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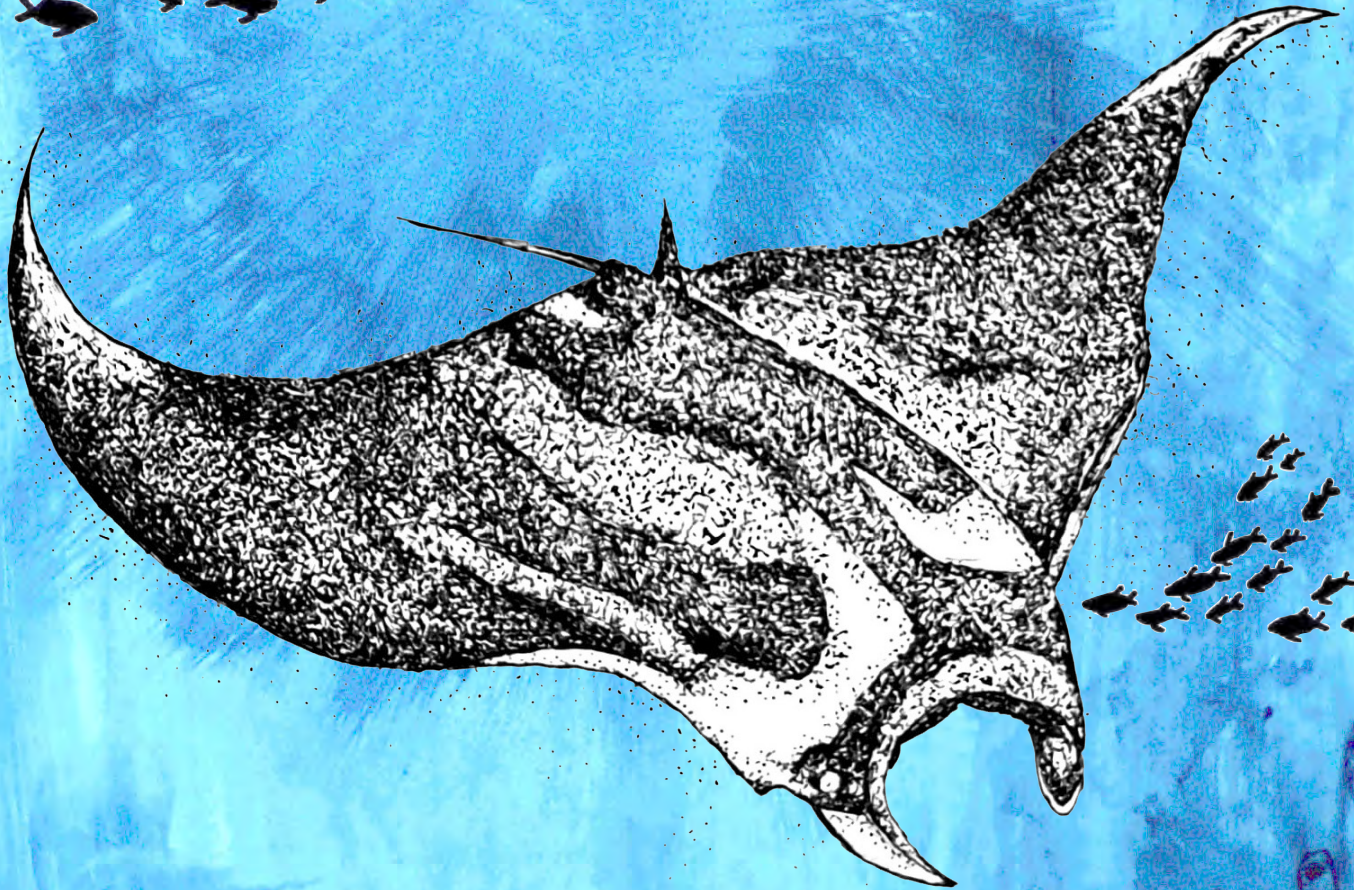
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continued on the back inside cover

Cover: Giant Oceanic Manta Ray *Mobula birostris* in ink on acrylic wash by Elakshi Mahika Molur adapted from scientific illustration by Roger Hall.



A first report of dung beetle *Garreta smaragdifer* (Walker, 1858) attending the faecal matter of Northern Plain Gray Langur *Semnopithecus entellus* (Dufresne, 1997) with range extension and a checklist of the genus *Garreta* Janssen, 1940

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Abstract: Genus *Garreta* Janssens, 1940 is an Afrotropical and of Oriental origin, consisting of 25 species and two subspecies from the world, eight species from India and two species from Maharashtra. Out of eight Indian species two are endemic to India. The present report is the first report of feeding of *Garreta smaragdifer* (Walker, 1858) on the faecal matter of Northern Plain Gray Langur *Semnopithecus entellus* (Dufresne, 1997) and also its range extension from central India to Maharashtra.

Keywords: Gautala-Autramghat Wildlife Sanctuary, primate, Satmala and Ajanta Hill ranges.

Marathi: सार: गॅरेटा जॅन्सेन्स, 1940 ही अफ्रोट्रोपिकल आणि ओरिएंटल वंशाची आहे, ज्यामध्ये जगातील 25 प्रजाती आणि दोन उपप्रजाती, भारतातील आठ प्रजाती आणि महाराष्ट्रातील दोन प्रजाती आहेत. आठ भारतीय प्रजातींपैकी दोन भारतासाठी स्थानिक आहेत. हा लेख नॉर्डन प्लेन ग्रे लंगूर सेम्नोपिथेकस एंटेलस (डुफ्रेस्ने, 1997) च्या विष्टेवरील, गॅरेटा स्मारागडिफर (वॉकर, 1858) च्या आहाराचा व मध्य भारतापासून महाराष्ट्रापर्यंतच्या विस्ताराचा पहिला अहवाल आहे.

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Author contributions: ASK formulated the study, identified the beetle, dissected genitalia, taken photos, prepared map, written MS. MJP written the identification part of the Hanuman Langur, identified the Langur and helped in compilation, taken photo of Langur.

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INTRODUCTION

The genus *Garreta* Janssens, 1940, is widely distributed in Afrotropical and Oriental regions (Davis & Deschodt 2018) and is known by 25 extant species and two subspecies (Morrto & Génier 2015; Schoolmeesters 2017; Davis & Deschodt 2018; Pokorný & Zidek 2018; Zidek 2018) from the world including 8 from India (Mittal 2011; Chandra & Gupta 2014). The Asian species of this genus have been revised by Pokorný & Zidek (2016) and the African species by Pokorný & Zidek (2018). In their revision, they clearly state that describing species in this genus based on the colours is not valid. The colour changes in this group are due to the temperature induced effect, they further state that the species distributed in the warmer regions are greenish-bluish in temperate regions and coppery in intermediate climatic conditions.

The species in this genus look similar and to delineate the species, recently in Afrotropical species, the micro-sculpture of the exoskeleton was used as an important character for differentiation by Moretto & Génier (2015) who divided some species into two species groups based on micro-sculpture and geographical distribution, i.e., *Garreta laetus* group and included three species, namely: *G. caffer* Fåhræus, 1857, *G. laetus* (Hope, 1842), and *G. nyassicus* (Kolbe, 1897). In *Garreta nitens* group *G. nitens* (Olivier, 1789), *G. rutilans* (Castelnau 1840), and *G. wahlbergi* (Fåhræus, 1857) have been included. The other species have not been included in any species group so far. In the present study, two infraspecific taxa, namely, *G. laetus laetus* (Hope, 1842) and *G. laetus olivaceus* (Quedenfeldt, 1884) have been considered valid (see Moretto & Génier 2015).

MATERIAL AND METHODS

The observation taken on the *G. smaragdifer* was opportunistic from the Gautala-Autramghat Wildlife Sanctuary, Maharashtra during a faunistic survey tour to the region from 9–18 August 2021. A few specimens were collected for identification in the laboratory. The specimens were hand-picked and kept in a vial of 70 percent ethyl alcohol. Leica EZ4E stereomicroscope with photographic facility was used for examining the specimens. The specimen was identified using available literature (Chandra & Gupta 2014; Pokorný & Zidek 2016). The distribution and the type locality data have been verified from Janssens (1940), Chandra & Gupta (2014), Pokorný & Zidek (2018), and Zidek (2018). The map of the collection locality was prepared using open,

free access QGIS software version 3.16 (Figure 1). The material examined was deposited in the national repository of Zoological Survey of India, Western Regional Centre, Pune, Maharashtra, India (ZSI-WRC).

RESULTS AND DISCUSSION

Taxonomic account

Family Scarabaeidae Latreille, 1802

Subfamily Scarabaeinae Latreille, 1802

Tribe Gymnopleurini Lacordaire, 1856

Genus *Garreta* Janssens, 1940

1803. *Gymnopleurus* Illiger (ex parte), *Mag. Ins.*, II: 199.

1897. *Paragymnopleurus* Shipp (ex parte), *Entom.*, XXX: 166.

1940. *Garreta* Janssens, *Verh Kon Nat Mus Belg Brussel* 2(18): 22.

Type species: *Ateuchus azureus* Fabricius, 1801 (= *Garreta azureus* (Fabricius, 1801)), Natural History Museum, London, UK (BMNH).

Garreta smaragdifer (Walker, 1858)

(Image 1B–D)

1858. *Gymnopleurus smaragdifer* Walker, *Ann. Mag. Nat. Hist.* (3) II: 208.

1931. *Gymnopleurus smaragdifer* Arrow, *Fauna British India including Ceylon & Burma, Coleoptera, Lamellicornis*, III : 60–61, pl. III, fig. 13.

1940. *Garreta smaragdifer*, Janssens, *Verh. Kon. Nat. Mus. Belg.*, 2 (18): 29, pl. I, fig. 2.

1963. *Gymnopleurus* (*Garreta*) *smaragdifer*, Balthasar, *Mon. Scarab. Aphod. Palae. Ori. Reg.*, (Coleoptera: Lamellicornia), *Coprinae*, I: 226.

2014. *Garreta smaragdifer* Chandra & Gupta, *Proc. Natl. Acad. Sci., India, Sect. B Biol. Sci.*, (B) 84 (2):317–330.

2016. *Garreta smaragdifer*, Pokorný & Zidek, *Insecta Mundi*, 0483: 1–8.

Type locality: Sri Lanka?

Material examined: ZSI-WRC Ent-1/4123, 12.viii.2021, 5 examples, Kedarkund (20.311N & 74.971E; 409m), Jalgaon, Maharashtra, India, coll. A.S. Kalawate.

Distributon: India (Chhattisgarh, Madhya Pradesh, Maharashtra (in this study range extended), southern India), Sri Lanka.

Gautala-Autramghat Wildlife Sanctuary, Maharashtra, India lies in the Satmala and Ajantha hill ranges. During our field survey tour of the sanctuary, we came across many *G. smaragdifer* adults, busy rolling in fresh primate faecal matter of the Northern Plain

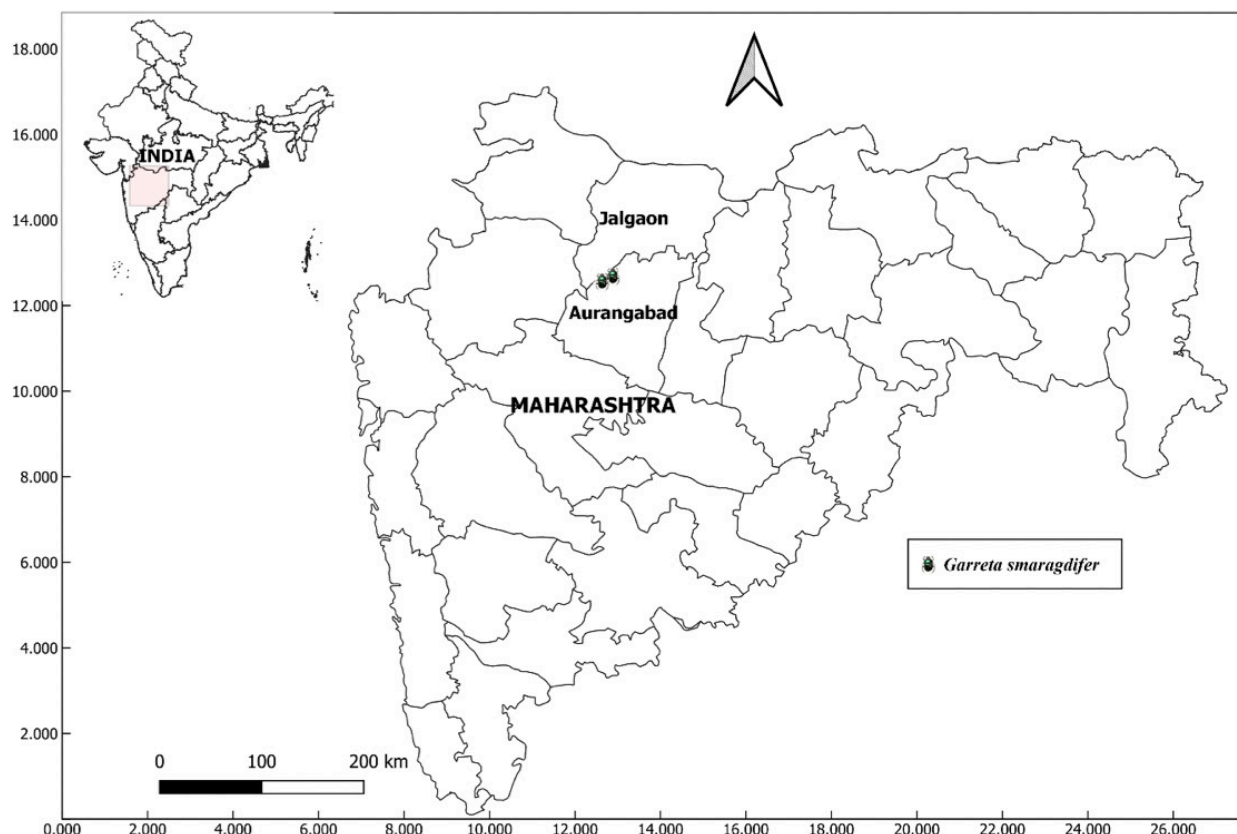


Figure 1. The study locality.

Gray Langur *Semnopithecus entellus* (Dufresne, 1997). Large troops of the langur were seen hopping on the *Hardwickia binata* Roxb. trees present in the Patnadevi part of the sanctuary and around the Bhaskaracharya Forest Guest house during the day time. Near the guest house it was observed that the fresh dung of the langur was rolled and carried by the large number of *G. smaragdifer*, who were busy in rolling and fighting for the dung in the day time. The langur was identified by the mammal expert and the second author. Some of the beetles were collected and brought to the laboratory for further study and to our surprise it was identified as *G. smaragdifer*, a new record for Maharashtra whose range extended from central India to Maharashtra. The aim of this paper is to provide a first report of the Dung Beetle *G. smaragdifer* attending the faecal matter of a primate species from India and also its range extension from Maharashtra.

First instance, on 12 August 2021, we observed a large troop of langurs near the Kedarkund area (20.309N & 74.967E; 447 m) very close to the water falls, about 4 km from the Bhaskaracharya Forest Rest House (Figure 1). The entire forest floor was covered with the shiny bluish-green dung beetles, either rolling or devouring

the faecal matters of the langur (Image 1). As many as 80 beetles were counted during the survey. The next day, a similar emergence of dung beetles was noticed all along within the campus of the Bhaskracharya Forest Rest House (20.318N & 74.975E; 468 m), where a small roost of about 15 langurs was seen. A total of more than 100 beetles were encountered during the period. All were actively rolling the very meagre faecal matters underneath the tree. Some of them were fighting for the dung balls. This is a common practice where male dung beetles fight for the dung pad with other males. Both the days were exceptionally wet and the weather was slightly overcast with a light drizzle.

Various reports suggest that a dung ball is rolled away from the dung for brood construction by a single beetle, or by a pair and buried in the soil (Prasse 1957). An egg is laid at its base, and is covered with dung in the chamber making a brood. This brood is then coated with a mixture of soil and dung to prevent fungal attack (Scholtz et al. 2009). The *Garreta* brood is generally oval in shape. We also noticed slightly oval shaped brood balls all along the locality.

The other primate species observed during the survey was the Rhesus Macaque *Macaca mulatta*

Zimmermann, 1780, which are found in small numbers at the locality. Major herbivorous animals observed from the Gautala-Autramghat Sanctuary were Nilgai *Bosephalus tragocamelus* (Pallas, 1766), Indian Gazelle *Gazella bennettii* (Sykes, 1831), Sambar *Rusa unicolor* (Kerr, 1792), Spotted Deer *Axis axis* (Erxleben, 1777), Barking Deer *Muntiacus muntjac* (Zimmermann, 1780), and Wild Boar *Sus scrofa* Linnaeus, 1758. Carnivorous animals like Leopard *Panthera pardus* (Linnaeus, 1758), Tiger *Panthera tigris* (Linnaeus, 1758), and Jungle Cat *Felis chaus* Schreber, 1777 were also found during the survey. It was observed in the field that faecal matters of these animals were not attended to by *G. smaragdifer*.

Most scarabs prefer to feed on herbivore faecal matter, which are largely undigested plant matter, rather than carnivore faecal matters, which hold very little nutritional value for insects (Hadley 2021). According to Al-Houty & Musalam (1997) the faecal matter of herbivorous mammals was more preferred than the carnivores. There are many studies on the dung beetles attending on the dungs of elephants (Sabu et al. 2006), Gaur (Vinod & Sabu 2007), cattle species (Tonelli et al. 2021) from India. There are reports of dung beetles attending on the scats of carnivorous animals too (Al-Houty & Musalam 1997). Even though studies were reported on the faecal matters of primates from other countries (Estrada & Coates-Estrada 1991) so far there were none from India. Hence, the present report forms the first instance of dung beetles on the dungs of primate species from India and also reporting the beetle species *G. smaragdifer* for the first time from Maharashtra State.

The extant species of the genus *Garreta* Janson, 1940 (modified from Moretto & Génier 2015 and Zidek 2018).

1. *Garreta australugens* Davis & Deschodt, 2018.

Garreta australugens Davis & Deschodt, *Zootaxa*, 4450(2): 242–248.

Type Locality: Wildlife College, South Africa; SANC (South Africa, Gauteng, Pretoria, South African National Collection of Insects).

Distribution: Southern Africa.

2. *Garreta azureus* (Fabricius, 1801)

1801. *Ateuchus azureus* Fabricius, *Syst. Eleuth.*, I: 57.

Type Locality: Guinea [Ghana]; ZMUC (Zoological Museum of Copenhagen University, Denmark).

Distribution: Africa.

3. *Garreta bechynei* (Pokorný & Zidek, 2018)

2018. *Garreta bechynei* Pokorný & Zidek, *Folia Heyrovskyana*, A, 26(1): 96.

Type Locality: N Zérékoré, se. Guinea; NMPC (National Museum (Natural History)), Prague, Czech Republic).

Distribution: Guinea.

4. *Garreta caffer* (Fahraeus, 1857)

1857. *Gymnopleurus caffer* Fahraeus, in Boheman, *Ins. Caffr.*, II: 181.

Type Locality: Caffraria; NHRS (Naturhistoriska Riksmuseet, Stockholm, Sweden).

Distribution: Angola, South Africa.

5. *Garreta crenulatus* (Kolbe, 1895)

1895. *Gymnopleurus crenulatus* Kolbe, *Stett. Ent. Zeits.*, LVI: 333.

Type Locality: N of Lake Albert (Uganda?); MNHB (Museum für Naturkunde Leibniz-Institut, Berlin, Germany).

Distribution: Republic Democratic Congo.

6. *Garreta dejeani* (Castelnau, 1840)

1840. *Gymnopleurus dejeani* Castelnau, *Hist. Nat. Col.*, II: 70.

Type Locality: Not known; MNHN? (Muséum National d'Histoire Naturelle, Paris, France).

Distribution: India (Chhattisgarh, Himachal Pradesh, Kerala, Madhya Pradesh, Maharashtra, Rajasthan, Tamil Nadu, Uttarakhand), Nepal, Pakistan.

7. *Garreta diffinis* (Waterhouse, 1890)

1890. *Gymnopleurus diffinis* Waterhouse, *Ann. Mag. Nat. Hist.* (6), V: 372.

Type Locality: Senegambia; BMNH (Natural History Museum, London, UK).

Distribution: Gabon, Gambia, Senegal, sw. DRC (Kuilu=Kwilu River).

8. *Garreta fastiditus* (Harold, 1867)

1867. *Gymnopleurus fastiditus* Harold, *Col. Hefte*, I: 74.

Type Locality: Cape of Good Hope MNHN (Muséum National d'Histoire Naturelle, Paris, France).

Distribution: Zimbabwe, Mozambique, South Africa.

9. *Garreta gilleti* (Garreta, 1914)

1914. *Gymnopleurus gilleti* Garreta, *Bull. Soc. Ent. Fr.*: 412.

Type Locality: Saigon, Cochinchine; MNHN (Muséum National d'Histoire Naturelle, Paris, France).

Distribution: India (Uttar Pradesh) Thailand, Vietnam.

10. *Garreta laetus* (Hope, 1842)

1842. *Gymnopleurus laetus* Hope, *Ann. Mag. Nat. Hist.*, IX: 494.

Type Locality: Liberia: environs de cap Palmas [=Cape Palmas, Liberia]; OXUM (Oxford University Museum of Natural History, UK).

Distribution: Benin, Burkina Faso, Cameroon, Central African Republic, Chad, Eritrea, Ethiopia, Ghana, Guinea, Ivory Coast, Kenya, Liberia, Niger, Nigeria, Democratic Republic of Congo, Senegal, Sierra Leone, Tanzania, Togo, and Uganda.

11. *Garreta laetus laetus* (Hope, 1842)

1895. *Gymnopleurus cupreovirens* Kolbe, *Stettiner entomologische Zeitung*, 56 (10-12): 333.

Type Locality: Liberia: environs de cap Palmas [=Cape Palmas, Liberia]; OXUM (Oxford University Museum of Natural History, UK).

Distribution: Cape Palmas.

12. *Garreta laetus olivaceus* (Quedenfeldt, 1884)

1884. *Gymnopleurus olivaceus* Quedenfeldt, *Berliner entomologische Zeitschrift*, 28 (2): 269.

Type Locality: Malange [Angola]; (MNHN) (Muséum National d'Histoire Naturelle, Paris, France).

Distribution: Angola, Congo, Malawi, Mozambique, Republic Democratic Congo, Tanzanie, and Zimbabwe.

13. *Garreta lugens* (Fairmaire, 1891)

1891. *Gymnopleurus lugens* Fairmaire, *Ann. Soc. Ent. Belg.*, XXXV: 284.

Type Locality: Somalia; NHMW (Naturhistorisches Museum, Vienna, Austria).

Distribution: Botswana, Ethiopia, Kenya, Mozambique, South Africa, Somalia, and Tanzania.

14. *Garreta malleolus* Kolbe, 1895

1895. *Gymnopleurus malleolus* Kolbe, *Stett. Ent. Zeits.*, LVI: 334.

Type Locality: Tanganyika. Lac Victoria [=East of Lake Tanganyika]; MNHB (Museum für Naturkunde Leibniz-Institut, Berlin, Germany).

Distribution: Republic Democratic Congo, Ruanda, Mozambique, Uganda, Urundi, and Zimbabwe.

15. *Garreta matabelensis* Janssens, 1938

1938. *Gymnopleurus* (*Paragymnopleurus*) *matabelensis* Janssens, *Mission de Witte, Pare National Albert*, 21: 44.

Type Locality: Matabele, Zimbabwe; ISNB (Institut Royal des Sciences Naturelles, Brussels, Belgium).

Distribution: Zimbabwe.

16. *Garreta mombelgi* (Boucomont, 1929)

1929. *Gymnopleurus mombelgi* Boucomont, *Ling. Sc. Journ.* 7 : 760.

Type Locality: Sichuan, Yunnan, China; MNHN (Muséum National d'Histoire Naturelle, Paris, France).

Distribution: China.

17. *Garreta morosus* (Fairmaire, 1886)

1886. *Gymnopleurus morosus* Fairmaire, *Ann. Soc. Ent. Fr.* (6), VI: 319.

Type Locality: Sichuan, Yunnan, China; MNHN (Muséum National d'Histoire Naturelle, Paris, France).

Distribution: China.

18. *Garreta mundus* (Wiedemann, 1819)

1819. *Gymnopleurus mundus* Wiedemann, *Zool. Mag.*, I, 3: 162.

Type Locality: the type destroyed.

Distribution: India (Bihar, Chhattisgarh, Himachal Pradesh, Kashmir, Madhya Pradesh, Punjab, Uttarakhand), Pakistan, southwestern China.

19. *Garreta namalugens* Davis & Deschodt, 2018

2018. *Garreta namalugens* Davis & Deschodt, *Zootaxa*, 4450 (2): 242–248.

Type Locality: NamibRand Nature Reserve, southern Africa; SANC (South Africa, Gauteng, Pretoria, South African National Collection of Insects).

Distribution: Southern Africa.

20. *Garreta nitens* (Olivier, 1789)

1789. *Scarabaeus nitens* Olivier, *Ent. I, Scharab.*:159, pl. 7, fig. 55.

Type Locality: Senegal; MNHN (Muséum National d'Histoire Naturelle, Paris, France).

Distribution: Senegal, Burkina Faso, Cameroon, Ivory Coast, Benin, Guinea, Guinea-Bissau, Liberia, Mali, Niger, Nigeria, Chad, Togo, Central African Republic, Sierre Leone, Angola, Republic Democratic Congo, Ethiopia, Eritrea, Ruanda, Zambia, Malawi, Zimbabwe, Mozambique, Namibia, Botswana, Kenya, and South Africa.

21. *Garreta opacus* (Redtenbacher, 1848)

1848. *Gymnopleurus opacus* Redtenbacher, in Hugel, *Kaschmir*, IV, 2 : 516.

Type Locality: Punjab during British India? type lost; NHMW (Naturhistorisches Museum, Vienna, Austria).

Distribution: India: (Himachal Pradesh, Jammu &



Image 1. A—Northern Plain Gray Langur *Semnopithecus entellus* (Dufresne, 1997) sitting on *Hardwickia binata* Roxb. Tree | B—*Garreta smaragdifer* rolling the faecal matter | C—Adult *Garreta smaragdifer*, dorsal view | D—male genitalia | E—Collection site. © Aparna S. Kalawate

Kashmir, Uttarakhand) and Nepal.

22. *Garreta ruficornis* (Motschulsky, 1854)

1854. *Gymnopleuru ruficornis* Motschulsky, *Etudes Ent.*, III: 63.

Type Locality: Not known.

Distribution: India (Assam, Himachal Pradesh, Punjab, Uttarakhand), Afghanistan, China, Myanmar, and Thailand.

23. *Garreta rutilans* (Castelnau, 1840)

1840. *Gymnopleurus rutilans* Castelnau, *Duménil, Paris*. 38: 71.

Type Locality: Sennaar, Sudan; MNHN (Muséum National d'Histoire Naturelle, Paris, France).

Distribution: Botswana, eastern South Africa, Sudan, and Zimbabwe.

24. *Garreta smaragdifer* (Walker, 1858)

1858. *Gymnopleurus smaragdifer* Walker, *Ann. Mag. Nat. Hist.* (3), II: 208.

Type Locality: Not known; BMNH (Natural History Museum, London, UK).

Distribution: India (Chhattisgarh, Madhya Pradesh, Maharashtra (reported in this study), southern India) and Sri Lanka.

25. *Garreta sylvestris* Mittal, 2011

2011. *Garreta sylvestris* Mittal, *Journal of Entomological Research* 35(3): 297.

Type Locality: Haryana; INPC (National Pusa Collections, New Delhi, India).

Distribution: India (Haryana).

Remark: Endemic to India.

26. *Garreta unicolor* (Fahraeus, 1857)

1857. *Gymnopleurus unicolor* Fahraeus, in Boheman, *Ins. Caffr.*, II: 182.

Type Locality: Caffraria; NHRS (Naturhistoriska Riksmuseet, Stockholm, Sweden).

Distribution: Mozambique, South Africa, and Zimbabwe.

27. *Garreta wahlbergi* (Fahraeus, 1857)

1857. *Gymnopleurus wahlbergi* Fåhraeus, *Officina Norstedtiana, Holmiae*. II: 183.

Type Locality: Caffraria; NHRS (Naturhistoriska Riksmuseet, Stockholm, Sweden).

Distribution: Botswana, Mozambique, South Africa, Swaziland, and Zimbabwe.

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