et al. (2018, 2020). Diagnosis and descriptive notes for most of the species listed below can be found in Astafurova et al. (2020). Morphological terminology follows that of Engel (2001) and Michener (2007). The ventral surface of some flagellomeres bear a distinctive patch of sensilla trichodea A (sensu Årgent and Svensson 1982), which we refer to as ‘tyloids’, and they are easily observable under a microscope. 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 diameter (in μm) / ratio of distance between punctures to average puncture diameter, e.g., 15–20 μm / 0.5–1.5. Integumental sculpture other than distinctive surface punctation is described following Harris (1979): areolate – coarse, contiguous punctures; reticulate – superficially net-like or network of raised lines; rugose – irregular, nonparallel, wrinkled raised lines (rugae); rugulose – minutely rugose; strigate – narrow, transverse or longitudinal streaks (strigae), variety of parallel lineations; tessellate – regular network of shallow grooves with flat interspaces.

Specimens were studied with a Leica M205A stereomicroscope and photographs taken with a combination of stereomicroscope (Olympus SZX10) and digital camera (Olympus OM-D and Canon EOS70D). Final images are stacked composites using Helicon Focus 6. All images were post-processed for contrast and brightness using Adobe Photoshop. New distributional records are noted with an asterisk (*).

Taxonomy

Sphecodes discoverlifei Astafurova & Proshchalykin, 2020

Sphecodes discoverlifei Astafurova & Proshchalykin in Astafurova et al. 2020: 46, ♀, ♂ (holotype: ♂, Laos, Phongsaly prov., Phongsaly env., 21°41'N, 102°06'E, 1500 m, 1–30.VI.2003, P. Pacholatko leg., PCMS).

Material examined. *Yunnan*: Naban River Watershed National Nature Reserve, Guomen-shan (22.2452N, 100.6011E), 1107 m, 6.IV.2009, (1 ♀), leg. Ling-Zeng Meng [IZCAS].

Published records. –

Variation. Unlike the typical form described from Laos where the female propodeal triangle has mostly longitudinal wrinkles (see Astafurova et al. 2020: 48, fig. 39), the specimen from Yunnan has a propodeal triangle with wrinkles clearly forming a reticular sculpture.

Distribution. *China (Yunnan); Laos.

Sphecodes fumipennis Smith, 1853

Sphecodes fumipennis Smith, 1853: 36, ♀ (holotype: ♀, N. India, coll. J.S. Baly, NHMUK).

Material examined. *Sichuan*: Wenchuan Xian, Mujiangping (31.4830N, 103.5965E), 1200 m, 2.VIII.1983, (1 ♀), leg. Xue-Zhong Zhang [IZCAS]; Yanyuan Xian, Jinhe (27.4282N, 101.5154E), 1250 m, 30.VI.1984, (3 ♂), leg. Jian-Guo Fan [IZCAS]. *Yunnan*: Jinping Xian, Shuangjinqiao (39.7439N, 116.5753E), 900–1200 m, 28.V.1956, (2 ♂), leg. D. Panfilov; 27.V.1956, (1 ♀, 3 ♂), leg. Chuan-Long Li [ZISP]; Zhongdian, Xiaqiaotou (22.7556N, 120.3110E), 1800 m, 6.VIII.1984, (1 ♀, 3 ♂), leg. Jian-Guo Fan [IZCAS].

Published records. –

Variation. The female exhibits variation in the degree of punctation on the marginal zones of T1, ranging from with denser punctures separated by 1–5 puncture diameters (typical form) to almost impunctate with a few tiny punctures (1 ♀, Sichuan, Mujiangping). Specimens from China have fewer hind wing hamuli (9–11 versus 11–12 in other studied specimens from India and Southeast Asia). Interesting specimens of a black form were collected in montane Yunnan (1 ♀, 3 ♂; Zhongdian, Xiaqiaotou, 1800 m). Unlike the typical form with red coloured T1–T4, these individuals have entirely black metasomas. Similar variation in coloration was also studied by us (unpublished data) in other *Sphecodes* species (*S. monilicornis* (Kirby, 1802), *S. nippon* Meyer, 1922, *S. intermedius* Blüthgen, 1923, *S. olivieri* Lepeletier de Saint-Fargeau, 1825, *S. pectoralis* Morawitz, 1876, *S. pingiculus* Pérez, 1903).

Distribution. *China (Sichuan, Yunnan); Laos, Myanmar, India (Sikkim).

Sphecodes grahami Cockerell, 1922

Sphecodes grahami Cockerell, 1922: 12 (holotype: ♀, China, Sichuan: Suifu [Yibin], Graham coll., USNM; <http://n2t.net/ark:/65665/339325f63-5855-4435-bce2-5efaaed0b335>).

Material examined. –

Published records. Cockerell 1922: 12 (Sichuan); 1931: 12 (Shanghai); Astafurova et al. 2018: 30 (Shanxi, Shaanxi).

Remark. According to Wu (1965) and Wu et al. (1988) this species was recorded from different provinces of China (Jilin, Hebei, Anhui, Jiangsu, Shandong, Shanghai, Zhejiang, Sichuan, Yunnan, Xizang, Guandong). However, re-identification of specimens from the IZCAS Collection determined by Prof. Wu as *S. grahami* as well as the analysis of the descriptive notes given in these works revealed misidentifications. In fact, the specimens from Yunnan (1 ♀, Lijiang) and Sichuan (1 ♂, Barkam; 1 ♀, Xi-angcheng) belong to *S. pieli*. These two species are very similar structurally and sculpturally, but *S. grahami* differs by lack of a longitudinal carina on vertex (also indicated in Cockerell 1922: 12). In contrast, the longitudinal carina on vertex in *S. pieli* is clearly developed, corresponding to descriptive notes by Wu (1965) and Wu et al. (1988), where pointed on “small process on vertex”. Among determined by Wu specimens we have not found any specimens from Xizang, with records from this province (Wu et al. 1988) instead referring to *S. montanus*, another species similar to *S. grahami* with a

vertex carina. So, males of *S. grahami* recorded by Wu, 1965 and Wu et al. 1988 refer to other species, and the male of *S. grahami* remains unknown. The female of this species is difficult to distinguish from the vicarious West-Palaearctic *S. ephippius* (Linné, 1767) and it is also similar to *S. pellucidus* var. *gibridus* Blüthgen, 1924. Clarification of the status of this species and possible synonymy is a task for future study.

Distribution. China (Shanxi, Shaanxi, Shanghai, Sichuan). The records by Ascher and Pickering 2020 from Jilin, Hebei, Zhejiang, Anhui, Jiangsu, Yunnan, Xizang, Guangdong based on misidentification that was published by Wu (1965) and Wu et al. (1988).

***Sphecodes holgeri* Astafurova & Proshchalykin, sp. nov.**

<http://zoobank.org/B19D33FE-5DA2-48A5-8E26-1CA47345F1DE>

Figures 1, 2

Material examined. Holotype: ♀, CHINA: *Yunnan*, Naban River Watershed National Nature Reserve, Guomenshan (22.2452N, 100.6011E), 1107 m, 26.III.2009, leg. Ling-Zeng Meng [IZCAS].

Diagnosis. From others small *Sphecodes* species with bidentate female mandibles this new species differs by combination of characters including scarcely and finely punctuation of the body, smoother propodeal sculpture and the short 2nd submarginal cell (Figs 1, 2).

Female. Total body length 5 mm (Fig. 1), fore wing 4.0 mm (Fig. 2F). Head black with brownish antenna and mandible (Fig. 2A); transverse, about 1.25 times as wide as long; preoccipital carina not developed; vertex not elevated as seen in frontal view; distance from top of head to upper margin of a lateral ocellus ca. 1.5 lateral ocellar diameters as seen in dorsal view; F1 0.8 times as long as wide, F2 and F3 as long as wide, remaining flagellomeres slightly longer than width; mandible bi-dentate; supraclypeal area weakly bulging; labrum trapezoidal, 0.7 times as long as basal width; face, vertex and gena finely (5–10 µm) punctate, sparser on clypeus and supraclypeal area, with shiny interspaces; face and gena with sparse tiny pubescence.

Mesosoma black, legs brownish with yellowish tarsi. Pronotum, between dorsal and lateral surfaces, with sharp angle. Mesoscutum and mesoscutellum smooth and shiny (Fig. 2C), with sparse and tiny setae punctures (5–10 µm). Hypoepimeral area shiny, smooth with microscopical punctures; mesepisternum smoother on upper half and rugulose below, with tiny setae punctures (Fig. 2D). Propodeal triangle (metapostnotum) shiny with a few coarse longitudinal wrinkles and large smooth shining interspaces (Fig. 2E); vertical part of propodeum smooth and shiny, with a few weak wrinkles; lateral parts of propodeum similar to mesepisternum, rugulose. Metafemur weakly enlarged medially, maximum width 0.32 times its length. Wings hyaline, weakly yellowish, with brown stigma and veins; 2nd submarginal cell short, 0.3–0.4 times as long as high (Fig. 2F); hind wing with the angle between basal (*M*) and cubital (*Cu*) veins 80°, costal margin with five hamuli.



Figure 1. *Sphecodes holgeri* Astafurova & Proshchalykin, sp. nov., holotype, female. Scale bar: 1.0 mm.

Metasoma (Fig. 2B) red-brownish (on T2 more reddish), terga almost impunctate (including marginal zones), only with a few tiny setae punctures on T3–T5 discs; pygidial plate dull, rounded apically, wide, 1.2 times as wide as metabasitarsus; sterna tessellate with sparse setae punctures.

Male unknown.

Etymology. The specific epithet is a patronym honoring our colleague and friend Prof. Holger Dathe (Senckenberg Deutsches Entomologisches Institut, Müncheberg, Germany) on the occasion of his 75th birthday and in recognition of his many contributions to the study of Hymenoptera diversity and that of the bees in particular.

Distribution. Only known from the type locality in Yunnan (China).

Sphecodes laticeps Meyer, 1920

Sphecodes laticeps Meyer, 1920: 121, ♀, ♂ (lectotype: ♂, designated by Astafurova et al. 2020: 64, Formosa [Taiwan], Takao, 8.12.1909, H. Sauter leg., ZMNB).

Material examined. *Yunnan*: Naban River Watershed National Nature Reserve, Mengsongson Township, Danuoyou [22.2069N, 100.6376E], 770 m, 10.XI.2008,

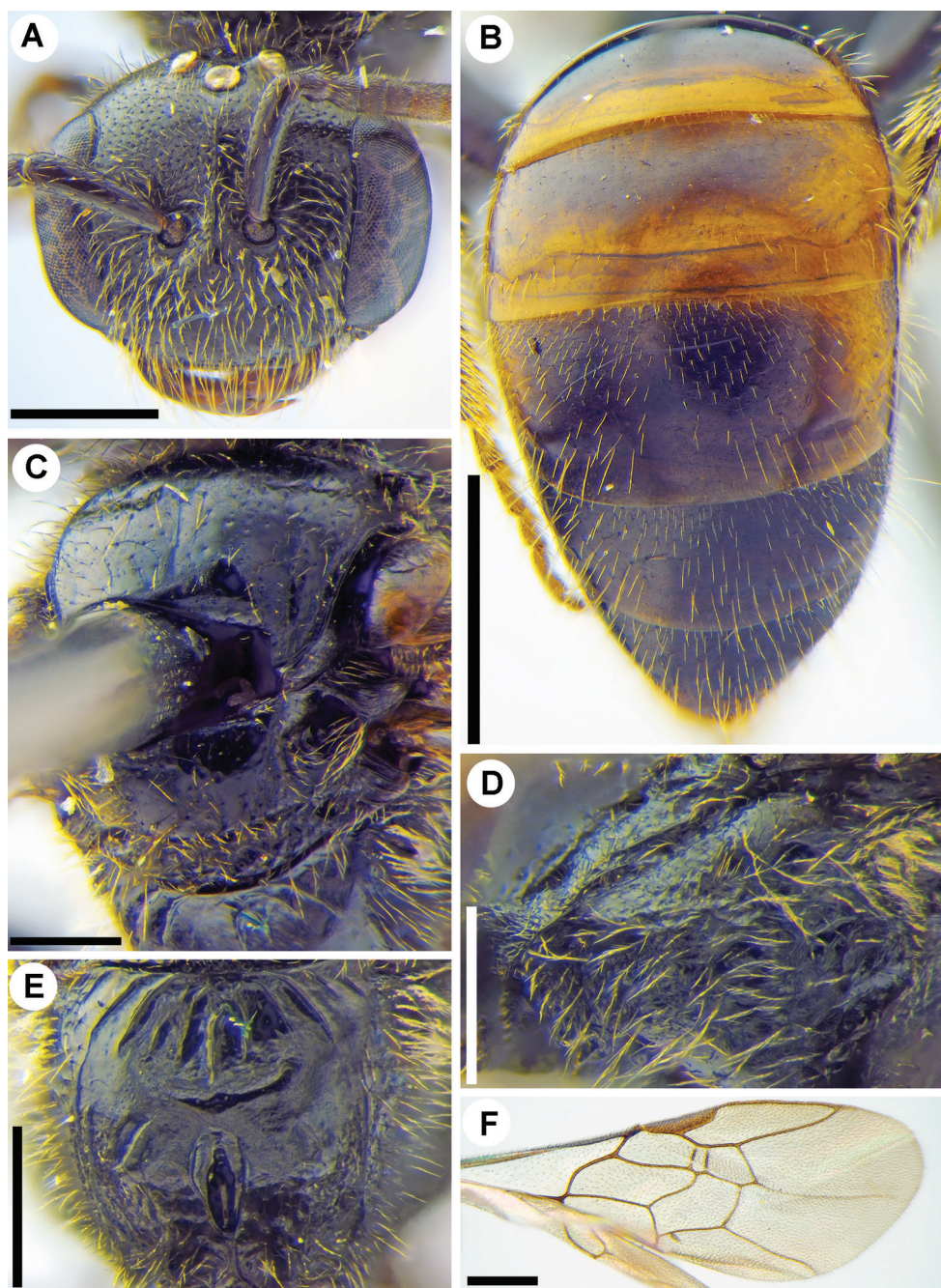


Figure 2. *Sphecodes holgeri* Astafurova & Proshchalykin, sp. nov., holotype, female **A** head, frontal view **B** metasoma, dorsal view **C** scutum, dorsal view **D** mesepisternum, lateral view **E** propodeum, dorsal view **F** forewing, lateral view. Scale bars: 0.5 mm (**A**, **D–F**); 1.0 mm (**B**, **C**).

(1 ♀); 20.XI.2008, (1 ♀), leg. A. Weigel [IZCAS]; Naban River Watershed National Nature Reserve, Mandian (22.1305N, 100.6681E), 753 m, 10.X.2008, (1 ♀), leg. A. Weigel; 20.XI.2008, (1 ♀), leg. Ling-Zeng Meng [IZCAS]; Naban River Watershed National Nature Reserve, Naban (22.1585N, 100.6652E), 709 m, 6.VI.2008, (2 ♀), 15.VI.2008, (1 ♀), leg. A. Weigel [IZCAS]; Naban River Watershed National Nature Reserve, Mengsong Township, Zhongzhichang (22.1585N, 100.6652E), (1 ♀), 12.V.2008, leg. Ling-Zeng Meng [IZCAS]; Simao City, Menglian County, Meng'anaka (24.1240N, 120.6750E), 3.X.2007, (1 ♀), leg. Rui Zhang [IZCAS]; Xishuangbanna, Yiwu (24.1240N, 120.6750E), 1300 m, 2.XII.1958, (1 ♂), leg. Shu-Yong Wang [IZCAS]; Hekou (22.5355N, 103.9454E), 200–300 m, 8–11.VI.1956, (3 ♂), leg. D. Panfilov; 8.V.1956, (1 ♀), leg. Ke-Ren Huang [ZISP].

Published records. Meyer 1920: 121 (Taiwan).

Variation. The size of the medial glabrous spot on the male tyloids is quite variable. Female specimens from Yunnan exhibit variation in the degree of vertex elevation (distance from top of head to upper margin of a lateral ocellus from 1.2 to 1.6 lateral ocellar diameters as seen in frontal view); specimens with a more elevated vertex have sparser punctures in the ocello-ocular area.

Distribution. China (*Yunnan, Taiwan); Thailand, Vietnam.

Sphecodes montanus Smith, 1879

Sphecodes montanus Smith, 1879: 27, ♀, ♂ (syntypes: ♀♀, Northen India, Masuri [Uttaranchal: Mussoorie], 7000 ft, B.M. Type HYM.17a549; NHMUK 013380316).

Material examined. *Yunnan:* Yingjing, Gangbiguan (24.7115N, 97.9384E), 1260 m, 10.III.1980, (1 ♀), leg. Hong-Xing Li [IZCAS]; Weixi, Lidiping (39.9109N, 116.4133E), 3200 m, 14.VIII.1984, (2 ♀), leg. Jian-Guo Fan [IZCAS]. *Sichuan:* Litang, Kangga (29.6922N, 100.3985E), 3650 m, 4.VI.1982, (1 ♀), leg. Shu-Yong Wang [IZCAS]; Emei Shan, Baoguosi (39.8970N, 116.3661E), 550 m, 30.III.1957, (1 ♀), leg. Ke-Ren Huang [IZCAS]. *Xizang:* Zhag'yab Xian, Jitang (39.9109N, 116.4133E), 3600 m, 7.VII.1976, (1 ♀), 8.VII.1976, (1 ♀), leg. Xue-Zhong Zhang [IZCAS]; Jomda Xian, Bingzhan (31.5052N, 98.2245E), 26.VII.1976, (1 ♀), leg. Yin-Heng Han [IZCAS]; Linzhi Country, Bayi Town (29.7245N, 94.3189E), 3000 m, 20.VI.2010, (1 ♀), leg. Ze-Qing Niu & Zhao-Hui Pan [IZCAS]; Chayu Country, Zhouwagoin Town, Xiongjiu Village (28.6067N, 97.2816E), 1938 m, 29.VII.2014, (1 ♀, 1 ♂), leg. Qing-Tao Wu [IZCAS].

Published records. –

Distribution. *China (Xizang, Sichuan, Yunnan); India (Uttarakhand, Rajasthan), Laos.

Sphecodes nipponicus Yasumatsu & Hirashima, 1951

Sphecodes nipponicus Yasumatsu & Hirashima, 1951: 122–124, ♂ (holotype: ♂, Ishidozawa, Provinz Shinano, Honshu, Japan, 16.IX.1934, S. Miyamoto leg., ELKU).

Sphecodes iwatensis Tsuneki, 1983: 25, ♀ (holotype: ♀, Takinoue, Iwate Pref., Honshu, Japan, MNHAH). Synonymized by Mitai and Tadauchi 2013: 52.

Sphecodes kisukei Tsuneki, 1983: 24, ♀ (holotype: ♀, Koike, Fukui Pref., Honshu, Japan, MNHAH). Synonymized by Mitai and Tadauchi 2013: 52.

Sphecodes itidyo Tsuneki, 1983: 23, ♀ (holotype: ♀, Taniyama, Fukui Pref., Honshu, Japan, MNHAH). Synonymized by Mitai and Tadauchi 2013: 52.

Sphecodes rikuchu Tsuneki, 1983: 25, ♀ (holotype: ♀, Takinoue, foot of Mt. Hachimantai, Iwate Pref., Honshu, Japan, MNHAH). Synonymized by Mitai and Tadauchi 2013: 52.

Material examined. *Yunnan*: Weixi Xian, Pantiange (39.9109N, 116.4133E), 2500 m, 27.VII.1981, (2 ♀), leg. Su-Bai Liao [IZCAS]. *Sichuan*: Chengdu (31.9109N, 116.4133E), 500 m, 29.V.1964, (2 ♂), leg. Yan-Ru Wu [IZCAS].

Published records. –

Variation. Unlike the typical Japanese form with an entirely black metasoma (Mitai and Tadauchi 2013: 54, fig. 23), the studied male specimens from Sichuan have T1–T3 partially red-brownish.

Remark. The species is closest to the Palearctic *Sphecodes scabricollis* Wesmael, 1835, but female differs by denser and distinctly punctate T1 (versus shallow sparse punctures) and the male differs by shorter antennae with F2 1.5 times as long as wide (versus 1.7), and a dark, usually entirely black metasoma (versus red T1–T3).

Distribution. *China (Sichuan, Yunnan); Japan (Hokkaido, Honshu, Shikoku, Kyushu, Okinawa-Honto).

Sphecodes pieli Cockerell, 1931

Sphecodes pieli Cockerell, 1931: 13, ♂ (holotype: ♂, China, Shanghai, Zo-Se, June 16, 1930 (Piel No 34), USNM).

Material examined. *Sichuan*: Barkam (31.9117N, 102.2135E), 2700 m, 18.VIII.1983, (1 ♂), leg. Xue-Zhong Zhang [IZCAS]; Xiangcheng Country, Chaihe (28.9367N, 99.8050E), 3000 m, 20.VI.1982, (1 ♀), leg. Xue-Zhong Zhang; [IZCAS]. *Yunnan*: Lijiang Yuhu (27.0260N, 100.2312E), 2750 m, 22.VII.1984, (1 ♀), leg. Jian-Guo Fan [IZCAS].

Published records. Cockerell 1931: 13 (Shanghai); Wu 1965: 37 (Zhejiang, Jiangsu); Wu et al. 1988: 38 (Sichuan, Yunnan as *S. grahami* sensu Wu 1965); Astafurova et al. 2018: 39 (Hebei, Beijing, Shaanxi, Sichuan).

Distribution. China (Hebei, Beijing, Shaanxi, Jiangsu, Shanghai, Zhejiang, Sichuan, Yunnan); Russia (Far East).

***Sphécodes sikkimensis* Blüthgen, 1927**

Figure 3

Sphécodes sikkimensis Blüthgen, 1927: 54, fig. 12a, ♀ (syntypes: ♀♀, Sikkim [India], 6.97., Rungit Tal, 1000', Coll. Bingham, ZMNB).

Material examined. *Yunnan*: Jinping Xian, Changpotou (22.9648N, 103.3164E), 1200 m, 23.V.1956, (1 ♀), leg. Ke-Ren Huang [ZISP]. *Sichuan*: Emei Shan (29.6070N, 103.4915E), 6.VI.1955, (1 ♀), leg. Ke-Ren Huang & Yin-Tao Jinjin [ZISP]; Emei Shan, Huguosi (39.9419N, 116.3818E), 550–750 m, 5.VII.1957, (1 ♀), leg. Ke-Ren Huang [IZCAS]. *Fujian*: Jianyang Xian, Huangkeng, Dazhulan (27.6041N, 117.7450E), 900–1000 m, 28.V.196-, (1 ♀), leg. Ten-Qiao Jiang [IZCAS]; Fuzhou, (1 ♂), leg. C.H. Kell [IZCAS].

Description of male (new). Total body length 13 mm. Head transverse (Fig. 3A), 1.2 times as wide as long; lateral preoccipital carina present; vertex elevated with distance from top of head to upper margin of a lateral ocellus ca. two lateral ocellar diameters as seen in frontal view; antenna long (Fig. 3C), attain anterior margin of mesoscutellum; F2 1.7 times as long as wide, remaining flagellomeres ca. 1.5 times as long as wide; tyloids weakly developed, narrowly semicircular across at most 1/4 basal flagellar surfaces and narrowly linear across remainder of flagellomere as seen in lateral view (Fig. 3C); face and ocello-ocular area deeply areolate-punctate. Face with plumose pubescence below antennal sockets (threadbare in the described male specimen); gena with sparse thin pubescence.

Mesosoma black, legs red-brown. Mesoscutum and mesoscutellum coarsely areolate-punctate to reticulate-rugose (Fig. 3B). Mesepisternum, propodeal triangle (metapostnotum) and lateral parts of propodeum coarsely reticulate-rugose. Wings with strong brownish darkening and weak metallic violet lustre; hind wing with the angle between basal (M) and cubital (Cu) veins almost 80°, costal margin with 13 hamuli.

Metasoma (Fig. 3E) densely punctate by coarse (30–50 µm / confluent–2; sparser on T1) and microscopical punctures (ca. 5 µm); marginal zones impunctate, except on basal half of T1 (25–30 µm / 1–4); T1–T4 red; gonocoxite dorsally without impression; gonostylus as on Fig. 3D.

Published records. Blüthgen 1927: 55 (Guandong).

Distribution. China (*Sichuan, *Yunnan, *Fujian, Guandong); India (Sikkim), Myanmar, Laos.

***Sphécodes simlaensis* Blüthgen, 1924**

Sphécodes simlaensis Blüthgen, 1924: 514–515, ♀ (syntypes: 2 ♀, India, Simla, VIII. and IX.[18]98, Nurse leg., were not found in NHMUK).

Material examined. *Yunnan*: Longling Country, 1600 m, 20.V.1955, (1 ♂), leg. V. Popov [ZISP]; Xianggelila Xian (27.8357N, 99.7074E), 3334 m, 14.VII.2017,

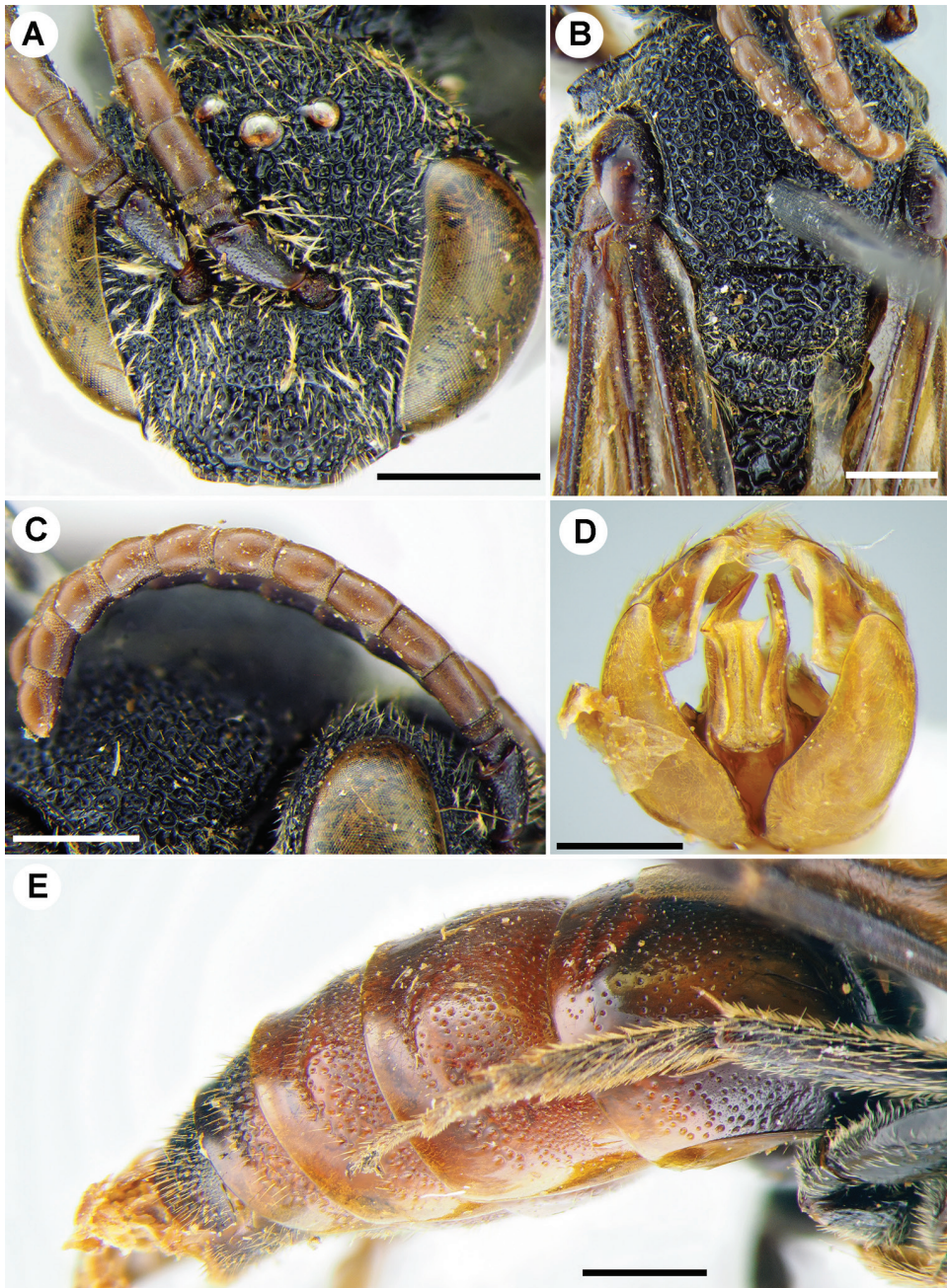


Figure 3. *Sphecodes sikkimensis* Blüthgen, male **A** head, frontal view **B** mesosoma, dorsal view **C** antenna, lateral view **D** genitalia, dorsal view **E** metasoma, lateral view. Scale bars: 1.0 mm (**A–C, E**), 0.5 mm (**D**).

(1 ♀), leg. Zhong-Ming Ye [IZCAS]. *Sichuan*: Nanping, Ta Zang (33.2528N, 104.2528E), 2200 m, 15–18.VI.1990, (1 ♀), leg. Chs [PCMS]; Wushan, Liziping (31.0805N, 109.8855E), 1850 m, 18.V.1994, (1 ♀), leg. Xing-Ke Yang [IZCAS];

Wolong, Santiaogou (39.9039N, 116.3863E), 2500 m, 6.VIII.1983, (1 ♂), leg. Xue-Zhong Zhang [IZCAS].

Published records. –

Variation. Coloration of metasomal terga in males varies from entirely dark brown or black to partially red on T1–T3. Sculpturing of the propodeal triangle is also quite variable, with wrinkles ranging from longitudinal and parallel to net forming. The male specimen from Santiaogou is larger than the typical form (6.5 mm versus 5.0–5.5 mm).

Distribution. *China (Sichuan, Yunnan); India (Jammu and Kashmir, Himachal Pradesh), Laos.

***Sphecodes tibeticus* Astafurova & Niu, sp. nov.**

<http://zoobank.org/D66E158F-D87C-40BE-8F9C-CA73487DA5CC>

Figures 4, 5

Material examined. *Holotype*: ♂, CHINA: *Xizang*, Chayu Country, Zhouwagoin Town, Zala Village [28.60795N, 97.28781E], 1973 m, 27.VIII.2014, leg. Q.T. Wu [IZCAS].

Diagnosis. This species resembles the East-Palaearctic *Sphecodes laticaudatus* Tsuneki, 1983, sharing a similar structure and sculpture of the body, including the shape of antennal tyloids and gonostylus, a densely punctate head, mesoscutum and scarcely punctate metasomal terga. The new species differs from *S. laticaudatus* by sparser, weakly-plumose facial pubescence below the antennal sockets that does not obscure the integument (versus denser, well-plumose pubescence, obscuring integument), and a more elevated vertex with the distance from top of head to upper margin of a lateral ocellus ca. a lateral ocellar diameter as seen in frontal view, Fig. 5A (versus a half diameter in typical form, Fig. 5B).

Description. Male. Total body length 8 mm (Fig. 4A). Head black (Fig. 5A), weakly transverse, about 1.1 times as wide as long; vertex elevated, with distance from top of head to upper margin of lateral ocelli ca. a lateral ocellar diameter as seen in frontal view ca. two lateral ocellar diameters as seen in dorsal view; antenna short (Fig. 5C), reaching posterior margin of mesoscutum, F1 0.6 times as long as wide, F2 1.9 times as long as wide, remaining flagellomeres ca. 1.4 times as long as wide; tyloids weakly developed, semicircular across basal 1/8–1/5 of flagellar surfaces; supraclypeal area flat; preoccipital carina absent; face and ocello-ocular area with confluent (finely areolate) punctures (ca. 20 µm); vertex behind ocelli roughly rugose; gena finely rugose; face below antennal sockets with relatively sparse weakly plumose setae, gena with sparse thin setae.

Mesosoma (Fig. 5D) black, tarsi brownish. Wings hyaline with brown stigma and veins; hind wing with the angle between basal (*M*) and cubital (*Cu*) veins 80°, costal margin with six hamuli. Pronotum, between dorsal and lateral surfaces, with sharp angle. Mesoscutum mostly with confluent punctures ca. 20–30 µm. Mesoscutellum, hypopleural area, mesepisternum, propodeal triangle and lateral part of propodeum roughly reticulate-rugose.



Figure 4. *Sphecoides tibeticus* Astafurova & Niu, sp. nov., holotype, male **A** habitus, lateral view **B** labels **C, D** genitalia, dorsal view (**C**), lateral view (**D**). Scale bars: 1.0 mm (**A**), 0.5 mm (**C, D**).

Metasoma dark black (Fig. 5E); terga scarcely punctate, T1 almost impunctate with a few microscopic punctures, remaining terga with a few shallow punctures on anterior half, marginal zones impunctate, smooth (except finely tessellate on T4); sterna delicately tessellate with numerous microscopical setae pores; gonocoxite dorsally with impression; gonostylus with semi-oval membranous part (Fig. 4C, D).

Female unknown.

Etymology. The new species is named after its locality Tibet (Xizang).

Distribution. Only known from the type locality in Xizang (China).

Sphecoides turneri Cockerell, 1916

Sphecoides turneri Cockerell, 1916: 430, ♀ (holotype: ♀, India, Assam, Shilong, 5.03., B. Turner, 1905-125. 17a.561; NHMUK 013380320).

Material examined. *Yunnan*: Naban River Watershed National Nature Reserve, Guomenshan (22.2452N, 100.6011E), 1107 m, 6.IV.2009, (4 ♂), 16.IV.2009, (1 ♂), 16.III.2009, (7 ♂), 26.III.2009, (3 ♂), leg. Ling-Zeng Meng [IZCAS]; Naban River Watershed National Nature Reserve, Naban (22.1585N, 100.6652E), 709 m, 26.III.2009, (1 ♂), leg. Ling-Zeng Meng [IZCAS]; Naban River Watershed National Nature Reserve, Mengsongson Township, Danuoyou (22.2069N, 100.6376E), 770 m, 14.XII.2007, (12 ♂); 15.I.2008, (4 ♂), leg. A. Weigel [IZCAS]; Naban River Watershed National Nature Reserve, Naban (22.2452N, 100.6041E), 732 m, 23.V.2008, (1 ♂), leg. Ling-Zeng

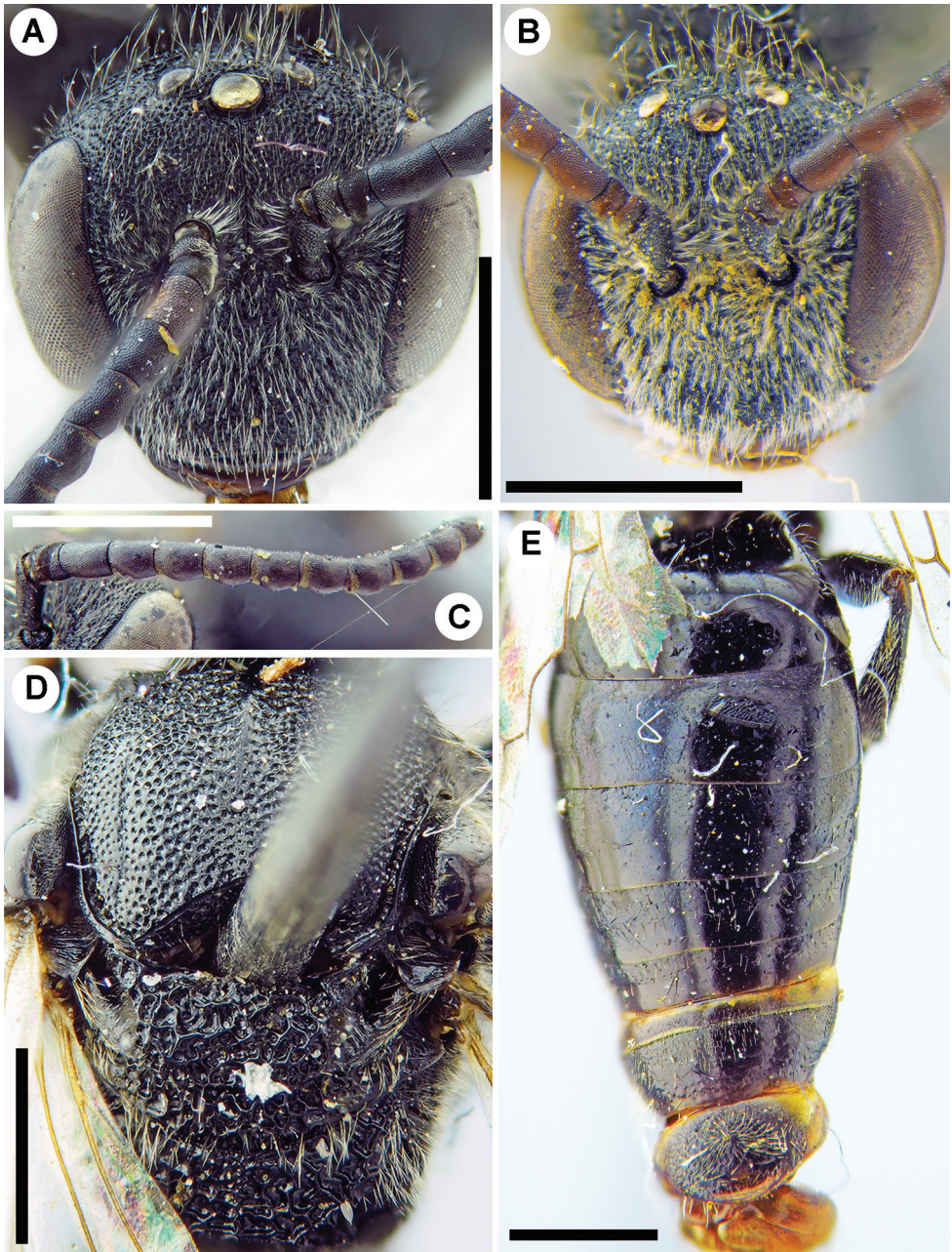


Figure 5. *Sphecodes tibeticus* Astafurova & Niu, sp. nov., holotype, male (**A**, **C–E**), and *S. laticaudatus* Tsuneki, male (**B**) **A**, **B** head, frontal view **C** antenna, lateral view **D** mesosoma, dorsal view **E** metasoma, dorsal view. Scale bars: 1.0 mm.

Meng [IZCAS]; Naban River Watershed National Nature Reserve, Mandian (22.1309N, 100.6686E), 689 m, 16–26.III.2009, (2 ♂), 26.IV.2009, (2 ♀, 5 ♂), leg. Ling-Zeng Meng [IZCAS]; Dali, Diancangshan (25.5976N, 100.2365E), 2600 m, 29.VI.1981,

(1 ♂), leg. Xue-Zhong Zhang [IZCAS]; Zhenyuan Xian (39.9109N, 116.4134E), 26.IV.1955, (1 ♂), leg. V. Popov [ZISP]; Cheli Xian (39.9109N, 116.4133E), 540 m, 11.III.1957, (1 ♂), leg. Shu-Yong Wang [ZISP]; Mangshi, Santaishan (39.8282N, 116.4708E), 1200 m, 18.V.1955, (1 ♂), leg. Kryzhanovskiy [ZISP].

Published records. –

Variation. Propodeal triangle sculpturing varies from coarsely reticulate-rugose (medially forming 2–3 rows close to square or shapeless cells) to with parallel wrinkles and large shining interspaces (forming a row of longitudinal cells).

Distribution. *China (Yunnan); India (Meghalaya), Laos.

Discussion

In total, 42 species of *Sphecodes* are now recorded from China. For comparison, to demonstrate the high species richness of the Chinese fauna, approximately 120 species are known from the entire Palaearctic and Oriental Regions together. However, the Chinese fauna of the genus (especially from the Oriental part) is poorly studied. Consequently, even following our addition of ten new species records, only twelve species are known from Xizang, Sichuan, and Yunnan.

To accurately assess *Sphecodes* distribution patterns in China requires a more in-depth studying of this country's fauna. Overall, the fauna of south and south-east mountain territories of China is similar to the faunas of Southeast Asia and the Himalayas. Seven species from the studied provinces (*Sphecodes discoverlifei*, *S. fumipennis*, *S. laticeps*, *S. montanus*, *S. simlaensis*, *S. sikkimensis*, and *S. turneri*) are also found in montane Southeast Asia or the Himalayas. Another three species (*S. pieli*, *S. nipponicus* and *S. grahami*) are elements of the eastern Palaearctic and Oriental fauna and predominantly occur in plains or foothills. The high habitat heterogeneity of these areas promises additional new species with further collections and taxonomic investigations.

Acknowledgements

We are grateful to Fritz Gusenleitner (OÖLM) for help during the Russian co-authors' visit to Austria, and David Notton for assisting during work in the NHMUK Collection and providing photos of type specimens. We thank Maximilian Schwarz (Ansfelden, Austria), Esther Ockermüller (OÖLM), James Hogan (OUMNH), Michael Ohl and Viola Richter (ZMNB) for providing *Sphecodes* specimens. We also thank Max Kasperek, Holger Dathe, and Alexander Fateryga for their comments and suggestions to streamline and improve the manuscript.

This investigation for Yulia Astafurova and Maxim Proshchalykin was supported by the Russian Funds for Basic Research (grant numbers 19-04-00027 and 20-54-44014) and the state research project AAAA-A17-117030310210-3; The National Science Foundation of China (31772487) and the second Tibetan Plateau scientific

expedition and research (STEP) program (Grant No. 2019QZKK0501) to Ze-Qing Niu, the grants from the National Science Fund for Distinguished Young Scholars (31625024) to Chao-Dong Zhu.

References

- Årgent L, Svensson B (1982) Flagellar sensilla on *Sphecodes* bees (Hymenoptera, Halictidae). *Zoologica Scripta* 11: 45–54. <https://doi.org/10.1111/j.1463-6409.1982.tb00517.x>
- Ascher JS, Pickering J (2020) Discover Life bee species guide and world checklist (Hymenoptera: Apoidea: Anthophila). http://www.discoverlife.org/mp/20q?guide=Apoidea_species [accessed 20 July 2020]
- Astafurova YuV, Proshchalykin MYu, Niu Z-q, Zhu C-d (2018) New records of bees of the genus *Sphecodes* Latreille (Hymenoptera, Halictidae) in the Palaearctic part of China. *ZooKeys* 792: 15–44. <https://doi.org/10.3897/zookeys.792.28042>
- Astafurova YuV, Proshchalykin MYu, Schwarz M (2020) New and little-known species of the genus *Sphecodes* Latreille (Hymenoptera, Halictidae) from Southeast Asia. *ZooKeys* 937: 31–88. <https://doi.org/10.3897/zookeys.937.51708>
- Blüthgen P (1924) Beiträge zur Systematik der Bienengattung *Sphecodes* Latr. II. *Deutsche Entomologische Zeitschrift* 1924: 457–516. <https://doi.org/10.1002/mmnd.48019240601>
- Blüthgen P (1927) Beiträge zur Systematik der Bienengattung *Sphecodes* Latr. III. *Zoologische Jahrbucher, Abteilung für Systematik, Geographie und Biologie der Tiere* 53(1/3): 23–112.
- Blüthgen P (1934) Schwedisch-chinesische wissenschaftliche Expedition nach den nordwestlichen Provinzen Chinas unter Leitung von Dr. Sven Hedin und Prof. Sü Ping-chang: Insekten, gesammelt vom schwedischen Arzt der Expedition Dr. David Hummel 1927–1930. 27 Hymenoptera. 5. *Halictus*- und *Sphecodes*-Arten (Hym.; Apidae; Halictini). *Arkiv för Zoologi* 27(1, 13): 1–23.
- Cockerell TDA (1911) Descriptions and records of bees – XXXIV. *Annals and Magazine of Natural History* 7(39): 225–237. <https://doi.org/10.1080/00222931108692933>
- Cockerell TDA (1916) Descriptions and records of bees – LXXII. *Annals and Magazine of Natural History* 17(8): 428–435. <https://doi.org/10.1080/00222931608693809>
- Cockerell TDA (1922) Bees in the collection of the United States National Museum. 4. *Proceedings of the United States National Museum* 60(2413): 1–20. <https://doi.org/10.5479/si.00963801.60-2413.1>
- Cockerell TDA (1931) Bees collected by the Reverend O. Piel in China. *American Museum Novitates* 466: 1–16.
- Engel MS (2001) A monograph of the Baltic amber bees and evolution of the Apoidea (Hymenoptera). *Bulletin of the American Museum of Natural History* 259: 1–192. [https://doi.org/10.1206/0003-0090\(2001\)259<0001:AMOTBA>2.0.CO;2](https://doi.org/10.1206/0003-0090(2001)259<0001:AMOTBA>2.0.CO;2)
- Harris RA (1979) A glossary of surface sculpturing. *Occasional papers of the Bureau of Entomology of the California Department of Agriculture* 28: 1–31.
- Meyer R (1920 [,1919"]) *Apidae-Sphecodinae*. *Archiv für Naturgeschichte, Abt. A* 1919(1): 79–160; (2): 161–242.

- Meyer R (1922) Nachtrag I zur Bienengattung *Sphecodes* Latr. Archiv für Naturgeschichte. Abteilung A 88(8): 165–174.
- Meyer R (1925) Zur Bienengattung *Sphecodes*. Archiv für Naturgeschichte. Abteilung A 90(12): 1–12.
- Michener CD (2007) The Bees of the World (2nd ed.). Johns Hopkins University Press, Baltimore, 953 pp. [+ 20 pls] <http://base.dnsgb.com.ua/files/book/Agriculture/Beekeeping/Thep-Bees-of-the-World.pdf>
- Mitai K, Tadauchi O (2013) Taxonomic study of the Japanese species of the genus *Sphecodes* (Hymenoptera, Halictidae). Esakia 53: 21–78.
- Niu Z-Q, Yuan F, Zhu C-D (2018) Apoidea (Apidae, Melittidae, Halictidae). Species Catalogue of China (Vol. II). Insect (IV). Science press, Beijing, 190 pp. [in Chinese]
- Niu Z-Q, Zhang D, Zhu C-D (2020) Extraordinary bees of the genus *Lasioglossum* Curtis, 1833 (Hymenoptera: Apoidea: Halictidae) from China. Zoological Systematics 45(1): 50–58. <https://doi.org/10.11865/zs.202005>
- Smith F (1853) Catalogue of Hymenopterous insects in the collection of the British Museum. Andrenidae and Apidae (Vol. 1). Printed by order of the Trustees, London, 197 pp. [+ taf. 1–6.] <https://doi.org/10.5962/bhl.title.20858>
- Smith F (1879) Descriptions of New Species of Hymenoptera in the Collection of the British Museum. British Museum, London, 240 pp. <https://doi.org/10.5962/bhl.title.17490>
- Strand E, Yasumatsu K (1938) Two new species of the genus *Sphecodes* Latreille from the Far East (Hymenoptera: Apoidea). Mushi 11(1): 78–82.
- Tsuneki K (1983) A contribution to the knowledge of *Sphecodes* Latreille of Japan (Hymenoptera, Halictidae). Special Publications of the Japan Hymenopterists Association 26: 1–72.
- Wu Y-R (1965) Hymenoptera: Apoidea, Chinese Economic Insect Fauna, Vol. 9. Science Press, Beijing, 83 pp. [pls. i–vii.] [in Chinese]
- Wu Y-R, He W, Wang SF (1988) Bee Fauna of Yunnan. Kunming, Yunnan Science and Technology Press, 131 pp. [pls. i–vi.] [in Chinese]
- Yasumatsu K, Hirashima Y (1951) Zwei neue *Sphecodes*-Arten aus Japan nebst Beschreibung des Weibchens von *Sphecodes esakii* Strandt et Yasumatsu. Insecta Matsumurana 17(3/4): 121–125. https://eprints.lib.hokudai.ac.jp/dspace/bitstream/2115/9523/1/17%283-4%29_p121-125.pdf
- Zhang D, Niu Z-Q, Orr MC, Ascher JS, Zhu C-D (2020) Chinese species of *Nomia* (*Gnathonomia*) Pauly, 2005 (Hymenoptera: Apoidea: Halictidae: Nomiinae). Zootaxa 4768(1): 76–94. <https://doi.org/10.11646/zootaxa.4768.1.5>