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Male genitalia of some species of catharsius hope (Coleoptera: scarabaeidae) and its taxonomic importance

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Abstract
The present paper deals with the study of male genitalia of some Nepalese species of *Catharsius* Hope. The male genitalia of four species of *Catharsius* Hope- *C. granulatus sharp, C. molossus* (L), *C. birmanensis* Lansb. *C. pithecius* (F) have been described and illustrated here. Male genitalia of *Catharsius* consists of phallobase, parameres, aedeagus and endophallus. Of these, phallobase and aedeagus of all the four species reported here are generally alike, but parameres and endophallus are different. This study also provides a reliable key for identification of the males.

Keywords: male genitalia, dung beetles, Morang district

Introduction
The Scarabaeidae is the well-known family of the order Coleoptera. The members of the family are commonly known as "dung beetles" which are both destructive and beneficial. In India, the first work of taxonomic importance on Indian Coprini was carried out by Arrow (1931) [1] who published in the series "Fauna of British India". Besides Arrow, some taxonomic and morphological work has been done by Balthasar (1963), Biswas (1978), Cordon and Oppenheimer (1975), Kapur (1954, 1961), Kushwaha (1961), Mittal (1981), Sewak (1984, 85, 86) [2, 3, 4] and Vezirani (1966), in India.
Catharsius Hope is a genus of giant dung beetles, widely distributed in Nepal. The name *Catharsius* was first proposed by Hope in 1837. Arrow (1931) [1] placed it in the subfamily Coprinae. The genus is characterised by the presence of double transverse carina at the outer edge of the middle and hind tibiae and a lateral carina in place of 8th stria on each elytron.
In recent taxonomic studies considerable importance has been given to genitalia. Arrow (1931) [1] completely ignored the taxonomic value of the geitalia in his fauna volume on the Coprinae beetles. The male genitalia of 4 species of *Cathersius* Hope have been described and illustrated in this paper.

Materials and Methods
Beetles were collected from the grazing fields, forest and dung heaps in the different places of Morang district. Both preserved and freshly killed specimens were used to study the male genitalia. The specimens were relaxed in boiling water and their abdomens were treated with 10% KOH solution for few days to dissolve the soft tissues in and around the membranous and sclerotised structure of genitalia. Abdomens were dissected under stereobinocular microscope to expose the genitalia. The genitalia was taken out with the help of forceps and mounted in canada balsam after dehydration process (Singh *et al*. 1983; Sewak 1984, 1985, 1986, and 1988) [2, 3, 4, 5, 6, 7, 8]. Photographs of male genitalia were taken by German microphotographic binocular microscope.

Observation
Male genitalia of *Catharsius* consists of various parts arranged around the terminal portion of the ejaculatory duct which are as follows:

a. Phallobase (Pb): It is proximal, long, hollow, highly sclerotized structure, forming complete ring above the parameres and aedeagus, and opens apically by wide orifice into which the ejaculatory ducts enter. At rest the phallobase contains aedeagus and parameres.
b. Paramere (Pm): It is a paired structure and is derived from the phallic lobes. These are in continuation with the phallobase and are highly sclerotized lateral appendages, which act as claspers during copulation.
c. Aedeagus (Aed): It is also known as phallus (Snodgrass, 1935) [11] and is a strong, symmetrical, sclerotized median tube and functions as the main copulatory organ. It has an aedeagal apodeme on dorsal side for the attachment of muscles which act like liver for the movement of endophallus.
d. Endophallus (End): It is a muscular internal structure situated inside the phallobase. It becomes everted into the female gonopore during coitus.

The phallobase and aedeagus of all the four species reported here are generally alike, but parameres and endophallus are different. The main differences are as follows:

1. *C. granulatus* Sharp (Fig.1): Apical ends of parameres are narrow, straight and pointed. The endophallus is broadened apically with flattened muscular structure and club-shaped proximally.
2. *C. molosus* (L) (Fig.2): Apical ends of parameres are narrow, straight and ponted. Endophallus broadened apically and having triangular-shaped muscular structure, narrow and pointed proximally.
3. *C. birmanensis* Lansb (Fig.3): Apical ends of parameres are narrow, straight and pointed. Endophallus broadened

apically with flattened muscular structure and narrow proximally.

4. *C. pithecius* (F) (Fig.4): Apical ends of parameres are narrow, pointed and curved inwards. Endophallus broadened apically with hook-shaped muscular structure, club-shaped proximally

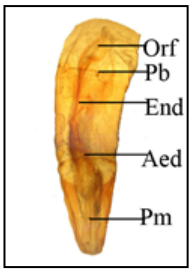

Fig 1: Male genitalia of *Catharsius granulatus* Sharp (Length 6mm)

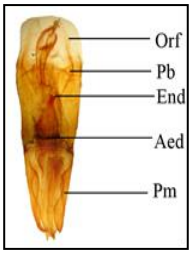

Fig 2: Male genitalia of *Catharsius molossus* L. (Length 7mm)

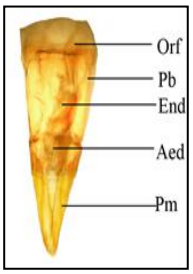

Fig 3: Male genitalia of *Catharsius birmanensis* Lansb (Length 5mm)

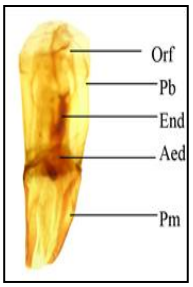

Fig 4: Male genitalia of *Catharsius pithecius* (Length- 5mm)

Key to the Nepalese species of *Catharsius* Hope, based on Male genitalia

1. Parameres straight and pointed, endophallus bearing flattened muscular structure on apical end and club-shaped proximally ……..……..*granulatus* sharp Parameres straight and ponted, endophallus bearing triangular shaped structure on apical end and pointed proximally ……..*molossus* (L).
2. Parameres straight and pointed endophallus bearing flattened muscular structure on apical end and narrow proximally ……..*birmanensis* Lansb …… Parameres curved and endophallus not bifurcated ……(3)
3. Parameres strongly pointed and curved inwards, endophallus bearing hook-shaped structure on apical end and clube-shaped proximally …… *pithecius* (F).

Summary

Male genitalia of four Nepalese species of *Cathersius* have been described and illustrated. The following features are noted: 1. Phallobase ring shaped; 2. Aedeagus tubular structure; 3. Parameres pointed, curved and without bristles; 4. Endophallus bearing flattened, triangular, hook-shaped structure on apical end; 5. Parameres and endophallus are most important for determination of species.

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