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# Morphometric investigation of adult dung beetles in Hassan district of Karnataka

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**Abstract**
Dung beetle species are one of the most important components of the ecosystem for its regulation and maintenance and represent a well-established community within an ecosystem. In the present study we report the morphometric investigation of Adult dung beetles, were identified based on the comparison of the earlier reports in India. The beetles were collected by handpicking in the field in and around the veterinary college premises which arrives due to the light sources in the night. The specimens were studied under stereozoom microscope. The illustrations were made with the use of digital camera attached to Lawrence and Mayo stereomicroscope and Nikon DSLR D-7000. In the present study noticed the presence of the golden color mark at the junction between the head and Pronotum on the dorsal aspect of the *Heliocopris bocephalus.* Also noticed the presence of tiny hairs on ventral aspect of the body in all the four species of beetles in the current study. In addition on each half of the elytra prominent elytral striae of 6-7 are noticed in all three species of beetles except in *Bolbohamatum calanus* where very ill defined numerous elytral striae are noticed. Complete length of the beetle *Heliocopris bocephalus, Catharsis molossus, Catharsius sagax and Bolbohamatum calanus* in the current study includes of 4.5cm, 2.1cm, 2.4cm and 1.4cm respectively. Further the outcome of the present study will be an eye opener and provides the basic Morphometric parameters of the dung beetles in the current geographical locations also its ecological importance.

**Keywords:** Beetle, dung, Hassan, morphometric, Scarabaeidae

## Introduction
Dung beetles belong to family Scarabaeidae; Coleoptera. Dung beetles are efficient decomposers and play a vital role in nutrient recycling, soil turnover, seed dispersal and as parasitoids of several flies [6]. These Beetles use dung as their major food source and for nesting [2]. These species are one of the most important components of the ecosystem for its regulation and maintenance and represent a well-established community within an ecosystem. About 7000species of Scarabaeinae family has been reported worldwide [5]. 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. Dung beetles are known to be the most important ecological balancers by safeguarding the manure into the earth, also by making the soil fertile and aerated properly. In the current study we report the morphometric investigation of Adult dung beetles *Heliocopris bocephalus*, *Catharsis molossus*, *Catharsius sagax*, *Bolbohamatum calanus*, in Hassan district of Karnataka.

## Materials and Methods
Geographical location of the present study includes Hassan district of Karnataka. This is located between 12° 13´ and 13° 33´ North latitudes and 75° 33´ and 76°38´ East longitude, which are known to be the Western Ghats region in India. The beetles were collected by handpicking in the field in and around the veterinary college premises which arrives due to the light sources in the night. The specimens were studied under stereozoom microscope. The illustrations were made with the use of digital camera attached to Lawrence and Mayo stereomicroscope and Nikon DSLR D-7000. The beetles were studied for about twenty Morphometric parameters like Head, Wings, Posterolateral angle of Pronotum, Pronotum, Tibial spine, Elytral Striae, Antenna, Elytra, Horn on forehead, Tibial tooth, Width of Elytral suture, Maxillary palp, Complete length of the beetle, Width of the beetle, Complete Length of

Both Wings upon extended, Presence of Tiny hairs, Width of the head, Width of the Pronotum, Abdominal ridges, Scutellum. The specimens were identified with the help of available literature from the recent reports from India [1, 2, 4, 5, 6, 7, 8, 9].

**Results and Discussion**

The outcome of the current study is depicted as Figure 1to 9 for all the species of the adult beetles and the Morphometric comparison analysis were presented in Table.1.

Super family Scarabaeoidea Latreille, 1802; Family Geotrupidae Latreille, 1802; Subfamily Bolboceratinae Mulsant, 1842

The specimens were identified with the help of available literature from India [1, 2, 4, 5, 6, 7, 8, 9].

***Helicopris bucephalus*** (Fabricius, 1775)

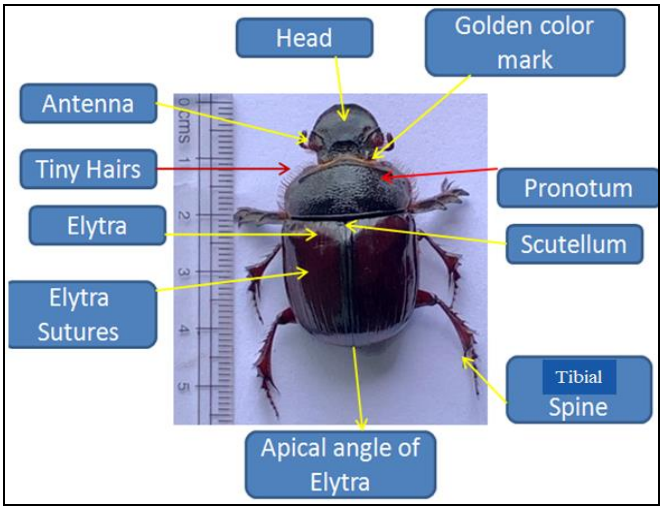


**Fig 1:** Illustrating different parts of the beetle *Helicopris bucephalus* (Dorsal View)

**Diagnostic characters:** Broad, nearly quadrate. Head with a slender pointed, slightly curved, nearly erect horn at center in male, with a cephalic carina in female. Pronotum not evenly rugose, vertical in front with a sharp straight carina, feebly touched at each end with anterior angles smooth, sharply produced in male; in female, anterior carina sharp, gently curved with blunt front angles, As reported [3, 4].

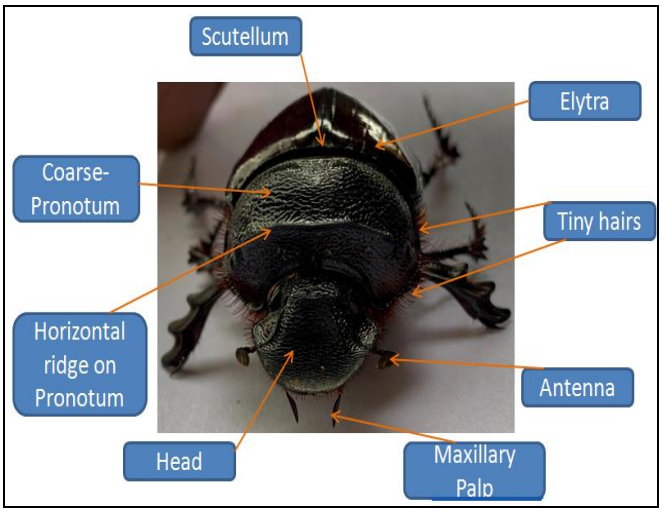


**Fig 2:** Illustrating different parts of the beetle *Helicopris bucephalus* (Front View)

Current study revealed the presence of the golden color mark at the junction between the head and Pronotum on the dorsal aspect of the beetle.

In addition there is a presence of tiny hairs on the lateral borders of Pronotum on dorsal aspect and also in the borders of the head.

There is evident that the presence of the tiny hairs on the ventral aspect of the Pronotum and abdomen also. Further there is a presence of the horizontal ridge on the Pronotum was also noticed. Pronotum is black in color and is not smooth but it is coarse in nature in the dorsal aspect whereas the complete elytron on dorsal side was slight red in color.

Maxillary palp, antenna were also prominently noticed on the ventral aspect of the head, further there is a blunt horn like structure noticed on the dorsal aspect of the head, in addition there is small ridges on the head moving laterally.

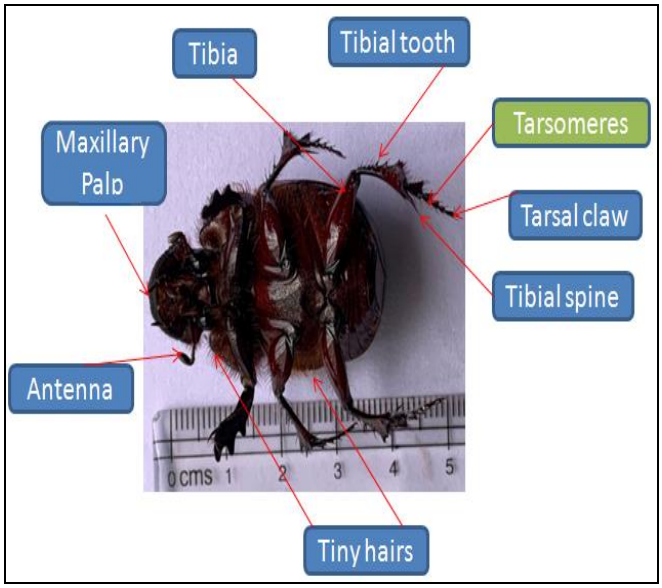


**Fig 3:** Illustrating different parts of the beetle Helicopris bucephalus (Ventral View)

**Distribution: India:** Bihar, Chhattisgarh,Haryana, Madhya Pradesh, Maharashtra,Rajasthan, Uttar Pradesh and West Bengal. Elsewhere: Java, Malay Peninsula and Myanmar [4].

***Catharsis molossus***

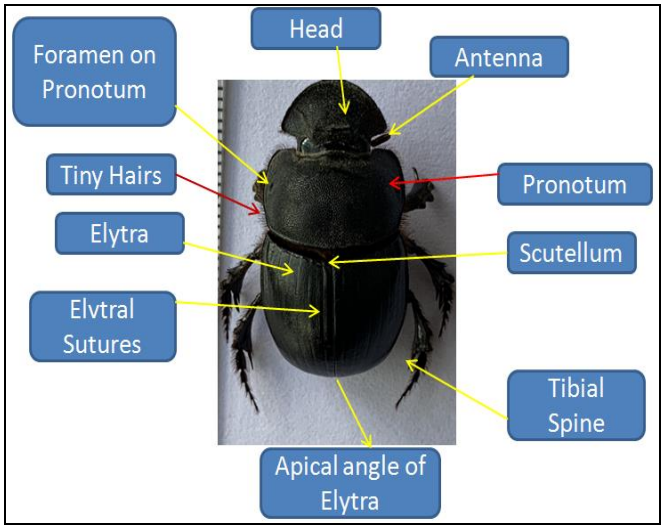


**Fig 4:** Illustrating different parts of the beetle *Catharsis molossus* (Dorsal View)

**Diagnostic characters:** Black, opaque, partly clothed with reddish hair beneath. Head broad with front margin imperceptibly excised in middle. Clypeus closely rugose, ocular lobes densely coarsely granular with smooth shining area adjacent inner margin of each eye.

Pronotum densely covered with fine round granules. Elytra finely, lightly striate intervals flat, microscopically coracious. Metasternal shield acutely angular in front with longitudinal grooved in hinder part. Terminal spurs of hind tibia truncate [7].

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 [8]. In the present study it was also noticed that there was presence of the tiny hairs on the lateral border of the head and Pronotum both on the dorsal and also the ventral aspect of the pronotum, abdomen and on all the legs.

In addition on the head there is a presence of the small ridges and it moves laterally. Further it was also noticed that the presence of the foramen on the lateral aspect of the Pronotum on both the sides. Pronotum consist of tiny granular in appearance.

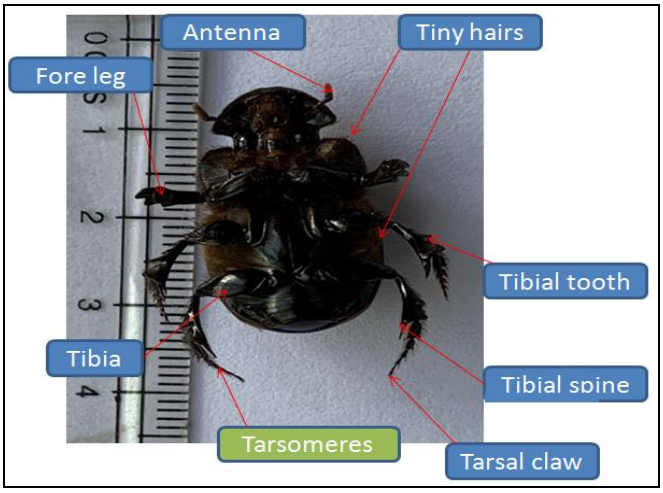


**Fig 5:** Illustrating different parts of the beetle Catharsis molossus (Ventral View)

**Distribution: India**: Andaman island, Arunachal Pradesh, Assam, Bihar, Chhattisgarh, Haryana, Himachal Pradesh, Karnataka, Kerala, Madhya Pradesh, Meghalaya, Odisha, Sikkim,Uttar Pradesh, Uttarakhand and West Bengal. Elsewhere: Afghanistan, Cambodia, China, Laos, Malaysia, Nepal, Pakistan, Sri Lanka, Thailand and Vietnam as reported [7, 8, 9].

In the current study it was observed that small horizontal ridges are evident on the dorsal aspect of the Pronotum. In addition in the current study prominent elytral striae are five are in the middle whereas on the edges of the elytra two striaea are slender longitudinal in orientation on the lateral edges. One striae is slender at the medial aspect of the elytra. Totally 8 number of striae are present in each half of the elytra.

***Catharsius sagax***

Black in color, body broad and convex, enlarged head and clypeus bearing granules without smooth shiny area. Pronotum having granules and elytra distinctly striated. Upper margin of declivity at pronotum straight and male bearing more or less erect horn further than head [9].

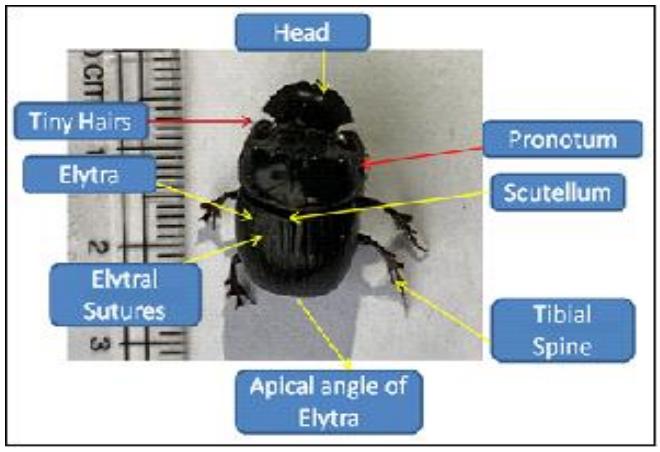


**Fig 6:** Illustrating different parts of the beetle Catharsis sagax (Dorsal View)

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 [8]. Geographical distribution: India: Andhra Pradesh, Bihar, Chattisgarh, Haryana, Himachal Pradesh, Madhya Pradesh, Maharashtra, Punjab, Tamil Nadu, Uttar Pradesh and West Bengal; elsewhere: Bhutan [8].

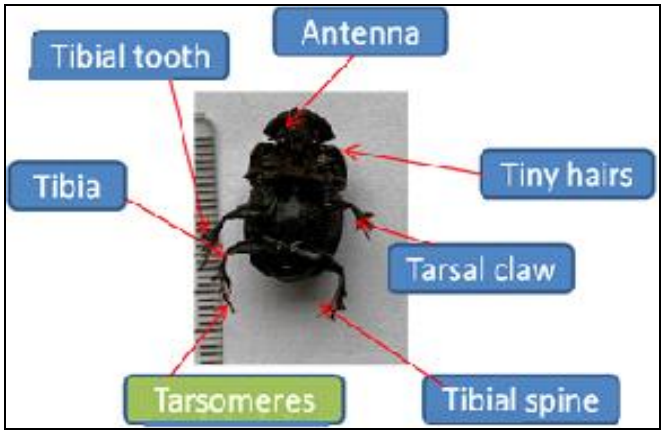


**Fig 7:** Illustrating different parts of the beetle Catharsis sagax (Ventral View)

Well noticed tibial tooth and tarsal claws, tarsomeres, tibial spines were also prominent.

Presence of the tiny hairs on the lateral border of the head and Pronotum both on the dorsal and also the ventral aspect of the pronotum, abdomen and on all the legs.

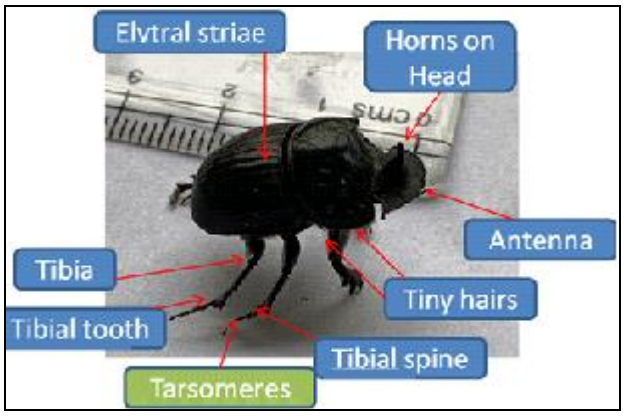


**Fig 8:** Illustrating different parts of the beetle Catharsis sagax (Lateral View)

In the current study elytral striae are prominent five are in the middle wheras on the edges of the elytra two striaea are slender longitudinal in orientation. One striae is slender at the medial aspect of the elytra. Totally 8 number of striae are present in each half of the elytra.

***Bolbohamatum calanus***

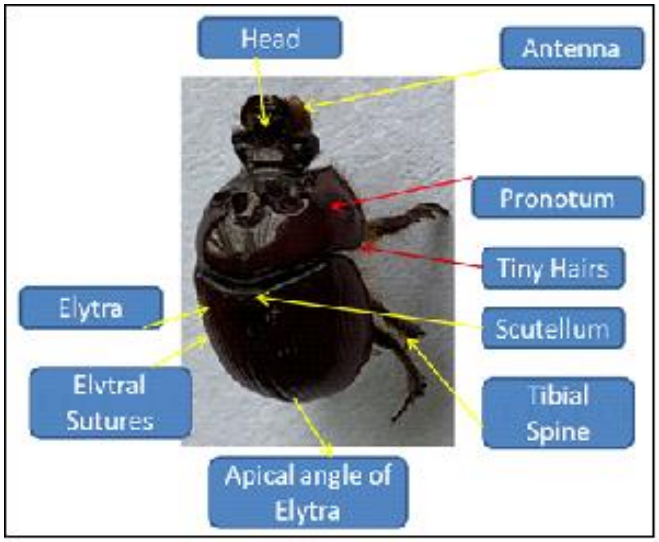


**Fig 9:** Illustrating different parts of the beetle Bolbohamatum calanus (Dorsal View)

**Distribution**

India (Assam, Bihar, Chhattisgarh, Karnataka, Madhya Pradesh, Maharashtra, Tamil Nadu, West Bengal and Uttarakhand), Bangladesh and Java [4]. This species of Bolbohamatum calanus was not been reported in the North eastern regions of the India like Tripura [8].

Suggesting its geographical localization and ecological confinement of the dung beetle. The complete beetle is like reddish in color on the dorsal. In the current study there is a presence of the prominent three depressions on the dorsal aspect of the pronotum one in the middle, one in the either lateral aspect besides the central depressions.

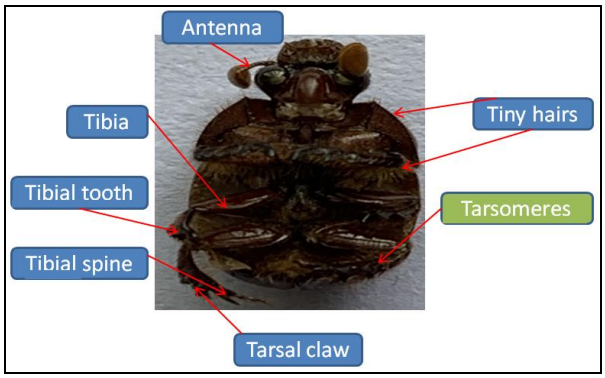


**Fig 10:** Illustrating different parts of the beetle Bolbohamatum calanus (Ventral View)

There is a presence of tiny hairs all over the legs and on the ventral aspect of the body of the beetle is also noticed in the current study.

There is prominent antenna also the striking feature, In addition there was not clear elytral striae are noticeable but are ill defined and are merged also are more in numbers on the dorsal aspect of the beetle.

In addition there is prominent Scutellum was also observed as characteristic feature of the beetle.

All the species of beetles like *Helicopris bucephalus*, *Catharsis molossus*, *Catharsius sagax Bolbohamatum calanus* in Hassan belongs to Scarabaeinae: Midcoxae jointed and a single spur on middle tibia [9].

As these species and its characters were also reported earlier [6, 7, 9] and other researchers however similar studies were also conducted recently on *Oryctes rhinoceros* and *Onthophagus bonasus Fabricius* in the same geographical area on different species depicting its ecological importance in this location [11, 12].

**Table 1:** Values depicting different Morphometric parameters of adult dung beetles found in the Hassan district of Karnataka.

| SL No. | Morphological Parameters (Adult Beetle) | *Helicopris bucephalus* (female) | *Catharsis molossus* (female) | *Catharsius sagax* (Male) | *Bolbohamatum calanus* (female) |
|---|---|---|---|---|---|
| 1 | Head : | 0.7cm | 0.3cm | 0.4cm | 0.3cm |
| 2 | Wings: | 5.30 cm | 2.1cm | 2.5cm | 1.3cm |
| 3 | Posterolateral angle of pronotum: | Curved | Curved like convex | Curved like convex | Curved like convex |
| 4 | Pronotum : | 1.3cm | 0.6cm | 0.8cm | 0.4cm |
| 5 | Tibial spine: | Prominent | Prominent | Prominent | Prominent |
| 6 | Elytral Striae | 7 prominent | 6 are prominent | 6 are prominent | 15 or more and are very ill defined |
| 7 | Antenna: | 1 cm | 0.4cm | 0.5cm | 0.1cm |
| 8 | Elytra: | 2.5cm | 1.2cm | 1.2cm | 0.7 |
| 9 | Horn on forehead: | No horns are noticed on the forehead but instead small horizontal ridge are evident. | No horns are noticed on the forehead. | Horns are noticed on the forehead. 0.4cm length | No horns are noticed on the forehead |
| 10 | Tibial tooth: | Prominent well defined | Prominent well defined | Prominent well defined | Prominent well defined |
| 11 | Width of Elytral suture: | 0.13cm width Prominent and are longitudinal in orientation | 0.1 cm width and are longitudinal in orientation | 0.1 cm width and are longitudinal in orientation | Less than 0.1cm |
| 12 | Maxillary palp: | Prominent | Prominent | Prominent | Prominent |
| 13 | Complete length of the beetle | 4.5cm | 2.1cm | 2.4cm | 1.4cm |
| 14 | Width of the beetle | 2.7cm | 1.0 cm | 1.2cm | 0.7cm |
| 15 | Complete Length of Both | 10.60 cm | 4.2cm | 5.0 cm | 2.6cm |

| | | | | | |
|---|---|---|---|---|---|
| | Wings upon extended | | | | |
| 16 | Presence of Tiny hairs | all over the body on ventral and legs | all over the body on ventral and legs | all over the body on ventral and legs | all over the body on ventral and legs |
| 17 | Width of the head | 1.5cm | 0.7cm | 0.8cm | 0.4cm |
| 18 | Width of the Pronotum | 2.7cm | 1.0 cm | 1.2cm | 0.7cm |
| 19 | Abdominal ridges | 7 major ridges | 6 major ridges | 6 major ridges | 6 major ridges |
| 20 | Scutellum | Absent | Absent | Absent | Roughly triangular |

## Conclusion

The outcome of the present study revealed the different Morphometric parameters of *Heliocopris Bocephalus*, *Catharsis molossus*, *Catharsius sagax*, *Bolbohamatum calanus* in Hassan district of Karnataka. Further the values presented in the study will be the baseline data for the further to study on species differentiation, ecological survey and other molecular studies in order to safeguard the dung beetles.

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