



Species diversity and distribution of Megachilidae bees from Chhattisgarh, Central India

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ABSTRACT: This study deals with the species diversity of leaf-cutter and resin bees from three tribes, four genera, and seven subgenera of the family Megachilidae from Central India. Before this study, only a few species were known from Central India. During the surveys undertaken in 2019–2022, 10 species, including two cleptoparasitic bee species of the family Megachilidae, were collected and examined. *Megachile lanata* Fab. was the predominant species in all the survey locations. Seven species were discovered for the first time in Central India. This paper provides details of the Megachilidae species with an updated distribution and brief diagnosis.

Key words: Megachilidae, Bee diversity, pollinator, Chhattisgarh

INTRODUCTION

Solitary bees have been known as important pollinators. Among these, bees under the family Megachilidae are important pollinators offering their crucial role in the wellbeing of the ecosystem. Megachilidae has approximately 4,000 species found worldwide (Ascher and Pickering, 2020; Michener, 2007). In India, 75 species have been reported from the tribe Megachilini (Gupta, 1999), of which 16 are reported from the genus *Megachile* Latreille. Several species of Megachilidae are known as effective pollinators and are now farmed and preserved because of their importance in pollinating commercial crops (Batra, 1977). The most common names for the megachilids are 'mason bees' and 'leafcutter bees,' which refer to the materials used to construct their nest cells (mud or leaves, respectively). Some gather plant or animal fur and fibers and are known as carder bees, while some utilize plant resins in nest construction and are known as resin bees. Most of the species feed on pollen and nectar. However, few cleptoparasites (cuckoo bees) eat pollen gathered by other Megachilid bees. These include genera *Coelioxys* Latreille of the tribe Megachilini and *Euaspis* Gerstaecker of the tribe Anthidiini (Hymenoptera: Megachilidae) and cleptoparasitic bees belonging to the genus *Megachile* Latreille (Michener, 2007). *Coelioxys* is an old-world cleptoparasitic bee genus including several species (Warncke, 1992; Gupta, 1993; Nagase, 2006; Wu, 2006; Michener, 2007; Ascher and Pickering, 2020). Gupta, 1993 reported *M. cephalotes* from Central India (Madhya Pradesh). Bingham reported *Coelioxys angulate* from different regions of India and,

for the first time, from Central India (1897). *Megachile elfrona* has been reported from Gujrat (Gupta, 1993) and Rajasthan, Madhya Pradesh (Kumari *et al.*, 2020). Three species, *M. anthracina*, *M. carbonaria*, and *M. elizabethae* Bingham, of genus *Megachile*, were reported by Kumari and Kumar (2016) from Punjab, India. Gupta (2015) recorded eight species of the family Megachilidae from Uttarakhand, India, of which six were of the genus *Megachile* and two of the *Coelioxys*. Recently, Sardar *et al.* (2021) reported seven species of the genus *Megachile* in 5 different states of India, and *M. lanata* was reported for the first time from Assam. Veereshkumar and Kumarnag (2018) reported the family Megachilidae with six species, *M. lanata*, *M. anthracina*, *M. lerma*, *M. disjuncta*, *L. atratus* and *M. bicolor* from Bengaluru, Karnataka, India. Even though many workers have been documenting bees, as evident from the above reports, this is not even 1% of the total expected bee diversity from the Chhattisgarh state.

The present study attempts to add and further update the information on the Megachilidae from Central India, specifically Chhattisgarh, which remains an under-explored region for bee fauna. Chhattisgarh has the country's most abundant and pristine set of natural resources. Recent surveys of bees from the forests and plains in Chhattisgarh state conducted by Minz *et al.*, (2020) discovered a few additional solitary bees with a sole representation of one Megachilidae species. Many researchers have worked on the diversity of bees in different parts of India and recorded numerous and diverse solitary bees, including many leafcutter and resin bee species in the family Megachilidae. Central India

Table 1. Survey details for the collection of Megachilid bees in Chhattisgarh state during 2019 to 2022

S. No.	Agro-climatic Zone	District	Location	Geographical coordinates	No. of specimens collected	Most abundant species
1.	Northern Hill Zone	Sarguja	RMD CARS, Ambikapur	23°09'05.4"N 83°09'00.1"E	24	<i>Megachile anthracina</i> Smith
			KVK, Ambikapur	23°14'02.7"N 83°14'85.74"E	0	-
2.		Balrampur	KVK, Balrampur	27°69'N 82°65'76.4"E	0	-
3.		Jashpur	Badalkhol WLS	22°89'61.73"N 83°91'58.04"E	0	-
4.	Chhattisgarh Plain Zone	Raipur	Tamorpingla WLS	23°36'01.8"N 83°00'01.1"E	0	-
5.			Lakhna, Somnath	21°56'74.86"N 81°66'95.68"E	12	<i>Euaspid carbonaria</i> Smith <i>Coelioxys angulata</i> Smith
			IGKV, Raipur	21°14'03.6"N 81°42'51.4"E	6	<i>Megachile vigilans</i> Smith
			Energy park, Raipur	21°21'94.77"N 81°69'76.54"E	0	-
6.	Mahasamund	Mahasamund	Barnawapara WLS	21°47'98.74"N 82°53'13.15"E	18	<i>Megachile hera</i> Bingham
			KVK, Mahasamund	21°03'47.0"N 82°05'04.6"E	0	-
7.	Baloda Bazar	Bhatapara	21°44'31.9"N 81°56'13.7"E	2	<i>Megachile vigilans</i> Smith	
	Bilaspur	Achanakmar WLS	22°26'04.4"N 81°42'11.0"E	0	-	
8.	Dhamtari	Dhamtari	20°41'37.7"N 81°33'00.3"E	0	-	
9.	Rajnandgaon	Dongargarh	21°13'20."N 80°43'07"E	0	-	
10.	MohlaManpur	Mohla	20°35'00.0"N 80°44'56.2"E	0	-	
11.	Bemetara	Bemetara	Patharra, Bemetara	21°38'24.1"N 81°36'07.1"E	4	<i>Megachile lanata</i> Fabricius
			Semariya	21°51'18.0"N 81°29'35.2"E	78	<i>Megachile bicolor</i> Fabricius <i>Lithurgus</i> sp. 1
12.	Kawardha	Bhoramdev WLS	Bhoramdev WLS	22°00'41.4"N 81°05'57.9"E	4	<i>Megachile lanata</i> Fabricius
13.	Khairagarh-Chhuikhadan-Gandai	Khairagarh	21°24'53.2"N 80°58'44.8"E	0	-	

14.	Bastar plateau zone	Jagdalpur	Shaheed	19°05'33.9"N	6	<i>Megachile lanata</i> Fabricius
			Gundadhur	81°57'38.7"E		
			CARS farm, Jagdalpur, Chhattisgarh			
			Kanger valley NP, Jagdalpur	18°57'14.3"N 82°14'11.7"E	2	<i>Megachile lanata</i> Fabricius

*WLS: Wildlife Sanctuary; CARS: College of Agriculture and Research station; KVK: Krishi Vigyan Kendra; IGKV: Indira Gandhi Krishi Vishwavidyalaya; RMD: Rajmohini Devi College of Agriculture and Research Station

remains an under-studied region for Megachilid bees, with barely four Megachilid bee species (Bingham, 1897; Minz *et al.*, 2020; Kumari *et al.*, 2020; Gupta, 1993). In this context, extensive surveys were undertaken and the present study aims to summarize the diversity and distribution of Megachilid bees from Chhattisgarh state.

MATERIALS AND METHODS

Extensive surveys were undertaken from July 2019 to August 2022 in three agro-climatic zones of Chhattisgarh state to document Megachilid bees. Different agricultural, horticultural crops and natural forest areas were visited during the surveys and rigorous collections were done. Elaborate details of the surveys are provided in Table 1. Permission was acquired to collect samples from the Office of the Principal Chief Conservator of Forests (Wildlife Management & Bio-diversity Conservation cum-Chief Wildlife Warden) Chhattisgarh via letter no. 4237, dated 07/27/2019.

Sweep net and Yellow Pan Traps were used to collect the samples. The sweep net collection method was chosen for bees foraging on the flowers during bright sunny days. The obtained samples were transferred to a charged killing bottle. After being killed, the bees were curated, labelled and secured in fumigated insect boxes. Specimens were later examined using a Leica S8AP0 microscope and identified up to the species level using Michener, 2000; Batra, 1977 and Bingham, 1897. Microphotographs were taken with a Leica MZ 16A camera using LAS V3.8 imaging software. Seventy identified voucher specimens were deposited in the National Insect Museum (NIM) of ICAR- National Bureau of Agricultural Insect Resources, Bangalore, India, with their respective accession numbers. Another set of specimens were deposited in IGKV, Raipur. Terminology, in general, follows Michener (2007).

Statistical analysis

Samples across the sampling duration were combined for analysis and the following observations were undertaken:

1. The species richness was calculated using following models (Magurran, 2004)
Menhinick's index ($D_{Mn} = S/\sqrt{N}$)
2. Diversity index was computed following (Hill, 1973)
Shannon Weaver diversity index ($H' = -\sum [p_i \ln(p_i)]$)
3. Species Evenness was calculated following (Hill, 1973): $E = H' / \ln S$

Where, H' is the diversity index calculated from Shannon Weaver diversity index.

4. Relative abundance

Samples from all the colored pan traps were compiled and used to calculate the relative abundance by the following formula (Curtis and McIntosh, 1951)

$$\text{Relative abundance} = \frac{\text{Total number of individuals of one species}}{\text{Total number of individuals of all species}} \times 100$$

RESULTS AND DISCUSSION

A total of 156 specimens were randomly collected in 35 surveys from 21 locations in Chhattisgarh. Ten species were found belonging to four genera and seven subgenera (Table 2). Diversity indices of the Megachilid bees were calculated and the following values were obtained: Shannon Weaver diversity index (2.18), Menhinick diversity index (0.80) with effective number of species (8.84). The results show the diverse population of Megachilid bees in Chhattisgarh. The highest relative abundance was found of *Lithurgus* sp. 1 (47% of total population) followed by *M. lanata* (12.82 %) but the distribution of *Lithurgus* sp. 1 was confined to one area (Semariya) in a horticulture field and could not be collected from any other site even after multiple attempts. However, *M. lanata* was found in many survey locations and was found to be the most common species in Chhattisgarh region. Amongst four genera collected, *Megachile* was found to be the predominant genus in Chhattisgarh (Fig. 1).

Table 2. List of Megachilid bee species collected from Chhattisgarh

Species	Specimens examined	Relative abundance (%)
<i>Megachile lanata</i> Fabricius	15 ♀, 5 ♂	12.82
<i>Megachile bicolor</i> Fabricius	4 ♀, 4 ♂	5.12
<i>Megachile anthracina</i> Smith	2 ♀, 8 ♂	6.41
<i>Megachile carbonaria</i> Smith	4 ♀, 2 ♂	3.84
<i>Megachile hera</i> Bingham	2 ♀, 4 ♂	3.84
<i>Megachile vigilans</i> Smith	10 ♀, 4 ♂	8.97
<i>Coelioxys fuscipennis</i> Smith	6 ♀	3.84
<i>Euaspis carbonaria</i> Smith	2 ♀, 4 ♂	3.84
<i>Lithurgus</i> sp. 1	2 ♀, 60 ♂	47.43
<i>Lithurgus</i> sp. 2	2 ♀	2.56

Details of species recorded from Central India

Brief diagnosis with key identifying characters of all species are as follows:

Megachile (Pseudomegachile) lanata Fabricius, 1775 (Figs 2A & 2B)

Female ♀

Body black, antennae with black scape and pedicel, flagellum dark brown, legs black, tegulae orange. Body length 20.94 mm, large bee with testaceous pubescence. Dense fulvous pubescence on thorax; scutellum rounded and wing flavohyaline.

Male ♂

Body black, body length 18.65 mm, smaller than female; face with dense fulvous red pubescence; Mesosoma: completely covered with dense fulvous pubescence. Metasoma: T1 and T2 covered with red fulvous dense pubescence; T2-T5 with transverse white apical bands of pubescence. Genitalia: inner surface of gonostylus with fringe of plumose bristles; bare gonocoxite; slightly dilated penis valve apically.

Distribution

India: Chhattisgarh (recorded during the present survey as well as by Minz *et al.*, 2020), Jammu (Abrol *et al.*, 2017), Karnataka (Amala and Shivalingaswamy, 2018), Tamil Nadu (Kannagi *et al.*, 2016), Uttarakhand (Kunjwal *et al.*, 2016), Himachal Pradesh, Haryana, Punjab, Gujarat, Rajasthan (Gupta, 1993), Jammu, Kerala, Maharashtra, Uttar Pradesh, Madhya Pradesh, Bihar (GBIF, 2021), West Bengal, Assam, Dadra and Nagar Haveli (Sardar *et al.*, 2011).

Global: India (Magnacca *et al.*, 2013), Pakistan (Akram

et al., 2019), Florida (Kevin *et al.*, 2019), Colombia (Gonzalez *et al.*, 2019), West Indies, Ethiopian and Oriental regions (Mitchell, 1962), Hawaii (Magnacca, 2015). Africa, Caribbean, North America, Oceania, South America, Southern Asia (ITIS, 2022), Sri Lanka (Inoka *et al.*, 2014), Africa, Trinidad and Tobago, USA, Thailand, Sint Maarten (Dutch part) (GBIF, 2021).

Megachile (Amegachile) bicolor Fabricius, 1781 (Figs 2C & 2D)

Colour: Body black with white pubescence on face and orange fulvous pubescence on metasoma, antennae black, leg black, tegulae dark brown.

Female ♀

Body length 20.26 mm, black. Head: face with dense white pubescence on frons and gena. Metasoma: T1-T5 covered with bright orange pubescence, T6 covered with dark brown suberect pubescence; pale white sternal scopa present on S2-S5, S6 sparsely covered with black small hairs.

Male ♂

Body length 15.94 mm, smaller than female, black with yellow pubescence on metasoma. Head: pale white to yellowish dense pubescence on the face, gena and hypostomal area; Metasoma: dorsal metasoma similar to female; T6 covered with fulvous red to white pubescence. Genitalia: gonostylus with sparse hairs on inner surface; brush of hairs on distal part and extended misally.

Distribution:

India: Chhattisgarh (**new record**), Jammu (Abrol *et al.*, 2017), Karnataka (Veereshkumar and Kumaranag, 2018 and Suma *et al.*, 2006), Uttarakhand (Kunjwal *et al.*, 2016), Tamil Nadu, Maharashtra, Madhya Pradesh,



Fig. 1. Distribution map of different genera of Megachilidae bees in Chhattisgarh

Gujrat, Bihar, Punjab, Haryana (GBIF, 2021), Uttar Pradesh (Veereshkumar *et al.*, 2020), Rajasthan (Hooda & Jain, 2020).

Global: Hong Kong, China, Thailand, India (GBIF, 2020), Japan (Yasumatsu and Hirashima, 2011), Pakistan (Saeed *et al.*, 2019), Southern Asia (ITIS, 2022).

***Megachile (Xanthosarus) anthracina* Smith, 1853** (Figs 2G & 2H)

Female ♀

Body length 25.40 mm, black, robust shiny bee, body entirely black, wing metallic dark fuscous. Head: black pubescence on face; clypeus coarsely punctate, bare, convex, impunctate shiny line medially. Mesosoma: mesosoma with dense black pubescence at latero-posterior margin.

Male ♂

Body length 18.88 mm, shiny, black bee with yellowish face. Head: fulvous white pubescence on face, gena and hypostomal area. Mesosoma: fulvous white pubescence on dorsolateral part of pronotum, scutum

and anterior tegulae. Genitalia: gonostylus with short and long hairs on inner and distal part respectively; penis valve apically slightly dilated.

Distribution

India: Chhattisgarh (**new record**), Punjab, Tamil Nadu (GBIF, 2021), Karnataka (Syed *et al.*, 2021 and Suma *et al.*, 2006), Uttarakhand (Kunjwal *et al.*, 2016).

Global: Southern Asia (ITIS, 2022).

***Megachile (Xanthosarus) carbonaria* Smith, 1853** (Figs 2I & 2J)

Female ♀

Body entirely black, wing metallic dark fuscous. Body length 23.79 mm, similar to *M. anthracina* except smaller in size and facial pubescence mixed black and white to golden. Head: black and golden white pubescence on face. Mesosoma: black and pale white mixed pubescence at latero-anterior part; Metasoma: black hair on anterio-lateral margin of T1; T2-T5 without hair, mid basal area without punctuation.

Male ♂

Black, body length 18.51 mm, similar to *M. anthracina* except fan like long hairs absent on mid tarsal segment. Head: face, hypostomal area and gena with pale white pubescence. Mesosoma: sooty black and white pubescence on outer margin of mesosoma. Metasoma: T1-T5 bare, finely punctate, impunctate at mid-basal area, shiny black; disc of T6 with pit like depression medially. Genitalia: similar to *M. anthracina* but penis valve slightly incurved at inner surface, narrow towards tip and directed straight.

Distribution

India: Chhattisgarh (**new record**), Gujarat, Tamil Nadu (GBIF, 2021), Karnataka (Suma *et al.*, 2006).

Global: Southern Asia, Africa (ITIS, 2022), USA (GBIF, 2021) Vietnam (Ngat & Lian, 2018).

Megachile hera (Eutricharaea) Bingham, 1897 (Figs 2P&2Q)

Female ♀

Body black with white apical bands on metasoma, tegulae dark brown, black legs with white hairs, body length 12.43 mm. Head: face, gena with pale dense white pubescence; Mesosoma: black, finely punctate with pale white shiny hairs at the outer margin of mesosoma. Metasoma: T1-T5 finely punctured, with white apical hair bands and black spines laterally, T6 covered with suberect black hairs;

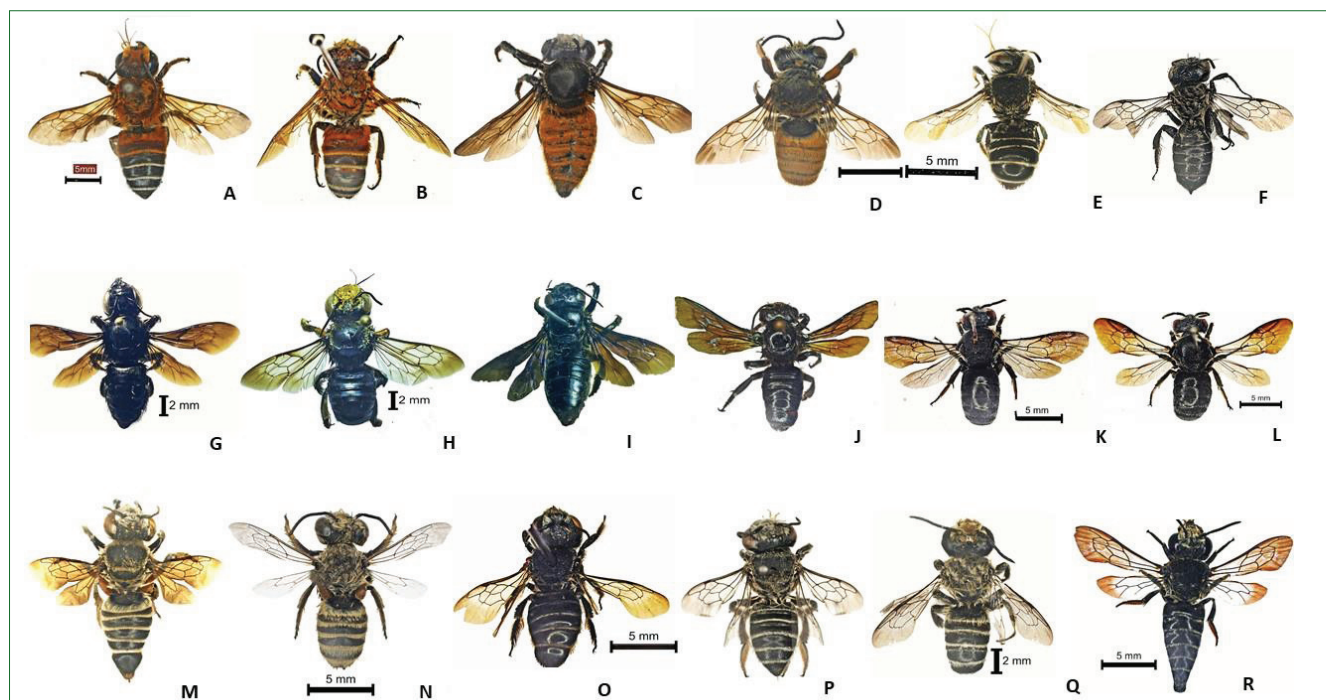


Fig. 2.(A) Female *Megachile lanata* (Fabricius) (B) Male *Megachile lanata* (Fabricius) (C) Female *Megachile bicolor* (Fabricius) (D) Male *Megachile bicolor* (Fabricius) (E) Female *Lithurgus* sp. 1 (F) Male *Lithurgus* sp. 1 (G) Female *Megachile anthracina* (Smith) (H) Male *Megachile anthracina* (Smith) (I) Female *Megachile carbonaria* (Smith) (J) Male *Megachile carbonaria* (Smith) (K) Female *Euaspis carbonaria* (Smith) (L) Male *Euaspis carbonaria* (Smith) (M) Female *Megachile vigilans* (Smith) (N) Male *Megachile vigilans* (Smith) (O) Female *Lithurgus* sp. 1 (P) Female *Megachile hera* (Bingham) (Q) Male *Megachile hera* (Bingham) (R) Female *Coelioxys fuscipennis* (Smith)

Male ♂

Body black, body length 11.79 mm, smaller than female, with yellowish hair on face, mesosoma and metasoma. Head: face, gena and hypostomal area with dense pale white to yellow pubescence. Mesosoma: pale white long pubescence on outer margin of mesosoma, scutum and scutellum disc finely punctate with fine sparsely distributed hairs. Metasoma: T1 with long white pubescence, T1-T4 with apical band of pale white hairs.

Distribution

India: Chhattisgarh (**new record**), Punjab (Ludhiana), Rajasthan (Alwar) (Gupta, 1993), Himachal Pradesh (Kangra, Kullu, Manali) (Suma, 2006), Karnataka (Bangalore, Mudigere, Hunsur) (Nayana, 2008; Dhanyavathi, 2009), Jammu (Abrol *et al.*, 2012).

Global: Bangladesh, China, Thailand, Malaysia, Vietnam, Chinese Taipei (Abrol *et al.*, 2012).

Megachile vigilans (*Eutricharaea*) Smith, 1879 (Figs 2M & 2N)

Female ♀

Body black, body length 15.23 mm, mid and hind

femora fulvous, white apical hair bands on dorsal metasoma. Metasoma: T1-T5 with pale white hairs band apically; T6 disc covered with suberect black pubescence.

Male ♂

Body length 11.98 mm, black bee with yellowish face and pale white hair bands on metasomal segment; similar to female except as follows: face with dense yellowish white pubescence; mandible tridentate; all the trochanter and femur fulvous in colour; T6 with 4 spines, covered with yellowish pubescence. Genitalia: gonostylus with bilobed distal end and sparse hairs; tip of the penis valves with hairs, directed straight and slightly dilated.

Distribution

India: Chhattisgarh (**new record**), Karnataka, Jammu (Shankar *et al.*, 2017; Bingham, 1897).

Global: Sri Lanka (Inoka *et al.*, 2014), Southern Asia (ITIS, 2022), America (Raw, 2002).

Coelioxys (*Liothyrapis*) *fuscipennis* Smith, 1854 (Fig 2R)

Female ♀

General description: Body length 19.7 mm, black, metasoma tapering through its length. Medio-posterior part of scutellum triangle, hanged posteriorly on metanotum with 2 lateral teeth not reaching to posterior margin of scutellum; fuscous wing, hyaline at the base; Metasoma: black, with white bands of small white hairs on T2-T5, T2-T3 with deep groove at side; T6 depressed apically with longitudinal carina, with 2 tubercle subapico-lateral and one long spine medially;

Distribution

India: Chhattisgarh (**new record**), Rajasthan (Hooda and Jain, 2020), Tamil Nadu (GBIF, 2021) Himachal Pradesh (Mandi, Kullu, Dharmshala) (Bingham, 1897), Karnataka (Shimoga) (Sanath *et al.*, 2020).

Global: Sri Lanka (Inoka *et al.*, 2014), Southern Asia (ITIS, 2022), India (GBIF, 2021).

Euaspis (Parevaspis) carbonaria Smith, 1854 (Figs 2K & 2L)

Female ♀

Body black, similar to *Euaspis edentate* except S6 with distal tooth with 2 laterobasal teeth.

Male ♂

General description: body black, body length 13.18 mm, smaller than female, with white hair on face; T7 with three apical spines, median spine prominent than lateral spines. Genitalia: gonostylus bulged and slightly concave with short hairs; penis valve pointed distally, sharply raised carina between penis valve and gonostylus.

Distribution

India: Chhattisgarh (**new record**), Karnataka, Tamil Nadu, Maharashtra, Odisha, Haryana (GBIF, 2021) Maharashtra (Bombay), Gujarat (Allahabad and Ahmedabad), Punjab (Pathankot, Firozpur, Ludhiana, Faridkot, Jalandhar), Himachal Pradesh (Kangra, Manali), Karnataka, Rajasthan (Alwar, Sikar, Nagaur, Sri Ganganagar, Udaipur, Mount Abu, Pilani, Gudha), Gujarat (Veraval, Deesa, Dantiwada), (Hunsur) (Bingham, 1897; Gupta, 1993; Baker, 1995; Dhanyavathi, 2009).

Global: India, Sri Lanka (GBIF, 2021), Southern Asia (ITIS, 2022).

Lithurgus (Lithurgus s.str.) sp. 1 (Figs 2E & 2F)

Body black with white shiny pubescence on face and bands of white pubescence on metasoma.

Female ♀

Body length 9.36 mm, body black with white apical white pubescent bands on metasoma. Head: shiny white pubescence on face; labrum with pale white pubescence. leg black, fore and middle tibia with two rows of small tubercles and hind tibia with large tubercles; median and hind basitarsus with fulvous hairs. Metasoma: T1 covered with sparse long white hairs; T2-T5 apical margin with white fasciae, interrupted in the middle of T1.

Male ♂

Body black, body length 8.96 mm, smaller than female; similar to female but tubercles on tibia not as much developed as in female; mesosoma with pale white pubescence; T1 with long fasciae at apical margin not interrupted in middle as female; T2-T5 with small hair bands at apex; pygidial plate present. Genitalia: much broader volsella which covered 3/4th of genitalia; narrow with slightly dilated gonostylus at the distal end, short and covered with pubescence.

Lithurgus (Lithurgus s.str.) sp. 2 (Fig 2O)

Body black with white shiny pubescence on face, yellowish pubescence on clypeus, metasomal segments with apical bands of pale white pubescence.

Female ♀

Body black with white shiny pubescence on face, yellowish pubescence on clypeus, metasomal segments with apical bands of pale white pubescence, body length 10.52 mm. Head as broad as thorax, roughly punctate; Face with white pubescence, pale white pubescence on clypeus, golden yellow scopa on S2-S5 with tiny white hairs beneath scopa, S8 with 2 lateral spines.

Comments: Two different morpho-species of *Lithurgus* sp. 1 (2♀, 60♂) and *Lithurgus* sp. 2 (2♀) were collected during the surveys. As for the second species we could not collect the males hence species confirmation could not be ascertained.

DISCUSSION

The present study is the continuation of their research by the same team of authors (Sahu *et al.*, 2022), who reported the diversity of different non-*Apis* bees in the Chhattisgarh plains, where among all the bee families, Megachilidae was the least encountered family. In the present study, the diversity and abundance of Megachilid bees were further analyzed. Compared to other bees, the Megachilid bees are difficult to encounter and collect as most of these can be collected only by manual scouting in the fields through a sweep net. The collection through traps was abysmal, and only a single species of *Lithurgus* could be collected after placing

hundreds of yellow pan traps in multiple locations. In the present study, the genus *Megachile* was the most abundant Megachilid in the Chhattisgarh state, with *M. lanata* as the most dominant species. During the surveys, ten species of Megachilidae were recorded for the first time from Central India, out of which two species, *C. fuscipennis* and *E. carbonaria*, were cleptoparasitic bees. The present study revealed that *M. lanata* was the most dominant group in Chhattisgarh, and *Lithurgus* sp. 1 was highly abundant; however, it was confined only to one location. All nine species are the first records for Chhattisgarh, which comprises a significant part of Central India and a reasonably rich biodiversity hotspot.

CONCLUSION

Extensive surveys are important for the documentation of bee taxa. Regarding the pristine and rich vegetation cover and climatic diversity of Central India, the actual number of bees is expected to be much greater. Hence, more exploratory surveys followed by thorough identification are needed to document the exact faunal wealth. Based on our experience, we recommend the sweep net collection method as the most efficient method for collecting Megachilid bees.

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