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## Taxonomic studies on *Adoretus* Dejean, 1833 (Rutelinae: Scarabaeidae) of Buxa Tiger Reserve (a forest under biodiversity hotspot zone), Dooars, West Bengal, India

**Subhankar Kumar Sarkar, Sumana Saha and Dinendra Raychaudhuri**

#### Abstract

Taxonomy of *Adoretus* Dejean, 1833 fauna included within the subfamily Rutelinae recorded from Buxa Tiger Reserve, Dooars, West Bengal, India are dealt herewith. The generated data is the outcome of long term faunistic investigations of the authors. Each of the species is redescribed and illustrated, supplemented by digital images. A key for identification of all the species recorded from the study area along with their distribution in India is also provided.

**Keywords:** *Adoretus*, Buxa tiger reserve, Dooars, India, new records

#### Introduction

The authorship of *Adoretus* Dejean, 1833 was bit controversial until Krell [1] when he put forward a critical review of the genus and favored for the attribution of authorship to Dejean [2] in place of Castelnau [3]. Krell [1] has also pointed out that the type species designation of the genus by many authors including Arrow [4] is also not valid and should be designated as *Melolontha nigrifrons* Steven, 1809, since the same was originally included by Dejean [2]. Contribution to the knowledge on these beetles globally were made chiefly by Baraud [5-7], Fairmaire [8], Reitter [9-11], Brenske [12], Burmeister [13, 14], Ohaus [15, 16], Bodenheimer [17], Machatschke [18], Chikatunov & Pavlicek [19], Král & Smetana [20], Smith [21], Krajcik [22], Sabatinelli & Rittner [23]. The genus ranks second after *Anomala* Samouelle, 1819 in terms of number of species recorded worldwide within the subfamily Rutelinae. However, a concise knowledge on the total number of species from this part of the globe is still craving and is limited to the monographic works of Arrow [24-26, 4], Balthasar [27] and Miksic [28]. Information on the Indian members is largely based on the regional works of Biswas [29, 30], Mittal [31, 32], Saha & Raychaudhuri [33], Chandra [34-40], Chandra & Singh [41], Chandra & Ahirwar [42], Chandra & Uniyal [43], Chandra & Gupta [44], Chandra *et al* [45] & Sarkar *et al* [46]. An updated list of the Indian members is therefore, difficult to provide.

Though Eastern Himalaya is one of the 18 hotspots of the world and one of the three of India, the area still lacks a thorough and extensive exploration, particularly for the insect fauna. We however concentrated on Buxa Tiger Reserve (BTR), Dooars, one of the tropical forests of Eastern Himalaya and the research team is engaged in doing so since 1993. In the process a total of 76 scarab species have been recorded so far (Saha & Raychaudhuri [33], Sarkar *et al* [47-50], Raychaudhuri & Saha [51]. The protected area falls under the biogeographic province 7B lower Gangetic plain and occupies an area of about 759.26 sq. kms. The reserve is located between latitudes 26°30" to 26°55" North and longitudes 89°20" to 89°35" East of India (Figure -1).

Majority of the taxa were described in the 19th century and here we redescribe all the taxa nearly after a century. A total of 11 species of the genus dealt herein are recorded from the study area, of which Sarkar *et al* [46] have reported *Adoretus rugosus* Arrow, 1914b as new from the country, *Adoretus renardi* Brenske, 1893 as new from the state of West Bengal and *Adoretus lasiopygus* Burmeister, 1855 as new from the study area without providing any other taxonomic detail. Present discourse is on the first ever taxonomic detail of the members of *Adoretus* Dejean, 1833 recorded from Buxa Tiger Reserve. The taxa are considered *sensu* Arrow [4].



Fig 1: Location map of Buxa Tiger Reserve.

### Materials and Methods

Both extensive and intensive surveys were conducted during 1993 – 2005 in different beats under different ranges of Buxa Tiger Reserve. Field visits were made in every month of each calendar year during the period of survey (except 15<sup>th</sup> June to 15<sup>th</sup> September when the forest remains closed). For collection of the samples sweep nets, bush beating and collection in inverted umbrella and hand picking techniques were used. In the evening hours UV light trap was used to collect nocturnal scarabs. Samples after collection were killed in chloroform and preserved in 70% alcohol in glass vials. Necessary data regarding locality, date of collection, collector's name was noted in a note book in the field. They were then brought to the laboratory where stretching, pinning and labeling is done as per the guidelines laid down by Zoological Survey of India. Part of the male samples stored in 70% alcohol were kept separately in order to dissect out the genitalia. This was met out under the microscope with the help of very sharp scalpel, forceps, needles and brush. After dissection the genital capsule containing parameres was cleared in clove oil. The genital capsule was then boiled in 10% KOH for 5-10 minutes to remove muscles. After study, the male genitalia were preserved in a micro vial containing 70% alcohol along with the adult specimen.

The collected samples were studied under Stereo Zoom Binocular Microscopes Olympus SZX7 and SZX16. Drawings were made with the aid of necessary accessories attached to the microscopes. Photographs were taken by a digital camera attached to the microscopes. All measurements are in millimeters, made with an eye piece graticule and each scale bar represents 1mm, if not otherwise mentioned.

All materials are in the collection of Department of Agricultural Biotechnology, IRDM Faculty Centre, Ramakrishna Mission Vivekananda University, Kolkata, India.

### Results and Discussion

Family: Scarabaeidae Latreille, 1802

Subfamily: Rutelinae MacLeay, 1819

Tribe: Adoretini Burmeister, 1844

Genus: *Adoretus* Dejean, 1833

*Adoretus* Dejean, 1833: 97 [2].

Type species: *Melolontha nigrifrons* Steven, 1809 [52].

Diagnosis: Body short, elongate and entirely covered with white setae; opaque; labrum produced downwards; antennae 9-10 segmented; head short; clypeus broad, generally semicircular, front margin reflexed and round or cut away at angles; pronotum transverse, sides round or medially angulate, base sinuate and medially produced; elytra irregularly coarsely punctured, disc generally with 2-3 raised longitudinal lines; fore tibiae bi or tridentate, mid and hind tibiae carinate externally and truncate at extremity.

Distribution: Asia (Arrow [4]; Chatterjee & Biswas [53]; Saha & Raychaudhuri [33]; Chandra & Gupta [44]; Sarkar *et al* [46]).

### Key to species:

1. Sides of pronotum medially angulate.....2
- Sides of pronotum round.....5
2. Head medially raised near base.....3
- Head medially not raised near base.....4
3. Head coriaceous; scutellum with a membranous margin; longer division of mid claw dilated near base.....*testaceus* Hope, 1831.
- Head punctured; scutellum without membranous margin; longer division of mid claw not dilated near base.....*ariel* Arrow, 1917.
4. Head rugose; front margin of clypeus cut away at sides; margins of pronotum elevated.....*lemniscus* Arrow, 1915.
- Head punctured; front margin of clypeus round at sides; margins of pronotum not elevated.....*versutus* Harold, 1869.
5. Sides of scutellum straight.....6
- Sides of scutellum sinuate/round/curved.....8
6. Pale testaceous; head punctured; front margin of clypeus medially notched.....*boops* Wiedeman, 1821.
- Brown testaceous; head rugose; front margin of clypeus medially not notched.....7
7. Margin of head broad; fronto-clypeal suture laterally raised; scutellum without membranous margin.....*serratipes* Arrow, 1914a.
- Margin of head narrow; fronto-clypeal suture laterally not raised; scutellum with a membranous margin.....*minutus* Brenske, 1893.
8. Elytra with 2 or 3 raised longitudinal line on each disc.....9
- Elytra without any raised longitudinal line on each disc.....10
9. Head and clypeus granular; scutellum with a membranous margin; elytra with 3 raised longitudinal line on each disc.....*lasiopygus* Burmeister, 1855.
- Head and clypeus coarsely punctured; scutellum without membranous margin; elytra with 2 raised longitudinal line on each disc.....*rugosus* Arrow, 1914b.
10. Head and clypeus coriaceous; base of pronotum round; sides of scutellum sinuate.....*bicaudatus* Arrow, 1917.
- Head and clypeus coarsely punctured; base of pronotum sinuate; sides of scutellum straight.....*renardi* Brenske, 1893.

### *Adoretus testaceus* Hope, 1831

(Figures 2A, 4A-H)

*Adoretus testaceus* Hope, 1831: 23 [54].

*Adoretus testaceus* – Arrow, 1917: 320, pl. 5, Figures 19 & 20 [4].

Description: ♀

Length 12.4 mm, humeral width 5.8 mm. Body short, elongate, parallel sided and flat.

Colour and markings (Figures 2A, 4A-H): Dorsum brown testaceous with clypeus, head and pronotum darker, venter red brown; entirely covered with white decumbent setae.

Head (Figures 4A, B): Short and elongate; coriaceous; medially little raised near base.

Clypeus (Figures 4A, B): Broad; coarsely punctured; front margin reflexed and round at angles.

Fronto-clypeal suture (Figures 4A, B): Marked by a transverse straight carina Interocular width: 3.4 x transverse eye diameter.

Antenna (Figures 4C): 10 segmented, club 1.1 x stem.

Pronotum (Figure 4A): Short and transverse; roughly hexagonal; coarsely and densely punctured; margins elevated; sides bluntly angulate at middle; base sinuate and roundly

produced at middle; front angles acute and hind angles obtuse. Scutellum (Figure 4A): Short; obtusely triangular; coarsely punctured; margin membranous; sides gradually round; apex blunt.

Elytra (Figure 4A): Coarsely and densely punctured; disc with three raised longitudinal line; humeral angles round and apical angles acute; humeral and apical humps raised.

Pygidium (Figure 4D): Rugose.

Mesosternum (Figure 4D): Laterally rugose; medially smooth having a longitudinal line.

Fore tibia (Figure 4F): Bluntly tridentate; outwardly longitudinally carinate; subterminally with 1 short spur.

Mid and hind tibiae (Figures 4G, H): Carinate externally; truncate and fringed with short spines at extremity; terminally with 2 unequal spurs.

Tarsi (Figures 4F, G & H): 5 segmented.

Claws (Figures 4F, G & H): Unequal; longer one of fore and mid cleft with the tips far away.

Material examined: 1♀, Poro, BTR, 05 April 2002, coll. S.K. Sarkar; 2♀, Panbari, BTR, 20 May 1995, coll. S. Saha.

Distribution: India: West Bengal; Bhutan; Nepal (Arrow <sup>[4]</sup>; Chatterjee & Biswas <sup>[53]</sup>; Saha & Raychaudhuri <sup>[33]</sup>).

### ***Adoretus ariel* Arrow, 1917**

(Figures 2B, 5A-J)

*Adoretus ariel* Arrow, 1917: 326, pl. V, Figure 23 <sup>[4]</sup>.

Description: ♂

Length 11.3 mm, humeral width 4.1 mm. Body short, elongate, parallel sided and flat.

Colour and markings (Figures 2B, 5A-J): Pale testaceous with clypeus, head and pronotum darker; entirely covered with white decumbent setae.

Head (Figures 5A, B): Elongate; coarsely punctured; medially little raised near base.

Clypeus (Figures 5A, B): Broad; coarsely rugose; front margin reflexed and round at angles.

Fronto-clypeal suture (Figures 5A, B): Marked by a transverse, nearly straight and laterally raised carina.

Interocular width: 2 x transverse eye diameter.

Antenna (Figure 5C): 10 segmented; club 1.33 x stem.

Pronotum (Figure 5A): Short; roughly hexagonal; coarsely and densely punctured; margins elevated, front being broad and sinuate; sides medially angulate; base sinuate and roundly produced at middle; front angles acute and hind angles obtuse.

Scutellum (Figure 5A): Short; obtusely triangular; nearly smooth; sides nearly straight; apex blunt.

Elytra (Figure 5A): Coarsely and densely punctured; disc with three raised longitudinal line; humeral angles round and apical angles acute; humps raised.

Pygidium (Figure 5D): Finely strigose.

Mesosternum (Figure 5E): Laterally rugose; medially smooth, with a longitudinal line.

Fore tibia (Figure 5F): Bluntly tridentate; outwardly longitudinally carinate; subterminally with 1 short spur.

Mid and hind tibiae (Figures 5G, H): Carinate externally; truncate and fringed with short spines at extremity; terminally with 2 unequal spurs.

Tarsi (Figures 5F, G & H): 5 segmented.

Claws (Figures 5F, G & H): Unequal; longer one of fore and mid cleft, with the longer one of latter dilated near base.

Parameres (Figures 3A, 5I & J): Long and unequal; base broad and straight, with a raised tubercle near it; sides straight, one having a tooth medially; inner margin curved; apex blunt and bilobed.

Material examined: 1♂, Rajabhatkhawa, BTR, 19 May 1997,

coll. S. Saha.

Distribution: India: Assam and West Bengal; Vietnam (Arrow <sup>[4]</sup>; Saha & Raychaudhuri <sup>[33]</sup>).

### ***Adoretus lemniscus* Arrow, 1915**

(Figures 2C, 6A-H)

*Adoretus lemniscus* Arrow, 1915: 232 <sup>[26]</sup>.

*Adoretus lemniscus* – Arrow, 1917: 321 <sup>[4]</sup>.

Description: ♀

Length 9.7 mm, humeral width 4 mm. Body short, elongate & nearly flat.

Colour and markings (Figures 2C, 6A-H): Brown testaceous with pronotum, head and clypeus black brown; entirely covered with white decumbent setae. Head (Figures 6A, B): Short and elongate; rugose.

Clypeus (Figures 6A, B): Broad; rugose; margin reflexed in front and cut away at sides.

Fronto-clypeal suture (Figures 6A, B): Marked by a transverse straight carina.

Interocular width: 2.18 x transverse eye diameter.

Antenna (Figure 6C): 10 segmented; club 1.3 x stem.

Pronotum (Figure 6A): Transverse; roughly hexagonal; coarsely and densely punctured; margins elevated; sides medially angulate; base sinuate and roundly produced at middle; front angles acute and hind angles obtuse.

Scutellum (Figure 6A): Obtusely triangular; minutely punctured; sides gradually round; apex blunt.

Elytra (Figure 6A): Coarsely and densely punctured with three denuded raised longitudinal line on each disc; sutural margin elevated near apex; angles not formed; humps evident.

Pygidium (Figure 6D): early smooth.

Mesosternum (Figure 6E): Coarsely punctured at sides; medially depressed and having a longitudinal line.

Fore tibia (Figure 6F): Bluntly tridentate with 1 short subterminal spur.

Mid and hind tibiae (Figures 6G, H): Carinate externally; truncate and fringed with long stout spines at extremity; terminally with 2 unequal spurs.

Tarsi (Figures 6F, G & H): 5 segmented.

Claws (Figures 6F, G & H): Unequal, longer one of fore and mid cleft, with tips far away.

Material examined: 1♀, Rajabhatkhawa, BTR, 19 May 1996, coll. S. Saha.

Distribution: India: West Bengal; Myanmar (Arrow <sup>[4]</sup>; Saha & Raychaudhuri <sup>[33]</sup>).

### ***Adoretus versutus* Harold, 1869**

(Figures 2D&E, 7A-J)

*Adoretus versutus* Harold, 1869: 124 <sup>[55]</sup>.

*Adoretus versutus* – Arrow, 1917: 350, Figure 73 & 74, pl. V Figure 42 <sup>[4]</sup>.

Description: ♂

Length 13.7 mm, humeral width 6.7 mm. Body short, broad, oval and convex.

Colour and markings (Figures 2D&E, 7A-J): Dorsum reddish brown with clypeus, median part of head, pronotum and venter dark brown; entirely covered with white decumbent setae.

Head (Figures 7A, B): Short; coarsely punctured.

Clypeus (Figures 7A, B): Small and transverse; strongly rugose; front margin reflexed and round at angles.

Fronto-clypeal suture (Figures 7A, B): Marked by a transverse straight carina.

Interocular width: 2 x transverse eye diameter.

Antenna (Figure 7C): 10 segmented, club 1.37 x stem.

Pronotum (Figure 7A): Short; strongly hexagonal; coarsely and densely punctured; sides bluntly angulate at middle; base sinuate and roundly produced at middle; front angles acute and hind angles obtuse.

Scutellum (Figure 7A): Short; obtusely triangular; coarsely punctured; sides gradually round; apex blunt.

Elytra (Figure 7A): Coarsely and densely punctured; disc with three raised longitudinal line; humeral angles round and apical angles acute; humeral and apical humps distinct.

Pygidium (Figure 7D): Rugose.

Mesosternum (Figure 7E): Laterally rugose; medially smooth with a longitudinal line.

Fore tibia (Figure 7F): Bluntly bidentate; subterminally with 1 short spur.

Mid and hind tibiae (Figures 7G, H): Carinate externally; truncate and fringed with short spines at extremity; terminally with 2 unequal spurs.

Tarsi (Figures 7F, G & H): 5 segmented.

Claws (Figures 7F, G & H): Unequal; longer one of fore and mid cleft with the tips far away.

Parameres (Figures 3B, 7I&J): Elongate and unequal; base broad, margin sinuate; sides sinuate; inner margin of one medially bluntly angulate and another curved; apex pointed.

Material examined: 1♀, Damanpur, BTR, 14 March 2003, coll. S.K. Sarkar; 1♀1♂, Nimati, BTR, 13 March 2003, coll. S.K. Sarkar; 1♂, South Volka, BTR, 21 May 1997, coll. S. Saha; 1♀, Kumargram, BTR, 18 May 1997, coll. S. Saha; 1♀, Raimatang, BTR, 30 May 1996, coll. S. Saha; 1♂, Rajabhatkhawa, BTR, 22 May 1995, coll. S. Saha; 1♀, Raimatang, BTR, 19 May 1995, coll. B. Kundu.

Distribution: India: Bihar, Madhya Pradesh, Tamilnadu, Uttarakhand and West Bengal; Indonesia; Malaysia; Mauritius; Seychelles; Sri Lanka (Arrow<sup>[4]</sup>; Chatterjee & Biswas<sup>[53]</sup>; Saha & Raychaudhuri<sup>[33]</sup>).

#### ***Adoretus boops* (Wiedemann, 1821)**

(Figures 2F, 8A-H)

*Melolontha boops* Wiedemann, 1821: 135<sup>[56]</sup>.

*Adoretus boops* – Burmeister, 1844: 474<sup>[13]</sup>.

*Adoretus latifrons* – Blanchard, 1851: 232<sup>[57]</sup>.

*Adoretus boops* – Arrow, 1917: 316<sup>[4]</sup>.

Description: ♀

Length 12.8 mm, humeral width 5.6 mm. Body elongate, parallel sided & flat.

Colour and markings (Figures 2F, 8A-H): Pale testaceous with head & clypeus darker in shade. Entirely covered with white decumbent setae.

Head (Figures 8A, B): Short and transverse; coarsely punctured.

Clypeus (Figures 8A, B): Broad; semicircular; coarsely punctured; front margin reflexed and medially feebly notched.

Fronto-clypeal suture (Figures 8A, B): Marked by a transverse nearly straight and laterally raised carina.

Interocular width: 3.11 x transverse eye diameter.

Antenna (Figure 8C): 10 segmented; club 1.3 x stem.

Pronotum (Figure 8A): Short and transverse; coarsely punctured; margins little elevated; sides gradually round; base sinuate and roundly produced at middle; front angles acute and hind angles obtuse.

Scutellum (Figure 8A): Obtusely triangular; coarsely punctured; sides nearly straight; apex pointed.

Elytra (Figure 8A): Coarsely and densely punctured; disc with three raised longitudinal line; angles not formed; humps raised.

Pygidium (Figure 8D): Coriaceous; laterally sinuate; apically

notched and produced into two tooth like processes.

Mesosternum (Figure 8E): Coarsely punctured at sides, medially smooth and having a longitudinal line.

Fore tibia (Figure 8F): Sharply tridentate; outwardly longitudinally carinate; distinctly serrate externally; subterminally with 1 short spur.

Mid and hind tibiae (Figures 8G, H): Carinate externally; truncate and fringed with long spines at extremity; terminally with 2 unequal spurs.

Tarsi (Figures 8F, G & H): 5 segmented.

Claws (Figures 8F, G & H): Unequal, longer one of fore and mid cleft, with tips far away.

Material examined: 1♀, Rajabhatkhawa, BTR, 22 May 1995, coll. S. Saha.

Distribution: India: Assam, Tamilnadu and West Bengal; Vietnam (Arrow<sup>[4]</sup>; Saha & Raychaudhuri<sup>[33]</sup>).

#### ***Adoretus serratipes* Arrow, 1914**

(Figures 2G, 9A-H)

*Adoretus serratipes* Arrow, 1914a: 595<sup>[24]</sup>.

*Adoretus serratipes* – Arrow, 1917: 319, pl. V, Figure 18<sup>[4]</sup>.

Description: ♀

Length 9 mm, humeral width 4.7 mm. Body short, elongate, parallel sided and more or less convex.

Colour and markings (Figures 2G, 9A-H): Brown testaceous, with clypeus and head black brown; entirely covered with white decumbent setae.

Head (Figures 9A, B): Short and transverse; rugose; basally little raised at middle with a broad margin.

Clypeus (Figures 9A, B): Broad; semicircular; rugose; front margin reflexed and round at angles.

Fronto-clypeal suture (Figures 8A, B): Marked by a nearly straight and laterally raised carina.

Interocular width: 3.3 x transverse eye diameter.

Antenna (Figure 9C): 10 segmented; club 1.31 x stem.

Pronotum (Figure 9A): Short and transverse; coarsely and densely punctured; margins little elevated; sides gradually round; base sinuate and roundly produced at middle; front angles acute and hind angles round.

Scutellum (Figure 9A): Short; obtusely triangular; coarsely punctured; sides nearly straight; apex obtusely pointed.

Elytra (Figure 9A): Coarsely and densely punctured with three distinctly raised longitudinal line on each disc; humeral angles obtuse and apical angles round; humeral hump evident and apical hump raised.

Pygidium (Figure 9D): Rugose; sides straight; apex blunt.

Mesosternum (Figure 9E): Laterally coarsely punctured; medially smooth, depressed and having a longitudinal line.

Fore tibia (Figure 9F): Sharply tridentate; outwardly longitudinally carinate; subterminally with 1 short spur.

Mid and hind tibiae (Figures 9G, H): Carinate externally; truncate and fringed with short spines

at extremity; terminally with 2 unequal spurs.

Tarsi (Figures 9F, G & H): 5 segmented.

Claws (Figures 9F, G & H): Unequal, longer one of fore and mid cleft with the tips far away.

Material examined: 2♀, Nimati, BTR, 04 April 2003, coll. S.K. Sarkar; 1♀, South Volka, BTR, 19 May 1997, coll. S. Saha; 1♀, Jayanti, BTR, 24 May 1996, coll. D. Raychaudhuri; 1♀, Rajabhatkhawa, BTR, 19 May 1995, coll. S. Saha.

Distribution: India: Assam and West Bengal; Myanmar (Arrow<sup>[4]</sup>; Chatterjee & Biswas<sup>[53]</sup>; Saha & Raychaudhuri<sup>[33]</sup>).

***Adoretus minutus* Brenske, 1893**

(Figures 2H&I, 10A-J)

*Adoretus minutus* Brenske, 1893: 140 [12].

*Adoretus minutus* – Arrow, 1917: 305 [4].

Description: ♂

Length 11.22 mm, humeral width 5.55 mm. Body short, elongate, parallel sided and flat.

Colour and markings (Figures 2H&I, 10A-J): Dorsum brown testaceous with head, clypeus and pronotum darker; venter red brown; entirely covered with white decumbent setae.

Head (Figures 10A, B): Short and elongate; medially raised near base; rugose.

Clypeus (Figures 10A, B): Broad; coarsely punctured; front margin reflexed and round.

Fronto-clypeal suture (Figures 10A, B): Marked by a transverse straight carina.

Interocular width: 4.25 x transverse eye diameter.

Antenna (Figure 10C): 10 segmented, club 1.3 x stem.

Pronotum (Figure 10A): Short and transverse; coarsely punctured; margins little elevated; sides gradually round; base sinuate and roundly produced at middle; front angles acute and hind angles obtuse.

Scutellum (Figure 10A): Obtusely triangular; coarsely punctured; margin membranous; sides straight; apex blunt.

Elytra (Figure 10A): Coarsely and densely punctured with three raised longitudinal line on each disc; anteriorly with a longitudinal carina starting from the humeral hump and diminishing at about 1/3<sup>rd</sup> of length; humeral angles obtuse and apical angles not formed; humeral hump evident and apical hump raised.

Pygidium (Figure 10D): Transversely strigose; basal margin strongly reflexed.

Mesosternum (Figure 10E): Coarsely punctured at sides; medially smooth and depressed having a longitudinal line.

Fore tibia (Figure 10F): Sharply tridentate; outwardly longitudinally carinate; subterminally with one short spur.

Mid and hind tibiae (Figures 10G, H): Carinate externally; truncate and fringed with long spines at extremity; terminally with two unequal spurs.

Tarsi (Figures 10F, G & H): 5 segmented.

Claws (Figures 10F, G & H): Unequal; longer one of fore and mid cleft, with tips far away.

Parameres (Figures 3C, 10 I&J): Short, elongate; base nearly equal to apex; sides sinuate; inner margin curved; apex sharply conical.

Material examined: 1♀, Newlands, BTR, 17 May 1997, coll. S. Saha; 1♀, Raimatang, BTR, 30 May 1996, coll. S. Saha; 1♂, Rajabhatkhawa, BTR, 22 May 1995, coll. S. Saha; 1♀, Rajabhatkhawa, BTR, 19 May 1995, coll. S. Saha.

Distribution: India: West Bengal; Vietnam (Arrow [4]; Saha & Raychaudhuri [33]).

***Adoretus lasiopygus* Burmeister, 1855**

(Figures 2 J, 11A-H)

*Adoretus lasiopygus* Burmeister, 1855: 530 [14].

*Adoretus lasiopygus* – Arrow, 1917: 349, pl. V Figure 36 [4].

Description: ♀

Length 11.11 mm, humeral width 5.33 mm. Body short, elongate, oval and flat.

Colour and markings (Figures 2J, 11A-H): Dorsum dark brown with clypeus, sides of pronotum, elytra and pygidium lighter; venter light brown; entirely covered with grey decumbent setae.

Head (Figures 10A, B): Short and elongate; densely granular; medially little raised near base.

Clypeus (Figures 11A, B): Broad; semicircular; granular; front margin strongly reflexed and round at angles.

Fronto-clypeal suture (Figures 11A, B): Marked by a transverse straight carina

Interocular width: 2.9 x transverse eye diameter.

Antenna (Figure 11C): 10 segmented, club 1.83 x stem.

Pronotum (Figure 11A): Short and transverse; coarsely and densely punctured; margins elevated; sides round; base sinuate and roundly produced at middle; front angles acute and hind angles obtuse.

Scutellum (Figure 11A): Short; obtusely triangular; minutely punctured; margin membranous; sides gradually round; apex blunt.

Elytra (Figure 11A): Coarsely and confluent punctured; disc with three faint longitudinal raised line near suture; humeral angles obtuse and apical angles acute; humps indistinct.

Pygidium (Figure 11D): Coriaceous.

Mesosternum (Figure 10E): Laterally rugose; medially smooth and marked by a longitudinal line.

Fore tibia (Figure 11F): Bluntly tridentate, third smallest; outwardly longitudinally carinate; subterminally with 1 short spur.

Mid and hind tibiae (Figures 11G, H): Carinate externally; truncate and fringed with short spines at extremity; terminally with 2 unequal spurs.

Tarsi (Figures 11F, G & H): 5 segmented.

Claws (Figures 11F, G & H): Unequal; longer one of fore and mid cleft.

Material examined: 2♀, South Raydak, BTR, 09 May 2002, coll. S.K. Sarkar.

Distribution: India: Assam, Tamilnadu, Uttarakhand and West Bengal; Sri Lanka (Arrow [4]; Chatterjee & Biswas [53]; Sarkar *et al* [46]).

***Adoretus rugosus* Arrow, 1914**

(Figures 2K, 12A-H)

*Adoretus rugosus* Arrow, 1914b: 589.

*Adoretus rugosus* – Arrow, 1917: 337, pl. V, Figure 33 [4].

Description: ♀

Length 12.22 mm, humeral width 6.66 mm. Body short, elongate, parallel sided and more or less convex.

Colour and markings (Figures 2K, 12A-H): Dark brown with pronotum, head and clypeus darker; frontoclypeal suture and all margins black; entirely covered with white decumbent setae.

Head (Figures 12A, B): Short and elongate; coarsely punctured with the punctures coalesce at regions to form strigosity; basally little raised at middle.

Clypeus (Figures 12A, B): Broad; semicircular; strigose; front margin reflexed and round.

Fronto-clypeal suture (Figures 11A, B): Marked by a transverse straight carina.

Interocular width: 2.5 x transverse eye diameter.

Antenna (Figure 12C): 10 segmented, club 1.23 x stem.

Pronotum (Figure 12A): Short and transverse; coarsely punctured; margins little elevated; sides gradually round; base sinuate and roundly produced at middle; front angles acute and hind angles obtuse.

Scutellum (Figure 12A): Triangular; coarsely punctured; sides gradually round; apex pointed.

Elytra (Figure 12A): Coarsely and densely punctured with two faint longitudinal raised line near suture of each disc; humeral angles obtuse and apical angles not formed; humeral and apical humps evident.

Pygidium (Figure 12D): Rugose.

Mesosternum (Figure 12E): Coarsely punctured, scantily at centre and densely at sides; medially with a longitudinal line.  
Fore tibia (Figure 12F): Sharply tridentate; outwardly longitudinally carinate; subterminally with 1 short spur.  
Mid and hind tibiae (Figures 12G, H): Carinate externally; truncate and fringed with long spines at extremity; terminally with 2 unequal spurs.

Tarsi (Figures 12F, G & H): 5 segmented.

Claws (Figures 12F, G & H): Unequal, with the longer one of fore and mid cleft; longer front claw cleft at a considerable distance from the tip.

Material examined: 1♀, Rajabhatkhawa, BTR, 17 March 2003, coll. S.K. Sarkar; 1♀, Newlands, BTR, 10 September 2002, coll. S.K. Sarkar.

Distribution: India: West Bengal; Sri Lanka (Arrow [4]; Sarkar *et al* [46]).

### *Adoretus bicaudatus* Arrow, 1917

(Figures 2L&M, 13A-J)

*Adoretus bicaudatus* Arrow, 1917: 310 [4].

Description: ♂

Length 12.66 mm, humeral width 6.22 mm. Body elongate, parallel sided and flat.

Colour and markings (Figures 2L&M, 13A-J): Brown testaceous; entirely clothed with decumbent white setae, with setae longer and forming patches in three longitudinal rows on elytra.

Head (Figures 13A, B): Elongate and transverse; coriaceous, coarsely punctured posteriorly.

Clypeus (Figures 13A, B): Short and broad; coriaceous; front margin reflexed and gently round at angles.

Fronto-clypeal suture (Figures 13A, B): Marked by a transverse, nearly straight, medially weakly produced and laterally raised carina.

Interocular width: 2.8 x transverse eye diameter.

Antenna (Figure 13C): 09 segmented, club 2.42 x stem.

Pronotum (Figure 13A): Short and transverse; coriaceous, with sides gradually round and base roundly produced at middle; front angles acute and hind angles obtuse.

Scutellum (Figure 13A): Obtusely triangular; coarsely punctured; sides sinuate.

Elytra (Figure 13A): Coriaceous; angles round; humps raised.

Pygidium (Figure 13D): Coriaceous.

Mesosternum (Figure 13E): Laterally rugose, medially smooth and having a longitudinal line.

Fore tibia (Figure 13F): Sharply tridentate; outwardly longitudinally carinate; distinctly serrate externally; subterminally with 1 long spur.

Mid and hind tibiae (Figures 13G, H): Carinate externally; truncate and fringed with long spines at extremity; terminally with 2 unequal spurs.

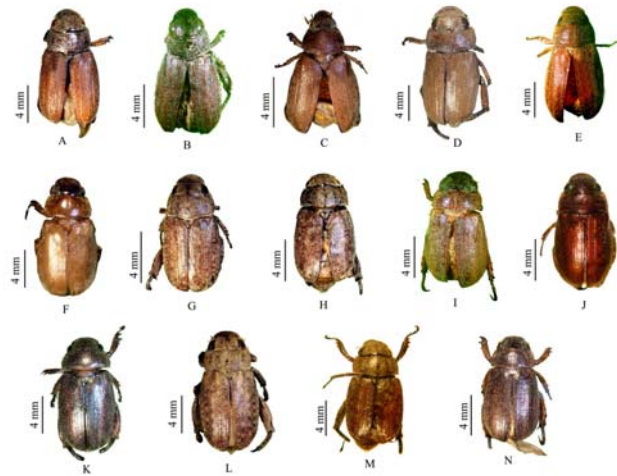
Tarsi (Figures 13F, G & H): 5 segmented.

Claws (Figures 13F, G & H): Unequal, longer one of fore and mid cleft, with tips far away.

Parameres (Figures 3D,13I&J): Short, elongate; base moderately broad; sides nearly straight; inner margin curved; apex conical.

Material examined: 1♂1♀, South Raydak, BTR, 08 March 2003, coll. S.K. Sarkar; 1♀, South Volka, BTR, 19 May 1997, coll. S. Saha; 3♀, Kumargram, BTR, 18 May 1997, coll. S. Saha; 1♂♀, Newlands, BTR, 17 May 1997, coll. S. Saha; 2♀, Rajabhatkhawa, BTR, 19 May 1995, coll. P.Das.

Distribution: India: Tamilnadu and West Bengal; Sri Lanka (Arrow [4]; Chatterjee & Biswas [53]; Saha & Raychaudhuri [33]).



**Fig 2:** A. *Adoretus testaceus* Hope, 1831, ♀ Dorsal habitus; B. *Adoretus ariel* Arrow, 1917, ♂ Dorsal habitus; C. *Adoretus lemniscus* Arrow, 1915, ♀ Dorsal habitus; D. *Adoretus versutus* Harold, 1869, ♂ Dorsal habitus; E. ♀ Dorsal habitus; F. *Adoretus boops* Wiedeman, 1821, ♀ Dorsal habitus; G. *Adoretus serratipes* Arrow, 1914, ♀ Dorsal habitus; H. *Adoretus minutus* Brenske, 1893, ♂ Dorsal habitus; I. ♀ Dorsal habitus; J. *Adoretus lasiopygus* Burmeister, 1855, ♀ Dorsal habitus; K. *Adoretus rugosus* Arrow, 1914, ♀ Dorsal habitus; L. *Adoretus bicaudatus* Arrow, 1917, ♂ Dorsal habitus; M. ♀ Dorsal habitus; N. *Adoretus renardi* Brenske, 1893, ♂ Dorsal habitus.

### *Adoretus renardi* Brenske, 1893

(Figures 2N, 14A-J)

*Adoretus renardi* Brenske, 1893: 140 [12].

*Adoretus renardi* – Arrow, 1917: 324 [4].

Description: ♂

Length 10.44 mm, humeral width 5.11 mm. Body short, elongate, parallel sided and more or less convex.

Colour and markings (Figures 2N, 14A-J): Brown testaceous with head black and clypeus deep brown; entirely covered with white decumbent setae.

Head (Figures 14A, B): Elongate and transverse; coarsely punctured; medially little raised at base.

Clypeus (Figures 14A, B): Broad; semicircular; coarsely punctured; front margin reflexed and round.

Fronto-clypeal suture (Figures 14A, B): Marked by a transverse sinuate carina.

Interocular width: 2.66 x transverse eye diameter.

Antenna (Figure 14C): 10 segmented, club 1.6 x stem.

Pronotum (Figure 14C): Short and transverse; coarsely punctured; margins little elevated; sides gradually round; base sinuate and roundly produced at middle; front angles acute and hind angles round.

Scutellum (Figure 14A): Obtusely triangular; coarsely punctured; sides straight; apex blunt.

Elytra (Figure 14A): Coarsely and densely punctured; humeral angles obtuse and apical angles acute; humeral hump raised and apical hump evident.

Pygidium (Figure 14D): Rugose; laterally sinuate; apically blunt and round.

Mesosternum (Figure 14E): Strigose with a median longitudinal line.

Fore tibia (Figure 14F): Sharply tridentate; outwardly longitudinally carinate; subterminally with 1 short spur.

Mid and hind tibiae (Figures 14G, H): Carinate externally; truncate and fringed with long spines at extremity; terminally with 2 unequal spurs.

Tarsi (Figures 14F, G & H): 5 segmented.

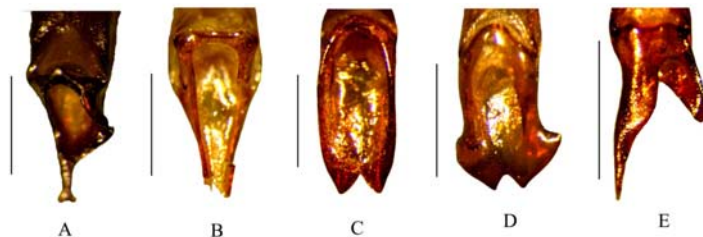
Claws (Figures 14F, G & H): Unequal, longer one of fore and mid cleft.

Parameres (Figures 3E, 14I&J): Short and broad; base medially produced; sides straight and sharply angulate near base; inner margin curved; apex medially notched and

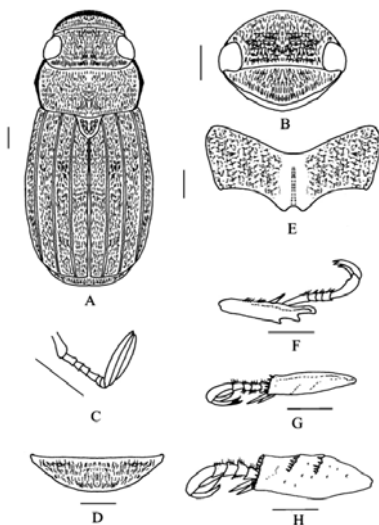
bilobed.

Material examined: 2♂, Poro, BTR, 28 March 2003, coll. S.K. Sarkar.

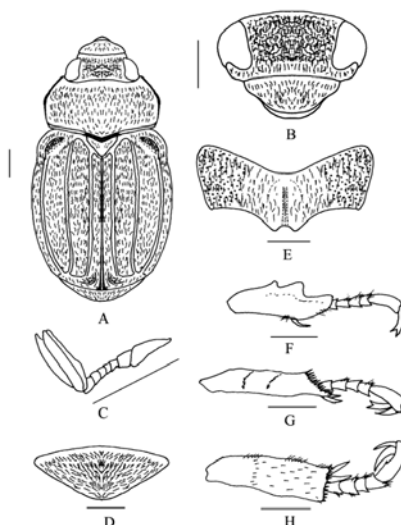
Distribution: India: Tamilnadu and West Bengal (Arrow [4]; Sarkar *et al* [46]).



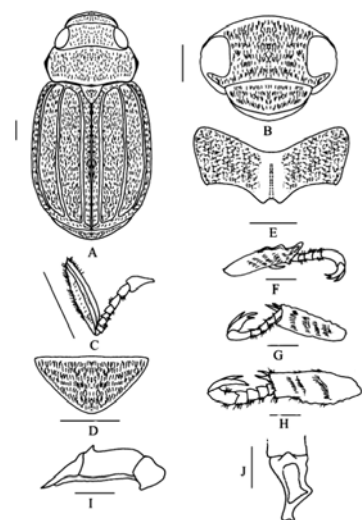
**Fig 3:** Parameres of – A. *Adoretus ariel* Arrow, 1917; B. *Adoretus versutus* Harold, 1869; C. *Adoretus minutus* Brenske, 1893; D. *Adoretus bicaudatus* Arrow, 1917; E. *Adoretus renardi* Brenske, 1893.



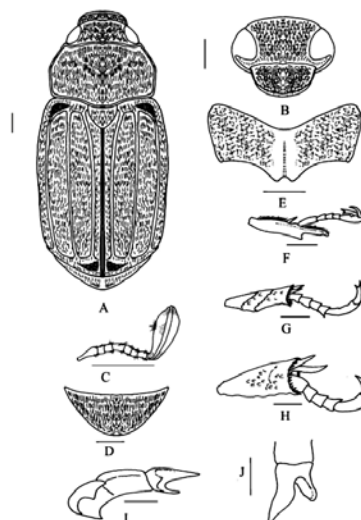
**Fig 4:** *Adoretus testaceus* Hope, 1831, Female: A. Dorsal habitus; B. Head & Clypeus, dorsal view; C. Antenna, lateral view; D. Pygidium, dorsal view; E. Mesosternum, ventral view; F. Fore tibia, tarsi & claws; G. Mid tibia, tarsi & claws; H. Hind tibia, tarsi & claws.



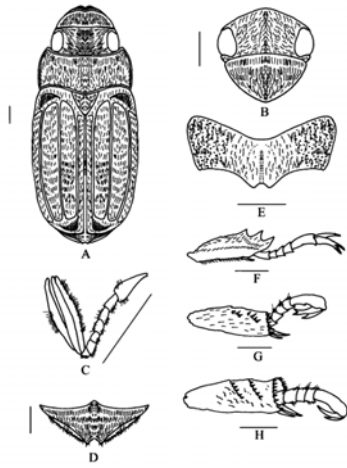
**Fig 6:** *Adoretus lemniscus* Arrow, 1915, Female: A. Dorsal habitus; B. Head & Clypeus, dorsal view; C. Antenna, lateral view; D. Pygidium, dorsal view; E. Mesosternum, ventral view; F. Fore tibia, tarsi & claws; G. Mid tibia, tarsi & claws; H. Hind tibia, tarsi & claws.



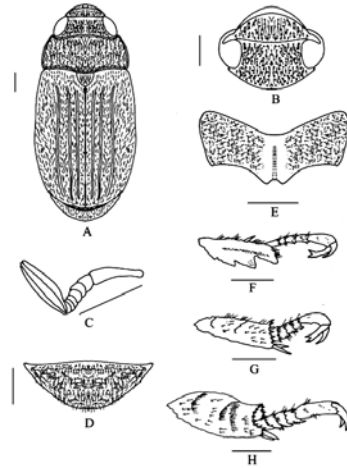
**Fig 5:** *Adoretus ariel* Arrow, 1917, Male: A. Dorsal habitus; B. Head & Clypeus, dorsal view; C. Antenna, lateral view; D. Pygidium, dorsal view; E. Mesosternum, ventral view; F. Fore tibia, tarsi & claws; G. Mid tibia, tarsi & claws; H. Hind tibia, tarsi & claws; I. Genital capsule, lateral view; J. Parameres, dorsal view.



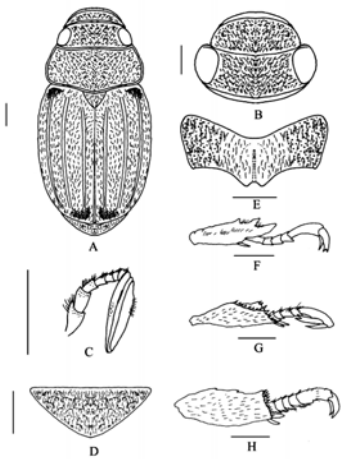
**Fig 7:** *Adoretus versutus* Harold, 1869, Male: A. Dorsal habitus; B. Head & Clypeus, dorsal view; C. Antenna, lateral view; D. Pygidium, dorsal view; E. Mesosternum, ventral view; F. Fore tibia, tarsi & claws; G. Mid tibia, tarsi & claws; H. Hind tibia, tarsi & claws; I. Genital capsule, lateral view; J. Parameres, dorsal view.



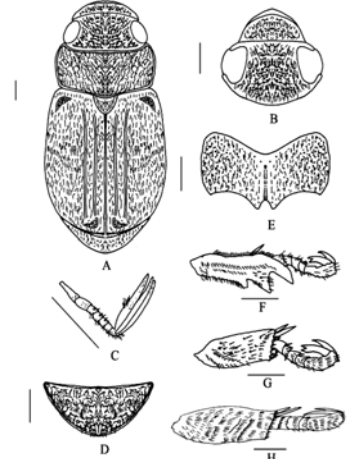
**Fig 8:** *Adoretus boops* Wiedeman, 1821, Female: A. Dorsal habitus; B. Head & Clypeus, dorsal view; C. Antenna, lateral view; D. Pygidium, dorsal view; E. Mesosternum, ventral view; F. Fore tibia, tarsi & claws; G. Mid tibia, tarsi & claws; H. Hind tibia, tarsi & claws.



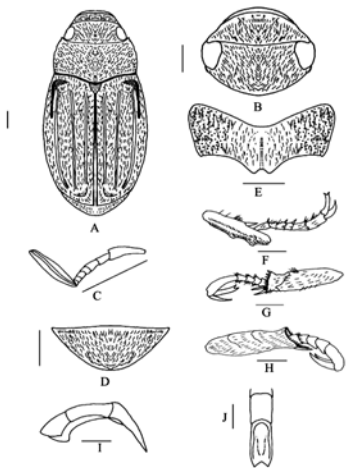
**Fig 11:** *Adoretus lasiopygus* Burmeister, 1855, Female: A. Dorsal habitus; B. Head & Clypeus, dorsal view; C. Antenna, lateral view; D. Pygidium, dorsal view; E. Mesosternum, ventral view; F. Fore tibia, tarsi & claws; G. Mid tibia, tarsi & claws; H. Hind tibia, tarsi & claws.



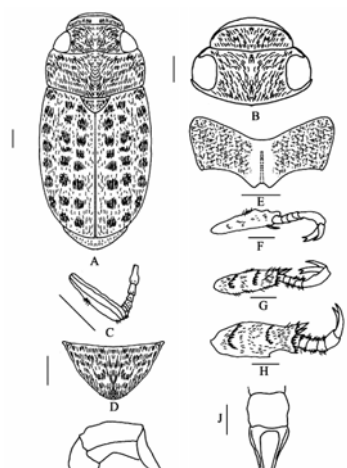
**Fig 9:** *Adoretus serratipes* Arrow, 1914, Female: A. Dorsal habitus; B. Head & Clypeus, dorsal view; C. Antenna, lateral view; D. Pygidium, dorsal view; E. Mesosternum, ventral view; F. Fore tibia, tarsi & claws; G. Mid tibia, tarsi & claws; H. Hind tibia, tarsi & claws.



**Fig 12:** *Adoretus rugosus* Arrow, 1914, Female: A. Dorsal habitus; B. Head & Clypeus, dorsal view; C. Antenna, lateral view; D. Pygidium, dorsal view; E. Mesosternum, ventral view; F. Fore tibia, tarsi & claws; G. Mid tibia, tarsi & claws; H. Hind tibia, tarsi & claws.

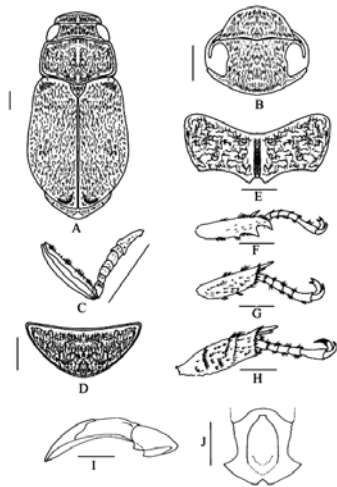


**Fig 10:** *Adoretus minutus* Brenske, 1893, Male: A. Dorsal habitus; B. Head & Clypeus, dorsal view; C. Antenna, lateral view; D. Pygidium, dorsal view; E. Mesosternum, ventral view; F. Fore tibia, tarsi & claws; G. Mid tibia, tarsi & claws; H. Hind tibia, tarsi & claws; I. Genital capsule, lateral view; J. Parameres, dorsal view.



**Fig 13:** *Adoretus bicaudatus* Arrow, 1917, Male: A. Dorsal habitus; B. Head & Clypeus, dorsal view; C. Antenna, lateral view; D. Pygidium, dorsal view; E. Mesosternum, ventral view; F. Fore tibia, tarsi & claws; G. Mid tibia, tarsi & claws; H. Hind tibia, tarsi & claws; I. Genital capsule, lateral view; J. Parameres, dorsal view.





**Fig 14:** *Adoretus renardi* Brenske, 1893, Male: A. Dorsal habitus; B. Head & Clypeus, dorsal view; C. Antenna, lateral view; D. Pygidium, dorsal view; E. Mesosternum, ventral view; F. Fore tibia, tarsi & claws; G. Mid tibia, tarsi & claws; H. Hind tibia, tarsi & claws; I. Genital capsule, lateral view; J. Parameres, dorsal view.

The present work is aimed to provide a first ever comprehensive taxonomic account of beetles comprising the genus *Adoretus* Dejean, 1833 under subfamily Rutelinae (Coleoptera: Scarabaeidae) occurring in Buxa Tiger Reserve. The diversity spectrum of the beetles in BTR yielded in the recognition of 11 species. Of these, *Adoretus rugosus* Arrow, 1914b is reported as new from the country, while *Adoretus renardi* Brenske, 1893 from the state of West Bengal and *Adoretus lasiopygus* Burmeister, 1855 from the study area (Sarkar *et al* [46]). At the species level BTR is found to harbor nearly half of the state fauna recorded till date, while at the level of higher taxa it is at least two-third. The generated data speaks high of BTR in terms of species richness.

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