



## A review of *Megachile* (*Chelostomoda*) Michener (Megachilidae: Megachilini) known from China with the description of a new species

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### Abstract

The Chinese species of *Megachile* (*Chelostomoda*) Michener, 1962, are treated in this paper. *Megachile* (*C.*) *guangxiense* sp. nov. is described and illustrated. A checklist of the known Chinese species, distribution records, and an updated identification key are provided. The type specimens of *M. guangxiense* are deposited in the Insect Collection of the Institute of Zoology, Chinese Academy of Sciences, Beijing, China (IZCAS, Beijing).

**Key words:** *Megachile* (*Chelostomoda*), taxonomy, species checklist, floral association, distribution

### Introduction

Michener erected *Chelostomoda* as a subgenus of *Chalicodoma* in 1962. He gave the diagnosis of *Chelostomoda* as follows: “body small, slender, parallel-sided, coarsely sculptured; posterior part of thorax as well as transverse tergal grooves as in both subgenera *Hackeriapis* and *Chelostomoides*; pitted zone at base of propodeum present only laterally; tergal grooves not fasciate; terga with apical pubescent fasciae; head not much developed posteriorly; lateral ocellus being little nearer eye than margin of vertex; preoccipital ridge sharp but not carinate; pronotal lobe carinate” (Michener, 1962: p.25). Michener (1965) provided a full description and illustrations of the subgenus *Chalicodoma* (*Chelostomoda*), including figures of male genitalia and sterna. Michener (2000) rearranged the classification of the tribe Megachilini, placing all nonparasitic Megachilini in the genus *Megachile*, therefore assigning *Chelostomoda* as a subgenus of *Megachile*. Michener (2007) noted that at least 14 specific names have been included in *M. (Chelostomoda)*, and that this subgenus ranges from China and Japan south to the Solomon Islands, and northern Queensland (Australia), westward throughout Indonesia and Southeast Asia to India.

Wu (2005) described two new species of *M. (Chelostomoda)* from China. Wu (2006) recorded and gave a key to the four Chinese species (four males, two females) of the subgenus. Baker & Engel (2006) considered *Megachile saphira* Cameron, 1907 to be a junior synonym of *M. ulrica* Nurse, 1901, and placed *M. ulrica*, *M. lefroma* Cameron, *M. albolineata* Cameron, *M. funnelli* Cockerell, and *M. bougainvillei* Cockerell in the subgenus *M. (Chelostomoda)*. Gonzalez (2008) explored the relationships among the 58 subgenera of *Megachile* Latreille *s. l.* by means of a cladistic analysis of adult external morphological characters. Gonzalez proposed a phylogenetic-based classification for the genus, and suggested grouping its subgenera into four genera (*Chalicodoma*, *Megachile*, *Matangapis*, and *Thaumatostoma*), a generic classification similar to that still followed by some authors (e.g., Ornos et al. 2007), although his results have not been widely accepted by other researchers. Ascher & Pickering (2011) listed 20 species of the subgenus *M. (Chelostomoda)* worldwide.

### Material and methods

The specimens examined in this study are deposited in the Insect Collection of the Institute of Zoology, Chinese Academy of Sciences, Beijing, China (IZCAS). The specimens were examined with a Leica M10 (Germany)

stereomicroscope. Attributes were recorded with a Cannon 450D12M (Japan) digital camera. The morphological terminology used in the descriptions follows Michener (2000). Body measurements are given in millimeters (mm) or relative measurements are used in some cases. Some abbreviations used in the description follows Niu *et al.* (2004): HL (head length): measured from the apicomedian margin of the clypeus to the upper margin of the vertex in frontal view; HW (head width): measured at the widest point of the head across the compound eyes in frontal view; EW (eye width): the greatest width of eye in lateral view; GW (genal width): the greatest width of the gena in lateral view; MtW (metasomal width): measured at the widest metasomal tergum in dorsal view; TW (width between tegulae): the greatest width between tegulae in dorsal view.

## Taxonomy

The checklist of known Chinese species of *Megachile* (*Chelostomoda*) is shown in Table 1.

**TABLE 1.** Checklist of known Chinese species of *Megachile* (*Chelostomoda*)

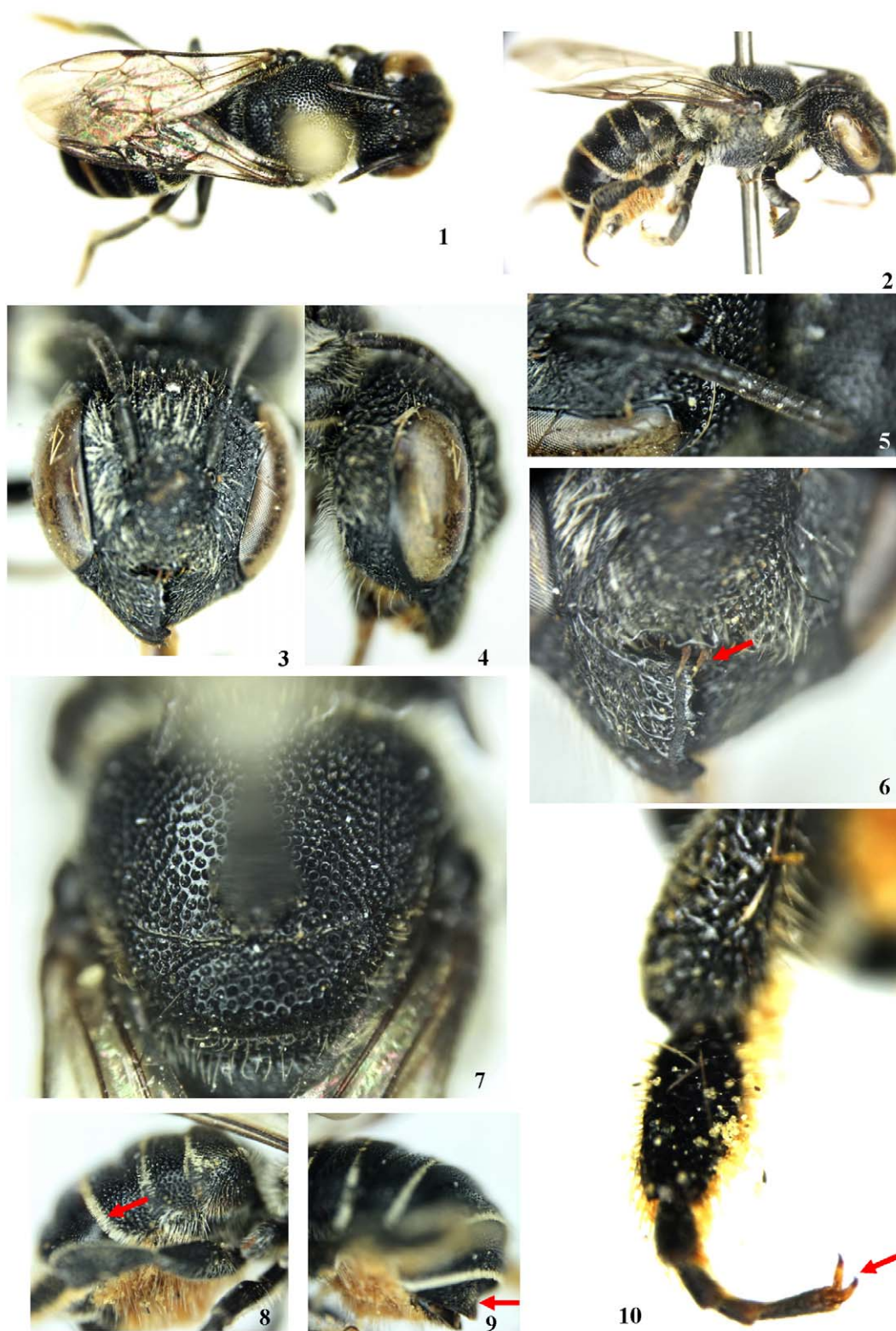
Species	Female	Male	Floral associations	Distribution
<i>M. (C.) crabipedes</i> Wu, 2005	×	√	unknown	Yunnan
<i>M. (C.) guangxiense</i> <b>sp. nov.</b>	√	√	unknown	Guangxi
<i>M. (C.) nigroapicalis</i> Wu, 2005	√	√	unknown	Yunnan
<i>M. (C.) ulrica</i> Nurse, 1901	√	√	<i>Melilotus officinalis</i> , <i>Homonoia</i> sp.	Beijing
<i>M. (C.) spissula</i> Cockerell, 1911	√	√	<i>Sophora japonica</i> , <i>Melilotus officinalis</i> , <i>Amomum villosum</i> , <i>Vitex negundo</i> , <i>Homonoia</i> sp., <i>Malva sinensis</i>	Beijing, Shanghai, Jiangsu, Zhejiang, Shandong, Fujian, Guangxi, Hainan, Sichuan, Yunnan
<b>Total</b>	4	5		

√ represents the sex of the species present in China; × represents the sex of the species unrecorded from China.

## Key to the Chinese species of *Megachile* (*Chelostomoda*)

(Modified from the key by Wu (2006), female of *Megachile spissula* unknown)

1. Females (antenna with 10 flagellomeres) . . . . . 2
- Males (antenna with 11 flagellomeres) . . . . . 5
2. Clypeal median lobe with two setal tufts (Figs 6, 22) . . . . . 3
- Clypeal median lobe with four setal tufts (Fig. 23) . . . . . 4
3. T1–T5 with white apical hair bands, hair bands not narrowed medially . . . . . *M. (C.) spissula*
- T1–T5 with white apical hair bands, but the bands on T1–T3 narrower medially . . . . . *M. (C.) guangxiense* sp. nov.
4. Postgradular grooves on T2–T3 deep; scopa yellowish; S6 glabrous . . . . . *M. (C.) ulrica*
- Postgradular grooves on T2–T3 shallow; scopa white; S6 with short black hairs . . . . . *M. (C.) nigroapicalis*
5. Hind legs obviously modified, hind femora and tibiae swollen, tarsomeres 1–4 strip-like, fifth tarsomere round clubbed, two times as long as tarsomeres 1–4 together (Fig. 28); S1 with median projected lobe (Fig. 24) . . . . . *M. (C.) crabipedes*
- Hind legs not modified; S1 flat, without a conspicuous median lobe (Fig. 25) . . . . . 6
6. Antenna short, only extending to apex of scutellum . . . . . 7
- Antenna long, extending to propodeum . . . . . 8
7. First antennal flagellomere slightly broader than long, less than half as long as second (Fig. 14) . . . . .
- First antennal flagellomere nearly as broad as long, half the length of the second (Fig. 29) . . . . . *M. (C.) guangxiense* sp. nov.
8. Mandible black, with three acute teeth, interspaces between teeth narrow (Fig. 30); outer surface of front tibia reddish-brown; hind distitarsus black (Fig. 32) . . . . . *M. (C.) spissula*
- Mandible brownish-black, with three blunt teeth, interspaces between teeth broad (Fig. 31); outer surface of front tibia blackish-brown; hind distitarsus brown (Fig. 33) . . . . . *M. (C.) nigroapicalis*
- Mandible brownish-black, with three blunt teeth, interspaces between teeth broad (Fig. 31); outer surface of front tibia blackish-brown; hind distitarsus brown (Fig. 33) . . . . . *M. (C.) ulrica*



**FIGURES 1–10.** *Megachile (Chelostomoda) guangxiense* sp. nov. Holotype, ♀, 1, Body in dorsal view; 2, Body in lateral view; 3, Head in frontal view; 4, Head in lateral view; 5, Antenna in lateral view; 6, Clypeus and mandible in frontal view, showing the setae-tuft on clypeal median lobe and teeth on mandible; 7, Mesoscutum and scutellum in dorsal view; 8, Metasoma in lateral view, showing the apical hair bands on terga; 9, Metasoma in lateral view, showing the T6; 10, Hind tarsus in lateral view, showing the claw.

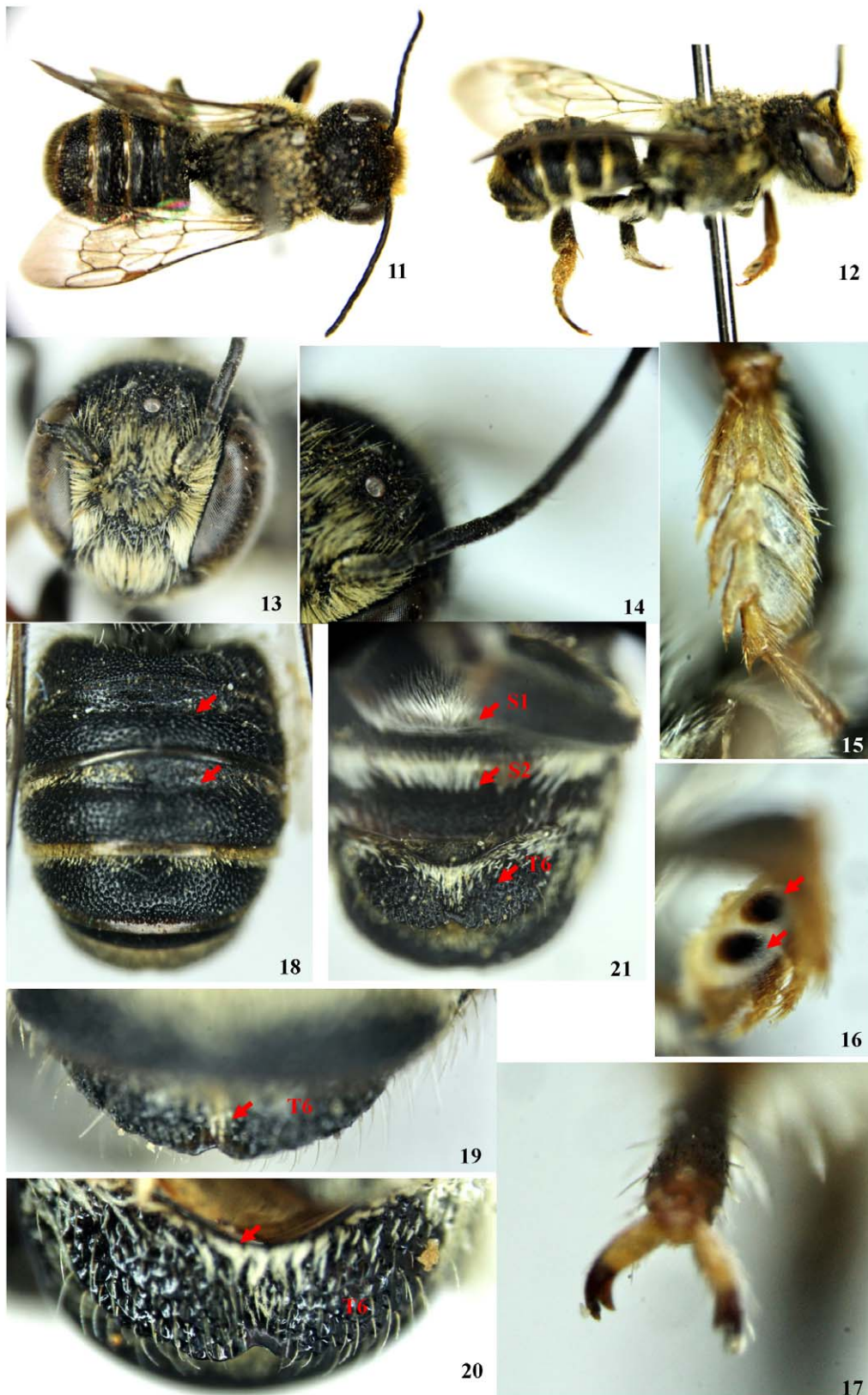
**1. *Megachile (Chelostomoda) guangxiense* sp. nov.**

(Figs. 1–10, ♀, holotype; Figs. 11–21, 37, 38, ♂, allotype)

**Diagnosis.** This species can be distinguished from all other Chinese *M. (Chelostomoda)* species by the following combination of characters: both sexes with small body size, female clypeal median lobe with two tufts of yellowish-brown setae, apical white hair bands on T1–T3 narrower medially; male antenna short, only extending to apex of scutellum, first antennal flagellomere slightly broader than long, and less than half as long as second flagellomere; hind leg unmodified; S1 unmodified, unlike other species in the subgenus that possess a conspicuous medial projection.

**Description.** Female. Body length 7 mm (Figs. 1, 2); head broader than long, HW: HL=80: 67 (Fig. 3); gena narrower than eye in lateral view, GW: EW=20: 25 (Fig. 4); width of metasoma equal to that of the tegula, MtW: TW=79: 79. First antennal flagellomere slightly longer than broad, second flagellomere broader than long, first flagellomere slightly longer than second, flagellomeres 3–9 approximately as long as broad, tenth flagellomere longer than broad (Fig. 5); clypeus broader than long, with round and shallow punctures, clypeal margin trilobed, median lobe broad and shallowly emarginated medially, with two tufts of yellowish-brown setae (Fig. 6); punctures on vertex and gena larger and denser than that of clypeus; mesoscutum and scutellum with round punctures (Fig. 7), size of punctures smaller than that of vertex; mesepisternum with round punctures, size of punctures roughly equal to that of mesoscutum; T1–T5 with punctures of different sizes; mandible roughly wide apically, with 5 teeth and a large incomplete cutting edge in second interspace only (Fig. 6); fore wing with two submarginal cells of roughly equal in length, basal vein roughly convex and meeting vein Cu at acute angle, 2nd m-cu meeting the apical margin of 2nd submarginal cell, marginal cell distal to stigma on costa longer than stigma; stigma over twice as long as broad, margin of stigma in first submarginal cell longer than width of stigma, prestigma much more than twice as long as broad; jugal lobe of hind wing less than half as long as vannal lobe, vein cu-v less than half as long as second abscissa of M+Cu; pronotal lobe carinate; axilla not produced posteriorly; metanotum without median spine; scuto-scutellar fovea absent; metasoma parallel sided; anterior surface of T1 strongly concave; T2–T4 with strong postgradular grooves, not fasciate; T1–T5 with apical bands of white hairs, bands of T1–T3 narrower at medially (Figs. 8, 9); T6 distinctly concave apically in lateral view (Fig. 9); S2–S5 with apical fasciae of white hair under scopa in lateral view; pygidial plate absent; middle and hind basitarsi distinctly shorter and narrower than corresponding tibiae, fore and middle tibiae with one spine on outer side, outer side of hind tibia without spine, outer surface of tibiae without tubercles; claws simple, without inner median tooth, arolia absent (Fig. 10). Clypeus, mandible, vertex, frons, antenna, pronotal lobe, mesoscutum, scutellum, and legs black. Pubescence sparse; paraocular area, pronotal lobe, posterolateral surface of propodeum with longer plumose white hairs; apex of T6 with shorter and denser dull brownish-yellow hairs. Scopa white.

Male. Body length 6 mm (Figs. 11, 12); head round, head broader than long (Fig. 13), HW: HL=77:74; gena narrower than eye, GW: EW =19: 24; width of metasoma narrow than that of tegulae, MtW: TW=74: 81. Clypeus broader than long, with round and deep punctures; vertex, genae with round and denser punctures, punctures larger than those of clypeus; mesoscutum and scutellum with round punctures, size of punctures smaller than that of vertex; antenna short, extending to the apex of scutellum, first flagellum slightly broader than long, less than half as long as second flagellomere, flagellomeres 2–11 roughly twice as long as broad and their nearly equal to each other in length (Fig. 14); mandible tridentate, no inferior projection; characters of forewing and hindwing same as in female; fore and middle tibiae with one spine on outer surface, hind tibia without spine; tarsomeres 1–3 of the foreleg flattened and broadened, triangle-shaped, apical median deeply excavated, outer surface with golden fringes (Fig. 15), inner surface of tarsomeres 2–3 with black spot (Fig. 16); middle tibial spur present, middle tarsus somewhat broadened, outer surface with long plumose white hairs; hind basitarsus much less than half the length of hind tibia and narrower than the latter, outer surface with long plumose white hairs; claws with inner median tooth, arolia absent (Fig. 17); T2–T5 with strong postgradular grooves (Fig. 18); T6 bent to ventral surface, in dorsal view, apical margin of T6 with weakly emarginated medially, median concave and lateral region bulbous (Fig. 19); in ventral view, T6 with a carina, not toothed, the carina rounded medially and extending the apex of T6, apical region of carina bulbous except median, median concave and weakly emarginated (Fig. 20); metasoma only three sterna exposed (Fig. 21). Clypeus, mandible, vertex, frons, antenna, pronotal lobe, mesoscutum, scutellum black; except inner surface of fore tibia yellowish brown, fore tarsus brownish yellow, and middle tarsus yellowish brown, other parts of all legs black. Pubescence denser than that of female; lower part of clypeus, paraocular area, lower



**FIGURES 11–21.** *Megachile (Chelostomoda) guangxiense* sp. nov. Allotype, ♂, 11, Body in dorsal view; 12, Body in lateral view; 13, Head in frontal view; 14, Antenna in lateral view; 15, Outer surface of fore tarsus; 16, Inner surface of fore tarsus, showing the black spots; 17, Claw on distitarsus of middle leg; 18, Metasoma in dorsal view, showing the postgradular groove on T2 and T3; 19, T6 in dorsal view, showing the apical margin; 20, T6 in ventral view, showing the carina; 21, Metasoma in ventral view, showing the exposed S1, S2 and T6.

part of gena, pronotal lobe, mesepisternum, and posterolateral surface of propodeum with longer plumose white hairs; T3–T5 postgradular grooves covered with short plumose yellowish-brown hairs; disc of S1 covered with triangle-shaped plumose white hairs, S2 with apical band of plumose white hairs (Fig. 21); coxa, trochanter, femur of fore and middle leg, and hind coxa with plumose white hairs; genitalia as in Figs. 37, 38.

**Type material.** Holotype, ♀, China, Guangxi, Jingxi, Bangliang, 23.13°N, 106.42°E, 5 Aug. 2010, coll. Ze-qing NIU. Allotype, ♂, same label information as the holotype.

**Distribution.** China (Guangxi).

**Floral association.** Unknown.

**Etymology.** Named after the type locality, Guangxi province, China.

## 2. *Megachile (Chelostomoda) crabipedes* Wu, 2005

*Megachile (Chelostomoda) crabipedes* Wu, 2005. Act. Zootaxon. Sin., 30(1), 164. Holotype, ♂. Type locality: Yunnan, Xishuangbanna, Menglun (21.9°N, 101.2°E), 22 Apr. 1994, coll. Huan-Li XU. Type depository: IZCAS, Beijing.

**Distribution.** China (Yunnan).

**Floral association.** Unknown.

**Specimens examined.** Holotype, 1♂, Yunnan, Xishuangbanna, Menglun (21.9°N, 101.2°E), Huan-Li XU coll.; Paratypes, 3♂♂, same label information as holotype; 1♂, Yunnan, Xishuangbanna, Damenglung, 650m, 4 May 1958, coll. Yi-Ran ZHANG.

## 3. *Megachile (Chelostomoda) nigroapicalis* Wu, 2005

*Megachile (Chelostomoda) nigroapicalis* Wu, 2005. Act. Zootaxon. Sin., 30(1), 162–163. Holotype, ♀. Type locality: Yunnan, Xishuangbanna, Menglun (21.9°N, 101.2°E, 650m), 31 Mar. 1994, coll. Long-Long YANG. Type depository : IZCAS, Beijing.

**Distribution.** China (Yunnan).

**Floral association.** Unknown.

**Specimens examined.** Holotype, 1♀, Yunnan, Xishuangbanna, Menglun (21.9°N, 101.2°E, 650m), 31 Mar. 1994, coll. Long-Long YANG; Paratypes, 1♂, same label information as holotype; 1♀, 1♂, Yunnan, Xishuangbanna, Menglun, 3 Apr. 1994, coll. Huan-Li XU; 3♂♂, Yunnan, Xishuangbanna, Menglun, 22 Apr. 1994, coll. Huan-Li XU; 1♂, Yunnan, Xishuangbanna, Damenglong, 650m, 12 Oct. 1958, coll. Zhi-Zi CHEN; 1♂, Yunnan, Xishuangbanna, Damenglong, 650m, 16 Apr. 1958, coll. Yi-Ran ZHANG.

## 4. *Megachile (Chelostomoda) ulrica* Nurse, 1901

*Megachile ulrica* Nurse, 1901. Jour. Asia. Soc. Beng., 151. ♀. Type locality: Matheran. Type: no record.

*Megachile saphira* Cameron, 1907. Jour. Bom. Nat. Hist. Soc., XVII, 1006. ♂. Type locality: Matheran. Type: no record.

*Chalicodoma (Chelostomoda) saphira*: Gupta, 1993. Taxonomic Studies on the Megachilidae of North-Western India, 159–162. ♀, ♂.

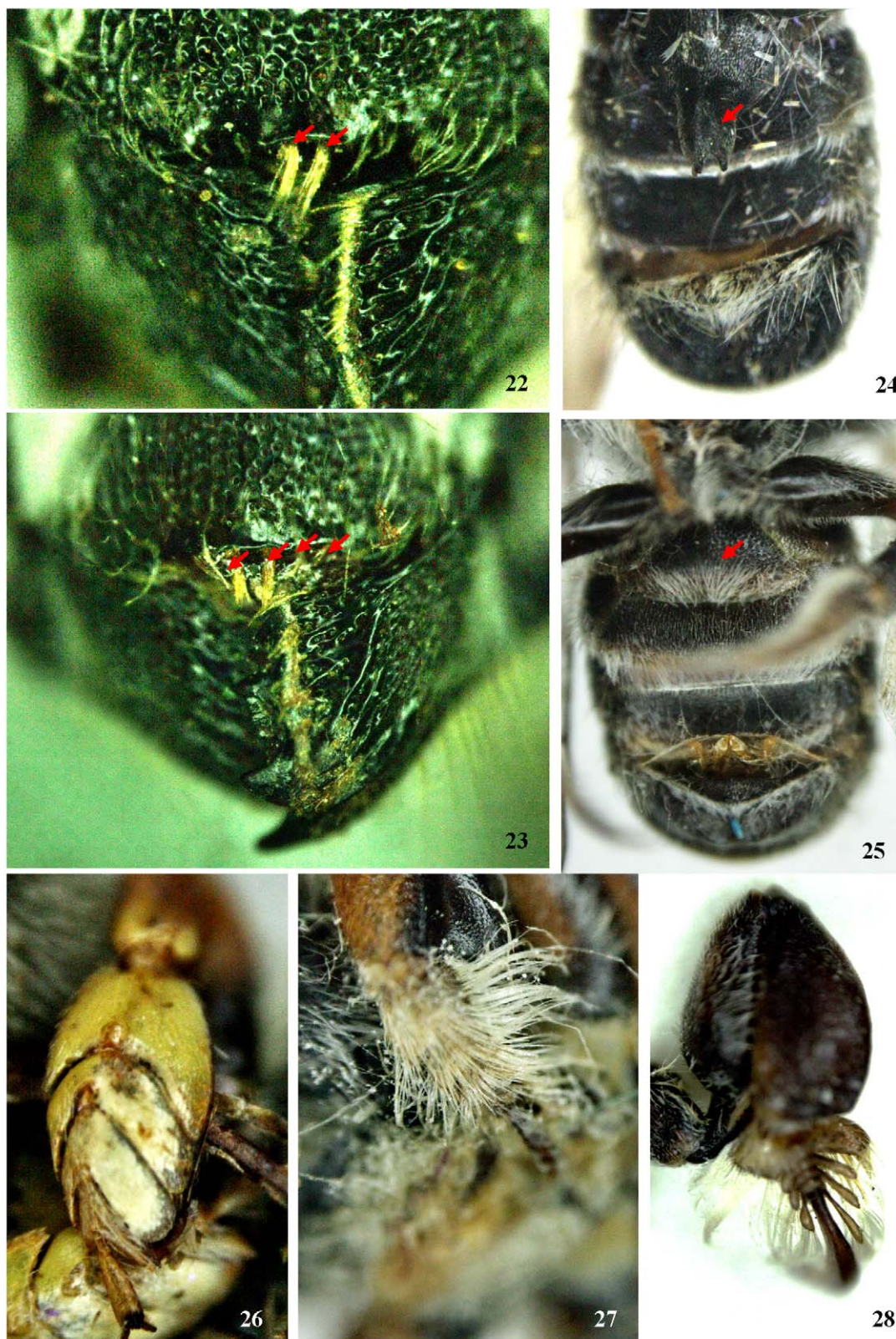
*Megachile (Chelostomoda) saphira*: Wu, 2006. Megachilidae in Fauna Sin., Ins., Vol. 44, 354. ♀, ♂.

**Redescription.** Male and female (Wu 2006).

**Distribution.** China (Beijing), India.

**Floral associations.** *Melilotus officinalis* (Fabaceae), *Homonoia* sp. (Euphorbiaceae).

**Specimens examined.** 4♂♂, Beijing, 3–7 Jul. 1952, coll. Su-Mei GE; 6♀♀, Beijing, 11 Jul. 1957, coll. Su-Mei GE; 2♀♀, Beijing, 27 Jul. 1965, coll. Ying-Hen HANG; 1♀, Beijing, 4 Jul. 1973, coll. Su-Fang WANG.



**FIGURES 22–28.** Characters of Chinese *Megachile* (*Chelostomoda*) species. 22, *M. (C.) spissula* female clypeus in frontal view, showing setae-tufts on clypeal median lobe; 23, *M. (C.) ulrica* female clypeus in frontal view, showing setae-tufts on clypeal median lobe; 24, *M. (C.) crabipedes* male metasoma in ventral view, showing horned lobe on S1; 25, *M. (C.) nigroapicalis* male metasoma in ventral view; 26, *M. (C.) crabipedes* male fore tarsus; 27, *M. (C.) crabipedes* male middle tarsus; 28, *M. (C.) crabipedes* male hind leg.







