



Research Article

TAXONOMY OF SCARABAEIDAE (INSECTA: COLEOPTERA) OF TRIPURA, NORTH EAST INDIA

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ABSTRACT

Beetles of the family Scarabaeidae, commonly known as dung or rhinoceros beetles, can be easily identified by their lamellate or clubbed antennae and stout body. These insects are very important, ecologically and economically, both. They act as nature's scavengers and enrich the soil by recycling human feces and dung of animals in the soil. Some of the beetles are plant eaters, and are serious pests of agriculture, forestry and fruit trees. This study reports 19 species of scarab beetles belonging to 17 genera under 13 tribes and 5 subfamilies from the state of Tripura, north east India. These include 9 species and 12 genera as new reports from the state. Taxonomic keys for the identification of subfamilies, tribes, genera and species are provided by studying the morphological characteristics of the specimens that were collected from different locations of the state.

Keywords: Scarabaeidae, Taxonomic keys, New records, Tripura, Northeast India.

INTRODUCTION

Scarabaeidae is one of the largest families of Coleoptera belonging to the super family Scarabaeoidea (Lamellicornia) commonly known as dung or rhinoceros beetles, and can be easily identified by their characteristic lamellate antennae and stout body. The family contains about 30000 species under 2000 genera from the world (Chandra *et al.*, 2012; Jameson & Moron, 2001). Sharma *et al.* (2002) were reported 2500 species from the Indian sub-region.

The beetles are economically important as some of them are serious pests of agriculture, forest and fruit trees whereas others act as nature's scavengers by feeding on dung and decaying vegetative and animal matters. A large number of beetles of this family are nocturnal in habit and hide during the day time and few are diurnal. They are found all over the world but are very common in tropics. The knowledge of Indian Scarabaeidae is based mainly on the contributions by Arrow (1917), Arrow (1910), Balthasar (1963), Bhattacharyya *et al.* (1997), Biswas & Chatterjee (1987), Brenske (1898), Chatterjee *et al.* (2007)

and Mittal, (1993) who worked on the scarabeids of Arunachal Pradesh, Silent valley in Kerala, Meghalaya, Nilgiri Biosphere reserve, Orissa, West Bengal, Meghalaya, Manipur, and Mizoram. Chandra (2000, 2002, 2008 & 2009) and Chandra & Gupta, (2012) made substantial contributions to the Scarabaeidae fauna of India based on studies in Madhya Pradesh.

Compared to the knowledge about the scarabs in other parts of India, there is little information on scarabs of Tripura. Based on a collection made till 1984, Chandra (2008) reported 34 species under 12 genera belonging to 4 subfamilies from the state but it was not possible to validate that report in the absence of specimens of that study. Also, that report did not provide taxonomic note or photographic evidence of the reported taxa. The aim of this study, therefore, was to explore different locations in the state of Tripura to expand the knowledge regarding the taxonomy and diversity of scarab beetles. Diagnostic characters and taxonomic key for the identification of different taxa are included.

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MATERIALS AND METHODS

Live specimens were collected from different locations of the Tripura state by using white light trap and by hand picking from weeds, cow dung or soil. Collected specimens were kept in killing jars lined in the bottom by plaster of Paris containing potassium cyanide to kill insects. In the laboratory, all the specimens were washed thoroughly in water to remove dirt. Specimens were individually pinned using stainless steel insect pins and kept in an incubator at 35°Celsius until these were dried. Pinned specimens were labeled with details of collection locality, scientific names, dates of collection and host plant, if known, and then transferred to insect boxes for preservation.

The specimens were studied under stereo zoom microscope (Leica model M 205C) for morphology, morphometry, photography, and their identification. Photographs were taken through microscope-mounted

digital camera (Leica model DFC 295) and Canon DSLR camera depending on the size of individual specimens. Specimens were identified using the key characters provided by Arrow, (1917) and Arrow, (1931). Voucher specimens of the reported species are preserved in the Ecology and Biodiversity Laboratories, Department of Zoology, Tripura University.

RESULTS AND DISCUSSION

A total of 50 specimens were collected and examined in this study (Table 1). Taxonomic study of the specimens revealed that these belonged to at least 19 species under 17 genera, 13 tribes and 5 subfamilies. These included 9 species and 12 genera reported here as new records from the state of Tripura. These are denoted by single asterisk (*) and double asterisks (**), respectively (Table 2). The remaining 11 species and 5 genera were previously reported by Mukherjee *et al.* (2004).

Table 1. Names of collection locations and number of specimens collected from each location.

Districts	Collection location	No. of specimens
West Tripura	Amtali	04
	Bhubanban	01
	Icchachandanagar	10
	Suryamaninagar	10
	Agartala	10
	Indranagar	07
	Lankamura	01
North Tripura	Dharmanagar	01
Sepahijala	Sepahijala	01
	Sonamura	01
South Tripura	Trishna Wild Life Sanctuary	02
Dhalai	Ambasa	02
	Total	50

Table 2. Subfamilies, tribes, genera and species of the Scarabaeidae collected from Tripura.

Subfamily	Tribe	Genus	Species	
1. Scarabaeinae	1. Gymnopleurini	1. <i>Paragymnopleurus</i> *	1. <i>sinuatus</i> **	
	2. Coprini	2. <i>Catharsius</i>	2. <i>molossus</i>	
		3. <i>Heliocopriss</i>	3. <i>sagax</i>	
	3. Oniticellini	4. <i>Oniticellus</i>	4. <i>bucephalus</i>	
		4. <i>Onitini</i>	5. <i>cinctus</i>	
		5. <i>Onthophagini</i>	6. <i>Onthophagus</i> * (<i>Digitonthophagus</i>)	6. <i>falcatus</i>
	2. Cetoniinae	6. <i>Cetoniini</i>	<i>Onthophagus</i> (<i>Onthophagus</i>)	7. <i>gazelle</i> **
			7. <i>Caccobius</i> *	8. <i>quadridentalus</i> **
		7. <i>Taenioderini</i>	8. <i>Protaetia</i> *	9. sp
9. <i>Coilodera</i> *			10. <i>fusca</i> **	
10. <i>Ixorida</i> *			11. <i>mearesi</i> **	
3. Dynastiinae	8. <i>Dynastini</i>	11. <i>Xylotrupes</i>	12. <i>mouhoti</i> **	
		9. <i>Oryctini</i>	13. <i>gideon</i>	
		12. <i>Oryctes</i> *	14. <i>rhinoceros</i> **	

	10. Sericini	13. <i>Maladera</i> *	15. <i>castanea</i> **
4. Melolonthinae	11. Melolonthini	14. <i>Apogonia</i> *	16. sp
		15. <i>Leucopholis</i> *	17. sp
5. Rutelinae	12. Anomalini	17. <i>Anomala</i> *	18. spp
	13. Adoretini	16. <i>Adoretus</i> *	19. <i>compressus</i> **

Taxonomic key to the subfamilies of the family Scarabaeidae

Spiracles in the posterior segments of the abdomen situated on dorsal side of the segments -2

Spiracles in the posterior segments of the abdomen situated on the lateral sides of the segments; hind tibiae with one spur each; middle coxae widely separated -Scarabaeinae

2. Labrum membranous, not visible -3

Labrum sclerotised, visible -4

3. Mandibles not visible, fore coxae vertical -Cetoniinae

Mandibles visible, fore coxae transverse -Dynastinae

4. Claws unequal -Rutelinae

Claws equal -Melolonthinae

Subfamily Scarabaeinae (Latreille, 1802)

Diagnosis: Body oval or oblong, rather depressed to highly convex; antennae 8- or 9-segmented, antennal club consists of three closely compact segments; scutellum very minute, sometimes absent; elytra covering the body, sometimes excised behind shoulders; middle tibiae with 1-2 terminal spur, hind tibiae with a single terminal spur. The world fauna of the subfamily Scarabaeinae includes approximately 5000 described species under 234 genera.

Taxonomic key to the tribes of subfamily Scarabaeinae;

Elytra emarginated on lateral margins; middle tibiae with single terminal spur; antennae 9-segmented; middle coxae obliquely placed -Gymnopleurini

Elytra never emarginated on lateral margins; middle tibiae with single or double terminal spurs; antennae 8- or 9-segmented; middle coxae parallel or slightly convergent in front -2

Antennae always 9-segmented; elytra with 9 striae, 9th one close to epipleural carina -Coprini

Antennae always 8-segmented; elytra with 8 striae, 8th one close to epipleural -Onticellini

Basal pits on pronotum round, oblique or elongate; scutellum clearly visible -Onitini

Basal pits on pronotum absent; scutellum not visible

- Onthophagini

Tribe Gymnopleurini(Lacordaire, 1856)

Diagnosis: The side edge of each elytron of the beetles of this tribe has a characteristic shape that exposed the underlying pleural sclerites; the fore tibiae bear a terminal spur, four tibial teeth, and tarsi; the middle and hind tibiae are mostly long and thin. The tribe comprises of about 110 species fewer than 4 genera.

Genus *Paragymnopleurus*(Shipp, 1897)

Diagnosis: Body broad and rather depressed, hind part narrowed; clypeus with anterior margin bi-lobed; elytra rather flat with sides deeply excised on the sides, exposing the sides of the body beneath.

Paragymnopleurus sinuatus (Olivier, 1789)

Diagnosis: Body black or very dark coppery black; club of antenna bright yellow; clypeus acutely notched in the middle and produced into an acute or rounded tooth on each side; pronotum is feebly convex, lateral margins abruptly angulated in the middle and nearly straight to the front; long slender legs, front tibia armed with three acute teeth placed close together in the terminal third of the tibia, remaining two thirds finely serrate; in males hind tibia strongly curved at its extremity.

Material examined: 1♂, coll. Majumder, 09.viii. 2013, cow dung, Bhubanban, West Tripura.

Geographical distribution: India: Chattisgarh, Haryana, Himachal Pradesh, Karnataka, Madhya Pradesh, Maharashtra, Tamil Nadu, Uttar Pradesh, Uttarakhand, and West Bengal (Figure 1).

Tribe coprini (Leach, 1815)

Diagnosis: It comprises of shiny black, medium to large bodied beetles averaging 9.5 mm to 30 mm long. This tribe is known by 400 species under 10 genera from the world (Chandra & Gupta, 2013).

Taxonomic key to the genera of tribe Coprini

First segment of antennal club entirely pubescent

-*Catharsius*

First segment of antennal club shining not pubescent

-*Heliocopris*.

Genus *Catharsius* (Hope, 1837)

Diagnosis: Supplementary lateral carina present in place of 8th striae upon each elytrum; additional transverse carina present at the outer edges of the middle and the hind tibiae; scutellum absent.

Taxonomic key to the species of genus *Catharsius*,

Head with a small smooth area adjoining each eye

- *molossus*

Head without smooth area adjoining each eye - *sagax*

***Catharsius*(*Catharsius*)*molossus* (Linnaeus, 1758)**

Diagnosis: Body broadly oval and strongly convex, black and partially clothed with reddish hair beneath; head broad, ocular lobes densely and coarsely granular with a small smooth shining area adjoining inner margin of each eye; a median horn present in males; pronotum densely granulate with a sharp declivity in front and its upper surface forms a sharp ridge, weakly convex in the middle.

Material examined: 1♂, coll. T. Das, 08.iii.2006, light trap, Shanmura, Lankamura, West Tripura.

Geographical distribution: India: Andaman and Nicobar islands, Arunachal Pradesh, Assam, Bihar, Chattisgarh, Haryana, Himachal Pradesh, Karnataka, Kerala, Madhya Pradesh, Meghalaya, Orissa, Sikkim, Uttar Pradesh, Uttarakhand, and West Bengal (Figure 2).

***Catharsius*(*Catharsius*)*sagax*(Quenstedt, 1806)**

Diagnosis: Body black, broad, oval, partially clothed with reddish hair beneath; head broad, clypeus transversely rugose, ocular lobes densely and coarsely granular, cephalic horn present; pronotum granulate; elytra finely and lightly striate, rugose.

Material examined: 2 adults ♀♀, coll. Sinha, 06.vii.2015, soil, Suryamaninagar, West Tripura.

Geographical distribution: India: Andhra Pradesh, Bihar, Chattisgarh, Haryana, Himachal Pradesh, Madhya Pradesh, Maharashtra, Punjab, Tamil Nadu, Uttar Pradesh and West Bengal; elsewhere: Bhutan (Figure 3).

Genus *Heliocopriss*(Hope, 1837)

Diagnosis: Large and broad body; pronotum lateral fringes stiff and erect, with rough surface and a complete basal groove; scutellum absent; fore coxae prominent, middle coxae long, opposite mid-coxae not widely separated, nearly parallel.

***Heliocopriss bucephalus*(Fabricius, 1775)**

Diagnosis: Body broad, about quadrate in shape; head rather small, male with a slender, pointed, slightly curve horn at centre; pronotum opaque and rough, unevenly

rugose, with a sharp straight carina in the front, feebly toothed at each end; elytra black, shining, with lower surface usually deep red; legs and parts of lower surface covered with reddish hairs.

Material examined: 1adult ♂, coll. Sinha, 06.vii.2015, soil, Ichachandanagar, West Tripura.

Geographical distribution: India: Bihar, Chattisgarh, Haryana, Himachal Pradesh, Madhya Pradesh, Maharashtra, Rajasthan, Uttar Pradesh and West Bengal; elsewhere: Myanmar, Malay Peninsula and Java (Figure 4).

Tribe *oniticellini* (Kolbe, 1905)

Diagnosis: Members of this tribe are characterized by the presence of 8-segmented antennae and a small visible scutellum; body elongate, usually quasi-rectangular, but tapering posterior.

Genus *Oniticellus*(Servillet, 1825)

Diagnosis: Body elongated; head short and broad; scutellum present; elytra rather flat, not completely covering the abdomen; legs stout.

***Oniticellus* (*Oniticellus*)*cinctus*(Fabricius, 1775)**

Diagnosis: Body oblong-oval, not very convex; head without carina and upper surface smooth and shining with a slight metallic green luster; pronotum smooth, with a deep median longitudinal line on posterior half; elytrum pale yellow, deeply striate; males with clypeus weakly excised in the middle of the front edge.

Material examined: 2 adults ♂♂, coll. Sinha, 04.vi.2016, light trap, Suryamaninagar, West Tripura.

Geographical distribution: India: Chattisgarh, Haryana, Himachal Pradesh, Madhya Pradesh, Maharashtra, Tamil Nadu, Uttarakhand, Uttar Pradesh, and West Bengal (Figure 5).

Tribe *onitini* (Laporte, 1840)

Diagnostic characters: The members of this tribe are adapted for tunneling in soil; antennae nine segmented; scutellum is present; fore tibiae with four teeth.

Genus *Onitis*(Fabricius, 1798)

Diagnosis: Body deep colored, oblong in shape; head not very broad; pronotum with basal impressions, scutellum small; front tarsi absent.

***Onitis falcatus*(Wulfen, 1786)**

Diagnosis: Body black or nearly black, with a clothing of reddish yellow hairs upon the legs and lower surface; head smooth and shining; pronotum finely punctured, without a well-marked median groove or line, the base strongly rounded but not distinctly lobed; elytra and pygidium subopaque; males - front tibiae elongate and each armed with four short external teeth.

Material examined: 2 adults ♂♂, coll. Barman, 17.ii.2007, cow dung, Sepahijala, Sepahijala district, Tripura.

Geographical distribution: India: Arunachal Pradesh, Assam, Gujarat, Haryana, Karnataka, Meghalaya, Manipur, Rajasthan, Tamil Nadu, Tripura, Uttaranchal, Uttar Pradesh, and West Bengal; elsewhere: Bangladesh, Malaya Peninsula, Philippine Island and South China (Figure 6).

Tribe onthophagini (Burmeister, 1846)

Diagnosis: Antenna always 9-segmented; scutellum invisible; fore tibiae with four teeth; species separation is based on horns, ridges and clypeal indentation on head, sculpturing of pronotal disc, and on punctuation or granulation of head, thorax and abdomen. The tribe includes over 2200 species distributed in 40 genera, of which 345 species are so far reported from the Oriental region.

Taxonomic Key to the genera of Tribe Onthophagini

Head provided with horns or tubercles; four posterior tarsi not broadly dilated
-*Onthophagus*

Head without horns; four posterior tarsi broadly dilated
- *Caccobius*

Genus *Onthophagus* (Latreille, 1802)

Diagnosis: Very small to large species of extremely varied form and colour; body smooth or clothed with hairs or setae; clypeus fused with the ocular lobes and variable in shape (round, bi-lobed or acuminate in front); scutellum absent.

Taxonomic key to the species of the genus *Onthophagus* (Latreille, 1802); A pair of blunt processes present on the smooth pronotum; elytra pale -*gazella*

A pair of short pointed horns present on hind margin of clypeus; elytra dark
-*quadridentalis*

Onthophagus (*Digitonthophagus*) *gazelle* (Fabricius, 1787)

Diagnosis: Body darkish yellow, broadly oval and convex, smooth and moderately shining, with a thin clothing of yellow setae present on legs and lower surface; female without horns, instead with a transverse ridge, males with 2 short, upward curving horns at base (from literature; front of pronotum vertical in the middle and forming a pair of strong, slightly divergent, blunt processes in females; scutellum absent; elytra brown, finely striate with intervals flat and impunctate.

Material examined: 1♀, coll. Sinha, 09.viii.2015, cow dung, Tuisangma, North Tripura

Geographical distribution: India: Andhra Pradesh, Chattisgarh, Delhi, Gujarat, Haryana, Himachal Pradesh, Karnataka, Madhya Pradesh, Maharashtra, Punjab, Rajasthan, and Tamil Nadu; elsewhere: Africa, Arabia, Madagascar, Pakistan and Sri Lanka (Figure 7).

Onthophagus (*Onthophagus*) *quadridentalis* (Fabricius, 1798)

Diagnosis: Body black, smooth and shining, broadly oval and moderately convex; antennae and mouth parts yellow; clypeal margins evenly rounded and strongly reflexed, separated from fore head by a slight rounded carina and hind margin having a pair of horns in males; pronotum finely and sparsely punctate; elytral striae closely punctate; tarsi reddish.

Material examined: 2 adult ♂♂, coll. U.D. Barman, 17.ii.2007, light trap, Ambasa, Dhalai district.

Geographical distribution: India: Arunachal Pradesh, Bihar, Chattisgarh, Himachal Pradesh, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Orissa, Punjab, Rajasthan, Tamil Nadu, Uttar Pradesh and West Bengal; elsewhere: Sri Lanka (Figure 8).

Genus *Caccobius* (Thomson, 1863)

Diagnosis: Body short and compact, convex, nearly metallic colored; scutellum absent; front angles of the thorax have a deep hollow beneath; legs short, front tibia very short and broad, with terminal tooth projected straight and forming a right angle with the inner edge of the tibia; males may be armed with a single short horn, a pair of horns, or they may be entirely without armature

Caccobius sp.

Diagnosis: Body black coloured, small, oval, compact and moderately convex; pronotum finely punctate; each elytron with red spots on the upper portion near the outer margin.

Material examined: 1 adult ♀, coll. Sinha, 08.vi.2015, light trap, Suryamaninagar, West Tripura. (Figure 9)

Subfamily Cetoniinae Leach, 1815

Diagnosis: Body somewhat flattened, cephalic horns absent; mandibles and labrum weakly developed, hidden by clypeus; antennae 10-segmented, antennal insertions visible from above; pygidium exposed; tarsal claws simple (not forked), and nearly of equal size.

Taxonomic key to the tribes of Cetoniinae

Mesosternal epimera dilated above, reaching the dorsal surface
-Cetoniini

Mesosternal epimera not dilated above, not reaching the dorsal surface
-Taenioderini

Tribe Cetoniini Leach, 1815

Diagnosis: Pronotum without baso-median lobe, scutellum visible; meso-epimeron distinct; meso- and meta-sternal protrusions developed; elytra glabrous, with post-humeral emargination distinct.

Genus *Protaetia* (Burmeister, 1842)

Diagnosis: Body elongate, gradually narrowed posteriorly; elytra with distinct pale markings, apical spines in male.

***Protoetia fusca*(Herbst, 1790)**

Diagnosis: Body broad oval, dorso-ventrally flattened; colour dull dark grey-brown to black; clypeus broad, anterior margin entire; elytra with distinct pale markings; front tibia of males with 2 external teeth.

Material examined: 1♂, coll. A. Majumder, 07.vii.2015, light trap, Indranagar, West Tripura.

Geographical Distribution: India: West Bengal, Assam; elsewhere: Australia, Burma, Hawaii, Malaysia, Mauritius, Philippines, Thailand, Hong Kong (Figure 10).

Tribe Taenioderini Miksic, 1976

Diagnosis: Base of the pronotum forming ridges; meso-sternalepimera not dilated; elytra broad in the front and tapering towards the apex.

Taxonomic key to the genera of tribe Taenioderini

Pronotum triangular, yellow, with two transverse ridges dividing it into three parts -*Coilodera*

Pronotum rounded, black, with a yellow band in the middle placed longitudinally -*Ixorida*

Genus *Coilodera* Hope, 1831

Diagnosis: Pronotum triangular in shape, yellow, with two transverse ridges dividing it into three parts.

***Coilodera mearesi*(Westwood, 1842)**

Diagnosis: Elytra with several yellow spots, two pairs of light yellow spots present adjoining the elytral suture, a pair of bright yellow spots at the tip of the elytra, a series of 5 very small yellow spots at the margins of elytra; pygidium entirely yellow.

Material examined: 1 adult (sufficient literature not available to identify the sex), coll. D.L. Laskar, TrishnaWLS, 16.v.2010, hand-picked from weeds.

Geographical distribution: India: Assam, Tripura; elsewhere: Nepal, Thailand (Figure 11).

Genus *Ixorida* Thomson, 1880

Diagnosis: Pronotum rounded in shape, black, with a yellow median band traversing longitudinally reaching the scutellum.

***Ixorida mouhoti*(Wallace, 1868)**

Diagnosis: Pronotum somewhat rounded, with middle yellow band and lateral black bands; elytra two lateral spots on each side; two yellow patches joined in the middle of the sutural line of elytra; pygidium yellow.

Material examined: 1 adult (sexual characters not distinct in the specimen), coll. P.P. Bhattacharjee, 6.v. 2010, TrishnaWLS, handpicked from weeds.

Geographical distribution: India: Tripura; elsewhere: Laos, Myanmar, Thailand, Vietnam (Figure 12).

Subfamily Dynastinae MacLeay, 1819

Diagnosis: Usually black, very rarely brown; males have very prominent horns on the head and thorax; clypeus small and the eyes less prominent; scutellum present; elytra completely cover the abdomen; all the coxae are contiguous in the middle.

Taxonomic key to the tribes of subfamily Dynastinae

Basal joint of hind tarsus similar to those succeeding

- Dynastini

Basal joint of hind tarsus more or less triangular -Oryctini

Tribe Dynastini MacLeay, 1819

Diagnosis: Males bear horns, females hornless; elytra coriaceous (leather-like) in both sexes; combined lengths of fore tibia and fore tarsus longer in males than in female, posterior tarsal segments cylindrical, basal segment with strong apical spine.

Genus *Xylotrupes* Hope, 1837

Diagnosis: Body ovate, moderately convex in shape, with slender legs; clypeus bi-dentate; pronotum acute at the front and obtuse behind; front tibiae strongly tridentate; middle and hind tibia armed externally with strong spines; tarsi simple.

***Xylotrupes gideon*(Linnaeus, 1767)**

Diagnosis: Large sized beetles, uniformly chestnut red or brown; head, pronotum and legs darker; sternum and hind coxae clothed with a fine pubescence; sex dimorphism prominent - females generally darker; head and pronotum rugose, coarsely punctured; males with large bifurcate horns projecting both from the head and the pronotum, females without horns.

Material examined: 1♂ and 1♀, coll. Sinha, 03.iv.2015 & 13.v.2016, light trap, Agartala, West Tripura.

Geographical distribution: India: Assam, Kerala, Maharashtra, Manipur, Mizoram, Meghalaya, West Bengal; elsewhere: Sri Lanka (Figure 13).

Tribe oryctini Mulsant, 1842

Diagnosis: Posterior tarsal segments (especially first or second) triangularly expanded; combined lengths of fore tibia and fore tarsus similar in both sexes.

Genus *Oryctes* (Illiger, 1798)

Diagnosis: body usually convex dorsally, elongate and somewhat cylindrical to oblong and weakly flattened forms also found.

***Oryctes rhinoceros* (Linnaeus, 1758)**

Diagnosis: Body black with lower surface reddish and clothed with a short pubescence; pronotum as broad as long; scutellum rugose, with a smooth outer margin; middle tibiae much shorter than the hind ones.

Material examined: 1♀, coll. Sinha, 13.iv.2016, light trap, Agartala, West Tripura.

Geographical distribution: India: West Bengal, Maharashtra, Tamilnadu; elsewhere: Burma, Thailand, Indonesia, Philippines, Hong Kong, Korea and Taiwan (Figure 14).

Subfamily Melolonthinae (Leach, 1819)

Diagnosis: It is the largest subfamily of Scarabaeidae with 750 genera and 11000 species recorded worldwide. They are dull brown or black in colour with rounded body; some are shiny, many with bristles or scales; antennae 9 to 10 segmented ending in a unilateral club of 3 or more segments; head usually unarmed, labrum externally visible, mandibles partly concealed; scutellum present; margins of elytra straight; tarsal claws equal, not strongly curved, fore tibiae flattened with 1 to three dentitions on outer edge.

Taxonomic key to the tribes of Melolonthinae

- | | |
|--|----------------|
| 1. Tarsal claws tri-dentate; elytra smooth; body covered with scales | - Leucopholini |
| Tarsal claws bi-dentate or paired; elytra striate | -2 |
| 2. Antennae 10-segmented | - Sericini |
| Antennae 8- or 9-segmented | - Diplotaxini |

Tribe sericini (Kirby, 1837)

Diagnosis: Body strongly ovate, without bristles or scales; labrum fused with clypeus; coxae conical interiorly, widened posteriorly; 1 spur each on the hind tibiae near the basal tarsal segment.

Genus *Maladera* (Mulsant and Ray, 1871)

Diagnosis: Small sized beetles; tan brown or reddish brown in colour; pronotum unarmed; bi-dentate for tibia; antennae 10-segmented, with terminal end 3-segmented loose lamellate club; front of clypeus flattened, with long and thin hairs; mid-coxae widely separated; hind femur and tibiae broad and flat with cleft claws.

***Maladera castanea* (Arrow, 1913)**

Diagnosis: Light chestnut red colour beetles; dorsal surface not setose; head vertex with backward projecting hairs; elytral margins straight; front tibia of female more robust than in male, hind tibia wide.

Material examined: 2 adults (sexual characters were not distinct in the specimens), coll. S. Akter, 9.vii.2015, Indranagar, West Tripura, light trap.

Geographical distribution: India: Rajasthan, Gujarat, Punjab, Bihar, Maharashtra, Mysore, Tripura; elsewhere: Korea, China, Russia, US, Japan (Figure 15).

Tribe Diplotaxini (Kirby, 1837)

Diagnosis: Medium sized beetles; antennae 8 to 9 segmented; mouth parts greatly reduced, except for maxillary palps, labrum globular, not visible in dorsal view, located below the clypeus; abdominal segments 1 to 4 approximately equal in length, abdominal segment 5 twice as long as other segments; sixth sternite partially or completely retracted within 5th sternite; meta-femora widened, swollen; meta-tibiae expanded towards apex; tarsal claws paired.

Genus *Apogonia* (Kirby, 1819)

Diagnosis: Body convex, black; head, pronotum and elytra covered with extremely short and poorly visible setae; labrum entirely covered by clypeus; eyes large; pronotum transverse, convex, base broader than apex; scutellum present; elytra striate, interstices irregularly punctate; fore tibia tri-dentate; claws equal in size.

***Apogonia* sp**

Material examined: 1 adult, coll. Barman, 17. V.2015, light trap, Dharmanagar, North Tripura

Taxonomic note: Females generally are larger in size than in males; pygidium is less convex than males. Since these characteristics can only be compared if enough specimens are available, so assigning the sex of this specimen was not possible (Figure 16).

Tribe Leucopholini Burmeister, 1855

Diagnosis: Large sized beetles; elytra without stria; tarsal claws tri-dentate; body covered with scales.

Genus *Leucopholis* (Dejean, 1833)

Diagnosis: Body ovoid to pear shaped; variously colored; pronotum with anterior and posterior margins smooth; eyes prominent; body covered with scales; meso-sternal spine and pro-sternal processes present; pygidium broader than long and broadly triangular; females larger than males on an average, hind tibial spurs broad and spatula like whereas in males they are spine like and pointed.

***Leucopholis* sp.**

Material examined: 1 adult (♂) coll. Suman, 02.vi.2017, Amtali, West Tripura (Figure 17).

Subfamily Rutelinae (Macleay, 1819)

Diagnosis: Elongated to oval, often shiny; scutellum present; anterior coxae transverse, middle tibia with two apical spurs; hind legs unequal, with independently movable tarsal claws; pygidium exposed.

Taxonomic key to the tribes of subfamily Rutelinae

Labrum horizontally produced with respect to clypeal apex, distinctly separated from clypeus - Anomalini

Labrum vertically produced with respect to clypeal apex and more or less fused to clypeus - Adoretini

Tribe Anomalini (Blanchard, 1851)

Diagnosis: Extremely varied in their outward form and brilliantly coloured; antennae 9-segmented; clypeus broadly rounded or semicircular, sometimes narrowly produced and snout like, a little excised in the middle; pronotum broadly lobed or narrowly excised in the middle; elytra with membranous border at lateral margin; legs stout or slender, front tibiae with one, two or three external teeth.

Genus *Anomala* (Samouelle, 1819)

Diagnosis: Small to medium- size, slightly oval shaped and convex; antennae 9-segmented; body surface extremely smooth and shining; pronotum not pubescent; labrum horizontal, not visible from above; pronotum transverse, slightly lobed and never excised in front of scutellum; elytra with shallow striations and punctures, rather translucent along sides; front tibia with two external teeth, apical tooth long and de-curved in both sexes.

***Anomala* spp.**

Material examined: 1adult, 03.vii.2016, Amtali, West Tripura; 1 adult, coll. Geetha, 04.vii.2017, Ichachandanagar, West Tripura; 2 adults, coll. Mrityunjoy, 20. vii. 2016, Ichachandanagar, West Tripura.

Taxonomic note: Generally for different species of *Anomala* male and female can be identified by observing the difference in the structure of last abdominal segment and last segment (tarsomere) of the foreleg. Here the characteristics are not much pronounced and due to lack of information regarding any other diagnostic features used to identify the sex it is not possible to assign the sex of the specimen (Figure 18a, b and c).

Tribe Adoretini (Burmeister, 1844)

Diagnosis: Small sized beetles, dull colored, body covered with a clothing of short hairs or setae on both surfaces; labrum produced downwards, rectangular or triangular shape with respect to clypeal apex, mandibles separate, maxillae nearly fused to clypeus.

Genus *Adoretus* (Laporte, 1840)

Diagnosis: Body elongate, oval, setose; eyes large sized; hind legs comparatively longer than the other two legs.

***Adoretus compressus* (Weber, 1801)**

Diagnosis: Body elongate, oval; brownish with numerous distinctive, cream –white setae; front tibia with 3 teeth at lateral margin; last sternite of female with apex rounded posteriorly, weakly quadrate in male.

Material examined: 7 adults (3♀, 4♂), coll. Babai, 02.vi.2016, Indranagar, West Tripura.

Geographical distribution: India: Tripura, West Bengal; elsewhere: Sri Lanka, Malaysia, Mauritius, Thailand, Indonesia and Papua New Guinea (Figure 19).

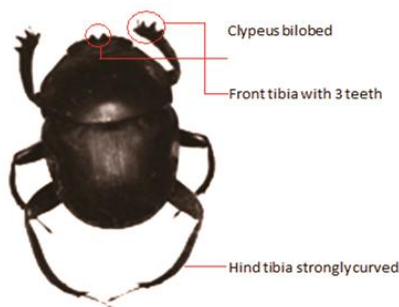


Figure 1. *Paragymnopleurus sinuatus* (adult male).

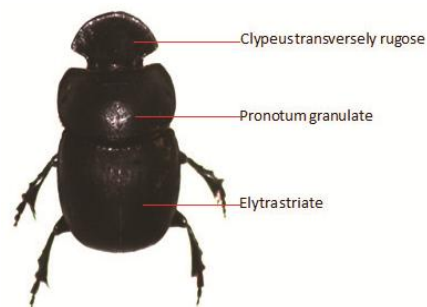


Figure 2. *Catharsius (Catharsius) molossus* (adult male).

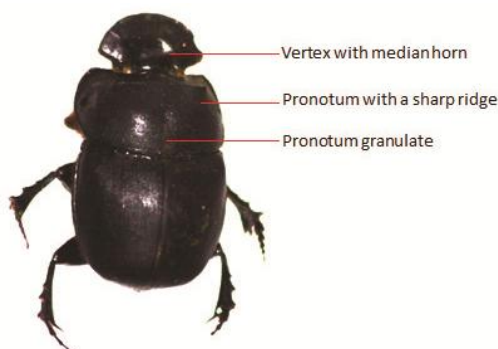


Figure 3. *Catharsius (Catharsius) sagax* (adult female).

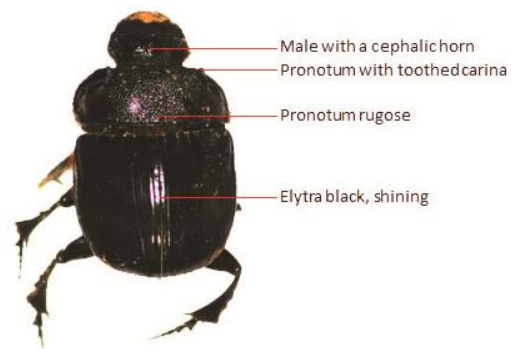


Figure 4. *Heliocopris bucephalus* (adult male).

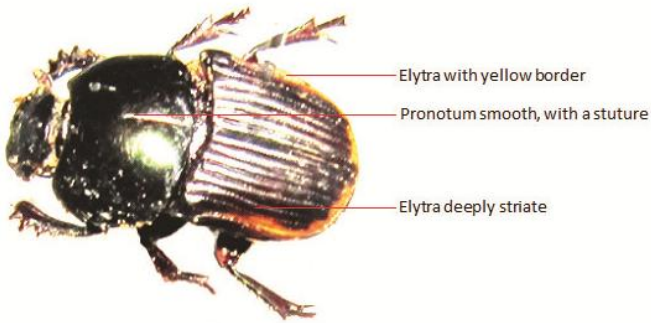


Figure 5. *Oniticellus (Oniticellus) cinctus* (adult male).



Figure 6. *Onitis falcatus* (adult male).

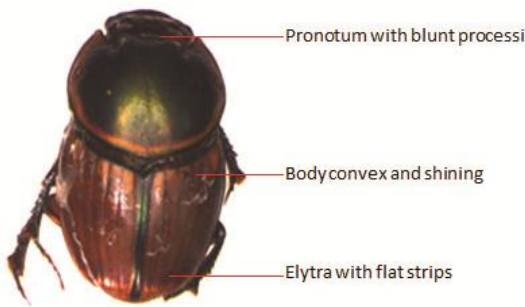


Figure 7. *Onthophagus (Onthophagus) gazelle* (adult female).

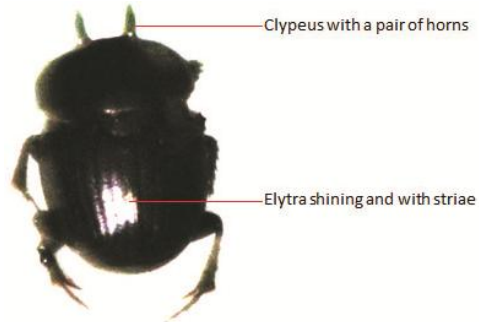


Figure 8. *Onthophagus (Onthophagus) quadridentalis* (adult male).

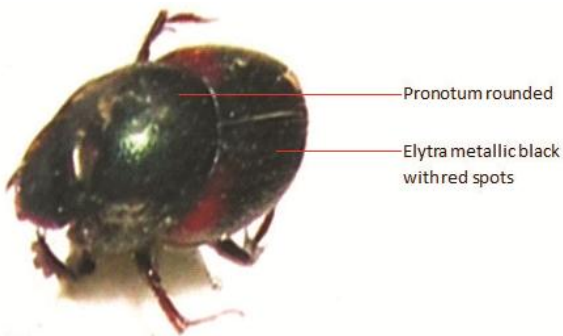


Figure 9. *Caccobius* sp. (adult female).

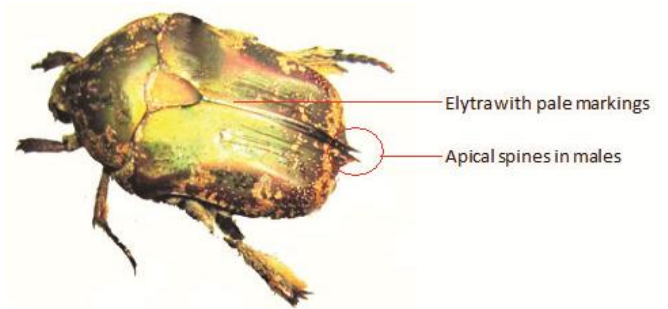


Figure 10. *Protaetia fusca* (adult male).

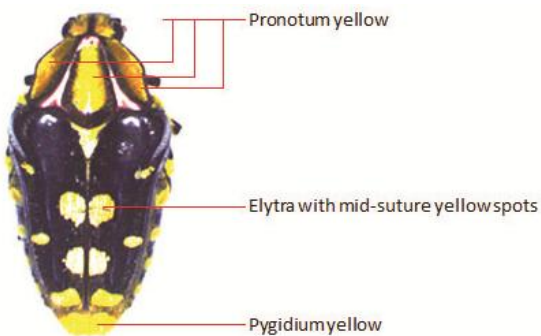


Figure 11. *Coilodera mearesi* (adult sex not specified).

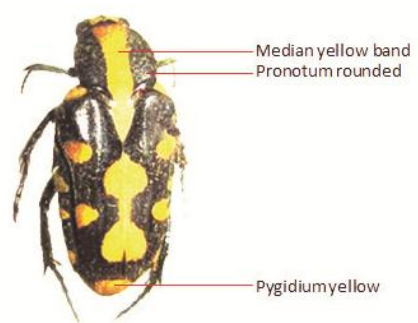


Figure 12. *Ixorida mouhoti* (adult sex not specified).

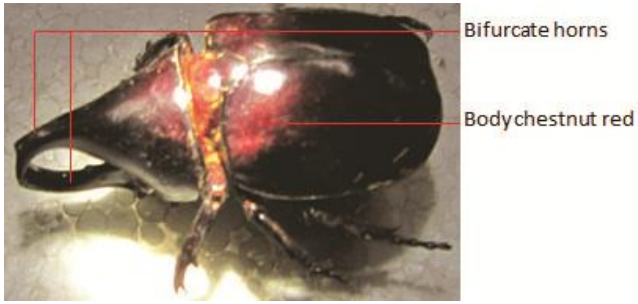


Figure 13a. *Xylotrupes gideon* (adult male).



Figure 13b. *Xylotrupes gideon* (adult female).

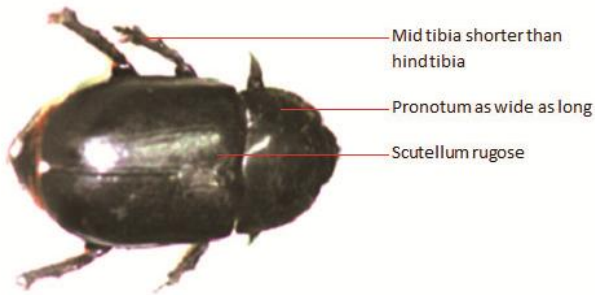


Figure 14. *Oryctes rhinoceros* (adult female).



Figure 15. *Maladera castanea* (adult sex not specified).

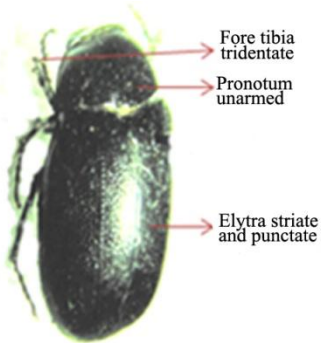


Figure 16. *Apogonia sp.* (adult sex not specified).

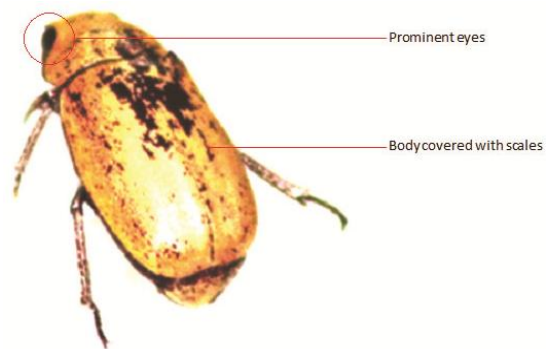


Figure 17. *Leucopholis sp.* (adult male).

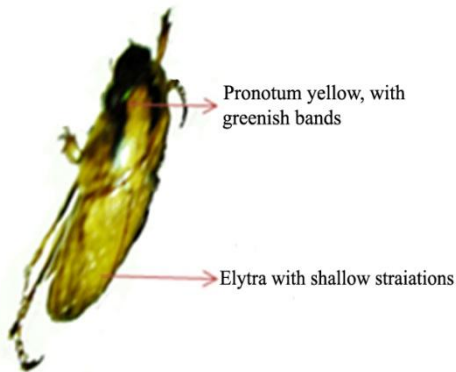


Figure 18a. *Anomala sp.* (adults sex not specified).

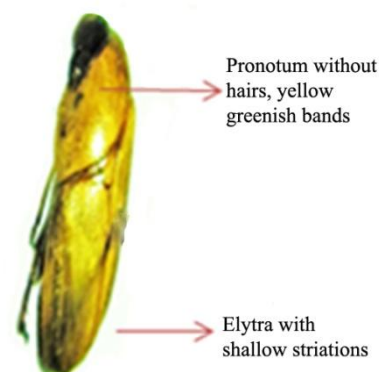


Figure 18b. *Anomala sp.* (adults sex not specified).

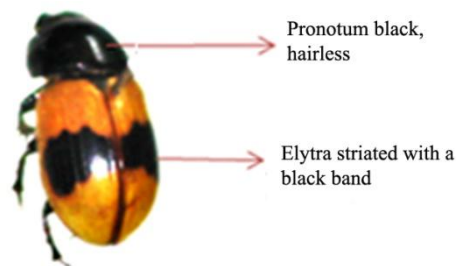


Figure 18c. *Anomala* sp. (adults sex not specified).

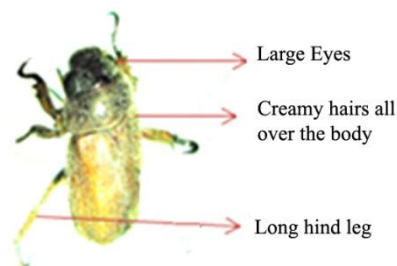


Figure 19. *Adoretus compressus* (adult male).

DISCUSSION

Members of the family Scarabaeidae are distributed worldwide with the maximum species richness and diversity recorded from the tropical parts of the world on both sides of the equator. Indian fauna of the family is known by about 2500 species. In comparison to the knowledge that is available from several parts of India, very little information was available from the State of Tripura in northeast India. This study resulted in the recording of 21 species from a collection of 50 specimens, that is, an average of 1 species for every 2.38 specimens. This is very interesting and suggests that there could be a large number of species of this family that await collection and identification. Among the recorded species, the subfamily Scarabaeinae is represented by highest number of species (9 species), followed by the subfamily Rutelinae (4 species), the subfamilies Cetoninae and Melolonthinae is represented by 3 species each, and the subfamily Dynastinae by 2 species. The species in the subfamily Scarabaeinae are scavengers (mostly dung eater) whereas the species belonging to the subfamilies Rutelinae, Cetoninae, Melolonthinae and Dynastinae are phytophagous.

CONCLUSION

A taxonomic study of the family Sacarbaeidae from Tripura has resulted in the find of 21 species, 17 genera, 13 tribes and 5 subfamilies. These include 9 species as new records from the state.

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