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AN INVENTORY OF SCARAB BEETLES (COLEOPTERA: SCARABAEIDAE) OF ACHANAKMAR-AMARKANTAK BIOSPHERE RESERVE, CHHATTISGARH, INDIA

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ABSTRACT
Biodiversity surveys in the years, 2004 to 2008 at many locations of Achanakmar-Amarkantak Biosphere Reserve (AABR) yielded 52 species of scarab beetles (Coprophagous and chafer beetle) belonging to 24 genera and 5 subfamilies of family Scarabaeidae. Of these, 26 species in the subfamily Scarabaeinae exclusively feed on dung while remaining 26 species are phytophagous in nature, distributed in four subfamilies; Rutelinae, Melolonthinae, Dynastinae and Cetoniinae.

KEYWORDS: Checklist, dung beetles, phytophagous scarabs and Achankmar-Amarkantak Biosphere Reserve.

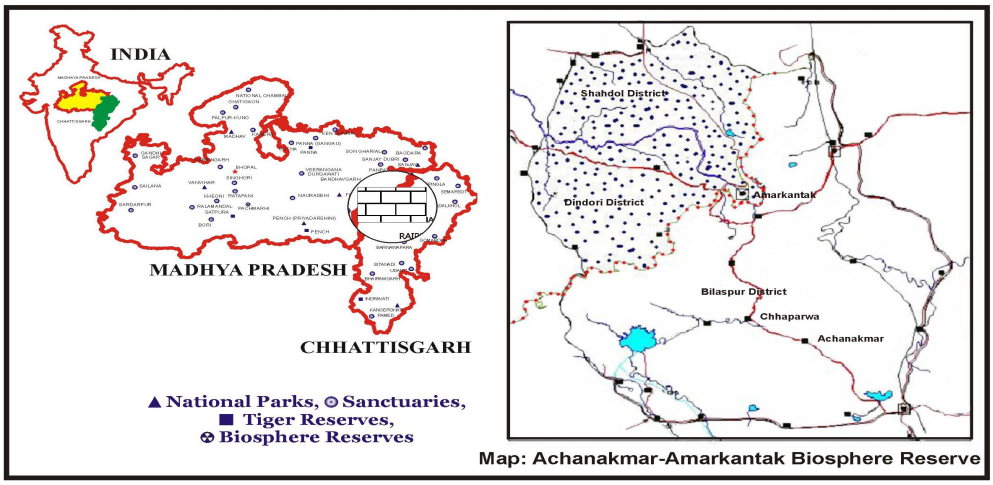
INTRODUCTION

Scarab beetles under family Scarabaeidae comprise a speciose group and are a conspicuous component of the beetle fauna of the world and are noticeable due to their relatively large size, bright colors, elaborate ornamentation and interesting life histories. The family Scarabaeidae includes 27,800 species worldwide, and within Scarabaeidae, the two subfamilies; Aphodiinae and Scarabaeinae are represented by approximately 6,850 species worldwide and the subfamilies; Orphninae, Melolonthinae, Dynastinae, Rutelinae, Cetoniinae, Trichiinae and Valginae include approximately 20,950 species (Ratcliffe & Jameson 2001). Beetles in the subfamilies; Scarabaeinae and Aphodiinae exclusively feed on dung while most species in the subfamilies; Melolonthinae, Dynastinae, Rutelinae and Cetoniinae feed on vegetation and are agricultural pests of various commercial crops. Dung beetles performs a series of ecological functions such as nutrient cycling, soil aeration, secondary seed dispersal, regulation of enteric parasites and dung breeding dipterans pests. The faunal and monographic works on scarab beetle diversity in India and Oriental and Palearctic region has been published by Arrow (1910, 1917 & 1931), Balthasar (1963a, 1963b), Janssens (1940), Machatschke (1972), Mikšić (1977), Chandra (1986), Gupta (1986), and Sabatinelli (1993) respectively. However, the scarabaeid fauna of Chhattisgarh has been studied by workers namely; Chandra & Ahirwar (2007), Chandra & Singh (2010), Chandra & Gupta (2012a, 2012b), Gupta & Chandra (2012) and Chandra *et al*., (2012). Chandra and Ahirwar (2007) published a comprehensive account of the scarab beetles of Madhya Pradesh and Chhattisgarh and recorded 124 species/subspecies belonging to 45 genera under 11 subfamilies. Chandra and Singh (2010) reported 22 species of the scarab beetles belonging to 11 genera and 6 subfamilies from Achanakamar Wildlife Sanctuary, Chhattisgarh. Recently Chandra and Gupta (2012b) studied the diversity and relative abundance of 26 species of pleurostict Scarabaeidae (phytophagous) of Achanakmar-Amarkantak Biosphere Reserve. Thus so for from this biosphere reserve 36 species of the scarab beetles have been reported (Chandra & Singh, 2010; Chandra & Gupta, 2012a; 2012b). Keeping in mind, the present study aimed to report the complete checklist of the scarab beetles of the biosphere reserve, including 52 species belonging to 24 genera and 5 subfamilies of family Scarabaeidae. The field photographs of 22 species are also provided (Plate A, B, C).

MATERIAL AND METHODS

Study area

Achanakmar-Amarkantak Biosphere Reserve (AABR) is located in Shahdol and Dindori districts of Madhya Pradesh and Bilaspur district of Chhattisgarh. Geographically, it lies between 22º15' to 22º58' N and 81º25' to 82º50' E and spreads over an area of 3835.51 sq. km. Biodiversity surveys in the years, 2004 to 2008 at many locations of AABR were conducted, which yielded the collection of 581 specimens of the scarab beetles. The specimens were collected using light trap with 160 watt mercury bulb used as light source and from dung pads. Later they were preserved dry pinned and identified using available literature (Arrow 1910, 1917, 1931; Janssens 1940; Balthasar 1963a, 1963b; Chandra 1986; Gupta 1986) and matched with the reference collections present at the Zoological Survey of India, Jabalpur, Madhya Pradesh. Identified specimens were deposited in the National Zoological Collections of the ZSI. Species listed with asterisks are recorded for the first time from the biosphere reserve.



Map: Achanakmar-Amarkantak Biosphere Reserve

RESULTS AND DISCUSSION

Altogether, 581 specimens of the scarab beetles were collected from Achanakmar-Amarkantak Biosphere Reserve, which yielded the identification of 52 species belonging to 24 genera and 05 subfamilies viz. Scarabaeinae, Rutelinae, Melolonthinae, Cetoniinae and Dynastinae of family Scarabaeidae. The classified list of the scarab beetles of AABR is provided in Table 1. Out of the total specimens, 156 were dung beetles and represented by 26 species, under 11 genera and 6 tribes of Scarabaeinae. As previous study (Chandra & Singh, 2010) reported only 10 dung beetle species, the current study recorded 16 species for the first time from the biosphere reserve. Depending up on the nesting strategies, two types of dung beetles were collected viz. rollers and tunnelers. Species belonging to the genera; *Scarabaeus*, *Sisyphus*, *Gymnopleurus*, *Garreta* and *Paragymnopleurus* were rollers while species in the genera *Heliocopris*, *Catharsius*, *Copris*, *Phalops*, *Onitis*, and *Onthophagus* were exclusively tunnellers. Based on the collections, *Gymnopleurus cyaneus* (27.56%), *Catharsius sagax* (10.25%), *Paragymnopleurus sinuatus* (7.69%), *Heliocopris bucephalus* (7.69%), *Onthophagus agnus* (5.79%), and *Onthophagus ramosellus* (5.12%) were dominating among dung beetles in the biosphere reserve respectively.

Remaining 426 specimens were indentified in to 26 species under 13 genera and 04 subfamilies of phytophagous scarabs. The highest number of beetles were collected from Rutelinae (303) followed by Melolonthinae (95), Cetoniinae (18) and Dynastinae (10). *Anomala* was found the most species rich genus (9 species), followed by *Adoretus*, *Mimela* and *Holotrichia* (each with 02 species), and *Popillia*, *Xylotrupes*, *Alissonotum*, *Phyllognathus*, *Heteronychus*, *Apogonia*, *Schizonycha, Clinteria* and *Gametis* (each with 1 species). The six most common species of phytophagous scarabs were; *Anomala ruficapilla* (31.52%), *Apogonia proxima* (19.5%), *Anomala biharensis* (9.41%), *Adoretus bimarginatus* (8.70%), *Anomala rugosa* (5.88%), and *Anomala varicolor* (5.64%). *Anomala polita*, *Anomala cantori*, *Anomala* sp., *Heteronychus lioderes*, and *Gametis versicolor* were the least abundant in the biosphere reserve, represented by only a single specimen (Table 1). As biodiversity surveys provide fundamental information needed for conservation planning, protected area justification and design, and development of management plans, the rich biodiversity of the scarab beetles in AABR needs to be conserved and protected so as to maintain the biological health of the newly formed biosphere reserve.

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PLATE A: (1) *Paragymnopleurus sinuatus* (Olivier), (2) *Heliocopris bucephalus* (Fabricius), (3) *Catharsius* (*Catharsius*) *molossus* (Linnaeus), (4) *Catharsius* (*Catharsius*) *sagax* (Quenstedt), (5) *Copris* (*Paracopris*) *imitans* Felsche, (6) *Copris* (*Paracopris*) *surdus* Arrow, (7) *Onthophagus* (*Proagoderus*) *pactolus* (Fabricius).

TABLE 1: Classified list of scarab beetles of Achanakmar-Amarkantak Biosphere Reserve:

S. No.	Name of the species	Subfamily	Tribe	Feeding strategy	No. of examples	Percent abundance
	LAPAROSTICT SCARABAEIDAE (COPROPHAGOUS OR DUNG BEETLES)					
1.	*Scarabaeus* (*Kheper*) *sanctus* (Fabricius)	Scarabaeinae	Scarabaeini	Roller	03	1.92
2.	*Sisyphus* (*Sisyphus*) *neglectus* Gory*	Scarabaeinae	Sisyphini	Roller	02	1.28
3.	*Gymnopleurus* (*Gymnopleurus*) *cyaneus* (Fabricius)	Scarabaeinae	Gymnopleurini	Roller	43	**27.56**
4.	*Paragymnopleurus sinuatus* (Olivier)	Scarabaeinae	Gymnopleurini	Roller	12	**7.69**
5.	*Garreta smaragdifer* (Walker)*	Scarabaeinae	Gymnopleurini	Roller	02	1.28
6.	*Heliocopris bucephalus* (Fabricius)	Scarabaeinae	Coprini	Tunneler	12	**7.69**
7.	*Catharsius* (*Catharsius*) *pithecius* (Fabricius)*	Scarabaeinae	Coprini	Tunneler	06	3.84
8.	*Catharsius* (*Catharsius*) *molossus* (Linnaeus)	Scarabaeinae	Coprini	Tunneler	06	3.84
9.	*Catharsius* (*Catharsius*) *sagax* (Quenstedt)	Scarabaeinae	Coprini	Tunneler	16	**10.25**
10.	*Copris* (*Copris*) *carinicus* Gillet*	Scarabaeinae	Coprini	Tunneler	06	3.84
11.	*Copris* (*Paracopris*) *imitans* Felsche*	Scarabaeinae	Coprini	Tunneler	04	2.56
12.	*Copris* (*Paracopris*) *surdus* Arrow*	Scarabaeinae	Coprini	Tunneler	01	0.64
13.	*Phalops divisus* (Wiedemann)*	Scarabaeinae	Onthophagini	Tunneler	02	1.28
14.	*Onthophagus* (*Onthophagus*) *igneus* Vigors*	Scarabaeinae	Onthophagini	Tunneler	01	0.64
15.	*Onthophagus* (*Proagoderus*) *pactolus* (Fabricius)	Scarabaeinae	Onthophagini	Tunneler	01	0.64
16.	*Onthophagus* (*Onthophagus*) *ramosellus* Bates*	Scarabaeinae	Onthophagini	Tunneler	08	**5.12**
17.	*Onthophagus* (*Digitonthophagus*) *bonasus* (Fabricius)	Scarabaeinae	Onthophagini	Tunneler	02	1.28
18.	*Onthophagus* (*Digitonthophagus*) *gazella* (Fabricius)	Scarabaeinae	Onthophagini	Tunneler	06	3.84
19.	*Onthophagus* (*Onthophagus*) *ramosus* (Wiedemann)*	Scarabaeinae	Onthophagini	Tunneler	01	0.64
20.	*Onthophagus* (*Onthophagus*) *dama* (Fabricius)*	Scarabaeinae	Onthophagini	Tunneler	04	2.56
21.	*Onthophagus* (*Onthophagus*) *quadridentatus* (Fabricius)*	Scarabaeinae	Onthophagini	Tunneler	02	1.28
22.	*Onthophagus* (*Onthophagus*) *armatus* Blanchard	Scarabaeinae	Onthophagini	Tunneler	02	1.28
23.	*Onthophagus* (*Onthophagus*) *agnus* Gillet*	Scarabaeinae	Onthophagini	Tunneler	09	**5.79**
24.	*Onthophagus* (*Onthophagus*) *ludio* Boucomont*	Scarabaeinae	Onthophagini	Tunneler	01	0.64
25.	*Onitis philemon* Fabricius*	Scarabaeinae	Onitini	Tunneler	02	1.28
26.	*Onitis subopacus* Arrow *	Scarabaeinae	Onitini	Tunneler	02	1.28
				Total=	**156**	**100%**
	PLEUROSTICT SCARABAEIDAE (CHAFFER BEETLES)					
27.	*Anomala bengalensis* (Blanchard)	Rutelinae	Anomalini	Phytophagous	03	0.70
28.	*Anomala biharensis* Arrow	Rutelinae	Anomalini	Phytophagous	40	**9.41**
29.	*Anomala cantori* (Hope)	Rutelinae	Anomalini	Phytophagous	01	0.23
30.	*Anomala dorsalis* (Fabricius)	Rutelinae	Anomalini	Phytophagous	16	3.76
31.	*Anomala polita* (Blanchard)	Rutelinae	Anomalini	Phytophagous	01	0.23
32.	*Anomala ruficapilla* Burmeister	Rutelinae	Anomalini	Phytophagous	134	**31.52**

33.	*Anomala rugosa* Arrow	Rutelinae	Anomalini	Phytophagous	25	**5.88**
34.	*Anomala varicolor* (Gyllenhal)	Rutelinae	Anomalini	Phytophagous	24	**5.64**
35	*Anomala* sp.	Rutelinae	Anomalini	Phytophagous	01	0.23
36.	*Mimela macleayana* (Vigors)	Rutelinae	Anomalini	Phytophagous	06	1.41
37.	*Mimela inscripta* (Nonfried)	Rutelinae	Anomalini	Phytophagous	02	0.47
38.	*Popillia laevis* Burmeister	Rutelinae	Anomalini	Phytophagous	04	0.94
39.	*Adoretus lasiopygus* Burmeister	Rutelinae	Adoretini	Phytophagous	04	0.94
40.	*Adoretus bicolor* Brenske	Rutelinae	Adoretini	Phytophagous	02	0.47
41.	*Adoretus limbatus* Blanchard	Rutelinae	Adoretini	Phytophagous	03	0.70
42	*Adoretus bimarginatus* Ohaus	Rutelinae	Adoretini	Phytophagous	37	**8.70**
43.	*Xylotrupes gideon* (Linnaeus)	Dynastinae	Dynastini	Phytophagous	02	0.47
44.	*Alissonotum simile* Arrow	Dynastinae	Pentodontini	Phytophagous	03	0.70
45.	*Phyllognathus dionysius* (Fabricius)	Dynastinae	Pentodontini	Phytophagous	04	0.94
46.	*Heteronychus liioderes* Redtenbacher	Dynastinae	Pentodontini	Phytophagous	01	0.23
47.	*Apogonia proxima* Waterhouse	Melolonthinae	Diplotaxini	Phytophagous	83	**19.5**
48.	*Schizonycha ruficollis* (Fabricius)	Melolonthinae	Melolonthini	Phytophagous	04	0.94
49.	*Holotrichia sculpticollis* Blanchard	Melolonthinae	Melolonthini	Phytophagous	05	1.76
50.	*Holotrichia problemetica* Brenske	Melolonthinae	Melolonthini	Phytophagous	03	0.70
51.	*Clinteria klugi* (Hope)	Cetoniinae	Gymnetini	Phytophagous	17	4.00
52.	*Gametis versicolor* (Fabricius)	Cetoniinae	Cetoniini	Phytophagous	01	0.23
				Total=	**425**	**100%**

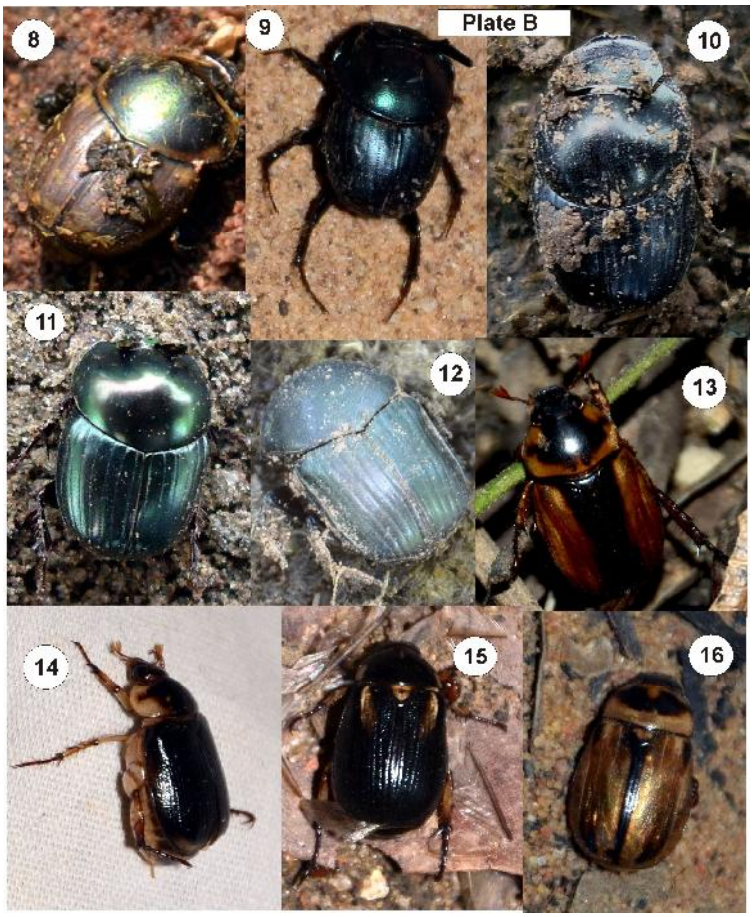

PLATE B: (8) *Onthophagus* (*Digitonthophagus*) *gazella* (Fabricius), (9) *Onthophagus* (*Onthophagus*) *ramosus* (Wiedemann), (10) *Onthophagus* (*Onthophagus*) *agnus* Gillet, (11) *Onthophagus* (*Onthophagus*) *dama* (Fabricius), (12) *Onitis philemon* Fabricius, (13) *Anomala dorsalis* (Fabricius), (14) *Anomala ruficapilla* Burmeister, (15) *Anomala rugosa* Arrow, (16) *Anomala varicolor* (Gyllenhal).

PLATE C: (17) *Mimela macleayana* (Vigors), (18) *Adoretus bimarginatus* Ohaus, (19) *Schizonycha ruficollis* (Fabricius), (20), *Holotrichia sculpticollis* Blanchard, (21) *Clinteria klugi* (Hope), (22) *Gametis versicolor* (Fabricius).