

OCCURRENCE OF FIVE HOLOTRICHIA SPECIES (COLEOPTERA: SCARABAEIDAE: MELOLONTHINAE) IN MAHARASHTRA AND THEIR MALE GENITALIA CHARACTERIZATION

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ABSTRACT

In Maharashtra, *Holotrichia* Hope is one of the most economically important genus of Coleoptera: Scarabaeidae: Melolonthinae, attacking Soybean, Sugarcane, Sorghum, Groundnut and many other field crops. The specimens were collected from five different agro-climatic zones of Maharashtra viz, South Konkan, Western ghat hills, Northern hills, Western Vidarbha plains and Eastern Vidarbha hills during 2012-2013. Male genitalia characterization has got prime importance as a species diagnostics tool. Thus, the investigations were carried out and described accordingly on external morphological characters and male genitalia. Studies revealed the presence of five species viz. *Holotrichia serrata* (Fabricius), *Holotrichia fissa* Brenske, *Holotrichia akolana* Khan and Ghai, *Holotrichia reynaudi* (Blanchard) and *Holotrichia nagpurensis* Khan and Ghai. Morphologically they were slightly varied. However, in male genitalia, significant variations were noticed in parameres, phallobase, endophallus and spiculum gastrale. *Holotrichia serrata* (Fabricius), was found to be the most prevalent species in every agro-climatic zones of Maharashtra.

INTRODUCTION

Genus *Holotrichia* Hope belongs to subfamily Melolonthinae of family Scarabaeidae under the superfamily Scarabaeoidea of Coleoptera. Because of their whitish appearance the larvae of these beetles are called as white grubs. The larvae feed in soil on roots of grasses and other important agricultural crops. The life cycle usually requires one to three years to complete. White grub larvae cause severe damage to groundnut as well as other commercial crops like potato, sugarcane, pea, maize etc. Heavy damage by white grubs has been recorded earlier in groundnut ecosystem around Khed Taluka of Northern Western Ghats of Maharashtra (Theurkar *et al.*, 2013). Work on taxonomy, and distribution of *Holotrichia* sp. has been carried out by various workers, but the work on external genitalia for species confirmation is limited. Singh *et al.* (2003) reported *Holotrichia* from Garhwal hills of Western Himalayas, Mittal (2000) from Himachal Pradesh, Chandra and Gupta (2012) from Achanakmar – Amarkantak Biosphere Reserve, Central India. *Holotrichia serrata* and *Holotrichia reynaudi* have been reported on rose around Bangalore by Kumar *et al.* (2006), while *Holotrichia serrata*, and *Holotrichia fissa* are reported from Northern, Western Ghats of Maharashtra by Theurkar *et al.* (2012). Life cycle and occurrence of *Holotrichia Karschi* from Ambha Reserve Forest, Kolhapur District of Maharashtra was studied by Bhawane *et al.* (2011). Earlier Khan and Ghai (1982) described some species of *Holotrichia* Hope from India. However, the characters of external male genitalia had been poorly described. As the external

morphology of these insects is having slight variation and leads to confusion, for species confirmation study of external male genitalia is necessary. In view of above, present investigations were carried out.

MATERIALS AND METHODS

The Scarabs were collected by using light traps and hand collection from five agro climatic zones of Maharashtra viz, South Konkan (Dapoli), Western ghat hills (Bahubali, Kumbhoj), Northern hills (Dhule, Nashik), Western Vidarbha plains (Akola, Amravati, Hudi and Sangrampur) and Eastern Vidarbha hills (Gadchiroli) during 2012-13. Simultaneously, some old specimens of NPIB laboratory were also used for the investigations.

Besides, White grub larvae were also collected from fields of Sugarcane, Soybean, Sorghum, Groundnut from Kumbhoj village of Kolhapur district and Hudi village of Yevatmal district of Maharashtra during September 2012 and were reared upto adult stage in the ICAR-NPIB laboratory, Department of Entomology, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola.

All the adults were then cleaned by using soap solution and plain water, kept in absolute alcohol for 24h, air dried and oven dried. Thereafter, the specimens were pinned and labeled appropriately and kept in collection boxes. The beetles were categorized up to genus by using external morphological characters. For species confirmation all the males/females were separated based on tibial spur characters and dissected. The

male genitalia was boiled in 10% KOH for 7 – 10 minutes and washed with water, after treating with glacial Acetic acid again washed with water for 2 to 3 times for cleaning. The aedeagus was then immersed in purified glycerol and preserved in genitalia vials.

The specimens were then identified up to species level based on key as given below and species have been described with the help of male genitalia characters for confirmation. All the species have been validated by NPIB Coordinating cell, IARI, New Delhi.

RESULTS AND DISCUSSION

Taxonomic key to species of *Holotrichia*

1. Large sized (> 23mm), lateral margins of pronotum sharply and deeply serrated2
 - Medium to large sized, lateral margins of pronotum feebly serrated.....4
2. Dark brown, pronotum with or without setae on the punctures, male genitalia with two chitinized processes from lateral sides.....3
 - Light brown, pronotum with or without setae, male genitalia with three chitinized processes that arise from lateral sides.....*H. nagpurensis* Khan and Ghai
3. Clypeus strongly bent upwards, chitinized processes of male genitalia with sharp pointed tip*H. farinosa* Nonfried
 - Clypeus broadly bent upwards, chitinized processes of male genitalia with round cap like tip.....*H. serrata* (Fabricius)
4. Abdomen bulged ventrally, thoracic sternum densely hairy, claws with first and second tooth widely separate5
 - Abdomen flat ventrally, thoracic sterna less hairy, claws with first and second tooth closely placed.....*H. fissa* Brenske
5. Chest nut brown, clypeus small and narrow, pronotal punctations more con-centrated anteriorly.....*H. consanguinea* Blanchard
 - Dark brown, clypeus slightly longer, pronotum uniformly punctate.....6
6. Anterior angle of pronotum shapely acute.....*H. reynaudi* (Blanchard)
 - Anterior angle of pronotum roughly obtuse, smooth area at centre*H. akolana* Khan and Ghai

The external male genitalia of five species of *Holotrichia* viz. *Holotrichia serrata*, *Holotrichia fissa*, *Holotrichia akolana*, *Holotrichia reynaudi* and *Holotrichia nagpurensis* were studied, diagnosed and then described. The description of these is given below.

Systematic account

Order – Coleoptera Linnaeus, 1758
 Suborder – Polyphaga Emery, 1886
 Superfamily – Scaraboidea Latreille, 1802
 Family – Scarabaeidae Latreille, 1802

Subfamily – Melolonthinae Leach, 1819

Genus *Holotrichia* Hope 1837

Phyllophaga Harris, 1827, *Massachusetts Agri. J.* **10(1)**: 1-12
Holotrichia Hope, 1837, *The Col. Manual*, **1**: 99
Lachnosterna Hope, 1837, *The Col. Manual*, **1**:100
Ancylonycha Blanchard, 1845, *Hist. des Inse.*, **1**: 398
 Type species: *Melolontha serrata* Fabricius, 1792

1. *Holotrichia akolana* Khan and Ghai

Holotrichia akolana Khan and Ghai, 1982, *Bull. Ent.*, **23**: 39

Material Examined

INDIA: Maharashtra

1(♂), 1(♀) Akola N20.6533°E 077.0142°, 925 ft MSL, July 2006, Dr S M Dadmal;

1(♂), 1(♀) Sangrampur N21.0339°E 076.6736°, 896 ft MSL, 17.x.2012, S S Khadakkar; 1(♂), 1(♀) Akola N20.6533° E 077.0142°, 925 ft MSL, 10.x.2012, P A Ghuge

Male Genitalia

Spiculum gastrale 'Y' shaped, arms widely separate, straight, united by membranous region.

Endophallus placed centrally with scattered spines; Parameres elongated, same length as that of phallobase; Phallobase slightly narrow towards ends; arms bent inwards towards tip; criticized lateral processes, with blunt tips present one on each side; ventrally both lobes are connected (Fig. 1).

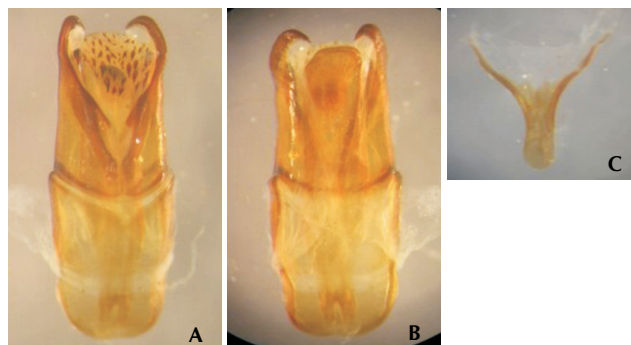


Figure 1: Male genitalia of *Holotrichia akolana* A - Aedeagus, Dorsal view, B - Aedeagus, Ventral view, C - Spiculum gastrale

Distribution

Rajasthan (Anonymous, 2010), Maharashtra

2. *Holotrichia nagpurensis* Khan and Ghai

Holotrichia nagpurensis Khan and Ghai, 1982, *Bull. Ent.*, **23**: 38

Material Examined

INDIA:Maharashtra:

1(♂), 1(♀) Nashik N20°01.415' E 073°49.856', 1840 ft MSL, 12.ix.2012, Dr S M Dadmal; 1(♂), 1(♀) Amravati N20.930° E 077.750°, 1125 ft asl , 7.v.2012, P A Ghuge

Male Genitalia

Spiculum Gastrale 'Y' shaped, with broad stem, two arms widely separated.

Endophallus with long sclerotised process that arise laterally and at the centre; Phallobase broad at base, curved at ends towards the ventral side, equal in size as parameres; Parameres

with criticized process present on both sides; ventrally both lobes are connected together; Endophallus with long spines in a group of one to three; one group of spines facing dorsal side, two groups laterally on each side (Fig. 2).



Figure 2: Male genitalia of *Holotrichia nagpurensis* A - Aedeagus, Dorsal view, B - Aedeagus, Ventral view, C - Spiculum gastrale

Distribution

Uttar Pradesh (Anonymous, 2010), Maharashtra

3. *Holotrichia serrata* (Fabricius)

Melolontha serrata Fabricius, 1787, *Christ.Gottl.Proft., Hafniae* 1:1-348

Ancylonycha serrata, Blanchard, 1850, *Cat. Col. Ent.*, 1: 138
Holotrichia serrata, Dallatorre, 1912, *Col. Cat.*, 49: 206

Material Examined

INDIA: Maharashtra

3♂, 1♀ Kumbhoj N20°53.967' E 074°48.292', 787 ft MSL, 10.ix.2012 Dr S M Dadmal;

1♂, 1♀ Dhule N20°53.967' E 074°48.292', 787 ft MSL, 4.x.2012 P A Ghuge;

2♂, 2♀ Amravati N20.930° E 077.750°, 1125 ft asl, 7.vii.2012 S S Khadakkar;

2♂, 2♀ Amravati N20.930° E 077.750°, 1125 ft asl, 7.vii.2012 P A Ghuge;

3 ♀ Hudi N19.5217°E77.3739°, 07. xi.2012 S S Khadakkar

Male genitalia

Spiculum gastrale 'Y' shaped, widely separate, bent towards tip; stem broad, arms longer than stem, elongated, connected at centre by membranous region.

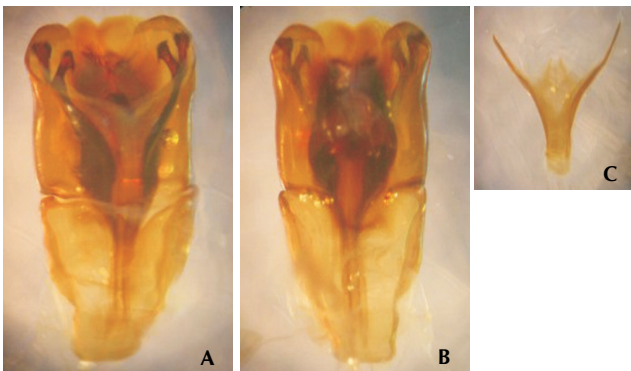


Figure 3: Male genitalia of *Holotrichia serrata* A - Aedeagus, Dorsal view, B - Aedeagus, Ventral view, C - Spiculum gastrale

Phallobase broad at base; narrow at bottom; as long as parameres; slightly curved towards ventral side at the ends. Parameres with ends broadly curved; two lateral criticiz process on each side with round cap like end. Endophallus sclerotised; membranous at anterior end, spines are present at the anterior margin (Fig. 3).

Distribution

Karnataka, Uttar Pradesh, Andhra Pradesh, Tamil Nadu, Rajasthan (Anonymous, 2010), Maharashtra.

4. *Holotrichia reynaudi* (Blanchard)

Ancylonycha reynaudi, Blanchard, 1850, *Cat. Col. Ent.* 1:139
Holotrichia insularis Brenske, 1894, *Mem. Soc. Entomol. Belg.* 2: 67

Holotrichia reynaudi, Dallatorre, 1912, *Col. Cat.* 49: 206

Holotrichia reynaudi Frey, 1971, *Entomol. Arb. Mus.* 22: 214

Material Examined

INDIA: Maharashtra

1(♂), 1(♀) Akola N20.6533°E 077.0142°, 925 ft MSL, 10.x.2012 Dr. S M Dadmal;

1(♂), 1(♀) Dhule N20°53.967' E 074°48.292', 787 ft MSL, 04.x.2012 P. Dharme;

1(♂), 1(♀) Dhule N20°53.967' E 074°48.292', 787 ft MSL, 07.vii.2012 G. Kabra

Male genitalia

Spiculum gastrale with arms longer; distance between the arms less.

Male genitalia consists of a broad Phallobase and elongate, symmetrical Parameres with two lateral process one on each side; Edophallus sclerotised with small spines (Fig. 4).

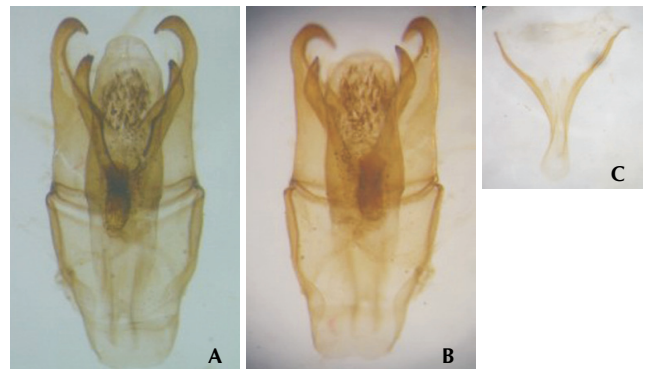


Figure 4: Male genitalia of *Holotrichia reynaudi* A - Aedeagus, Dorsal view, B - Aedeagus, Ventral view, C - Spiculum gastrale

Distribution

Karnataka, Andhra Pradesh, Tamil Nadu (Anonymous, 2010), Maharashtra

5. *Holotrichia fissa* Brenske

Holotrichia fissa Brenske, 1894, *Mem. Soc. Entomol. Belg.* 2: 71

Material examined

INDIA: Maharashtra

1(♂), 1(♀) Bahubali N16° 45.29' E 74°25.19', 690 ft MSL, 12.ix.2012, Dr. S M Dadmal;

1(♂), 1(♀), Nashik N20°01.415' E 073°49.856', 1840 ft MSL, 12.ix.2012 S S Khadakkar;
 3(♂), 2(♀) Dapoli N17° 76.67' E 073°18.33', 800 ft MSL, 08.ii.2007 Student collection;
 1(♂), 1(♀) Akola N20.6533° E 077.0142°, 925 ft asl, 2.ix.2010 Dr. S M Dadmal

Male genitalia

Spiculum gastrale with arms longer than the length of the stem; slightly bent at separation.

Phallobase broad at base, decrease in breadth towards tip; Parameres shorter than phallobase, symmetrical, darker than phallobase, lateral processes are shorter than length of paramere, one on each side, both lobes decrease in length towards tip and folded inwards; ventrally connected by a sclerotised membrane; Endophallus with small spines in two rows (Fig. 5).

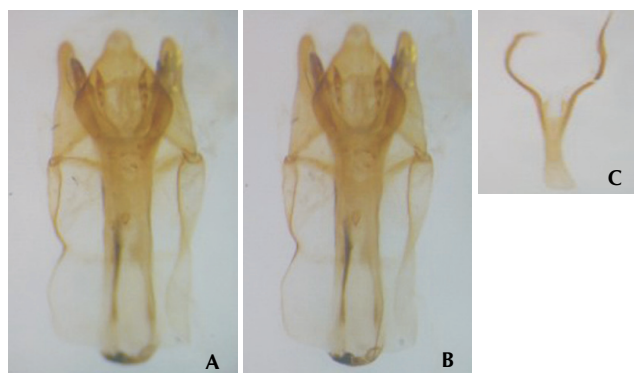


Figure 5: Male genitalia of *Holotrichia fissa* A - Aedeagus, Dorsal view, B - Aedeagus, Ventral view, C - Spiculum gastrale

Distribution

Karnataka, Uttar Pradesh, Andhra Pradesh, Maharashtra (Anonymous, 2010)

From foregoing discussion it is concluded that, occurrence and geographical distribution of all the five species of *Holotrichia* have now been well documented from Maharashtra. However Theurkar *et al.* (2012) and Theurkar *et al.* (2013) have also reported occurrence of *H. fissa* and *H. serrata* from Khed Tq. of Pune district of Maharashtra in Groundnut ecosystem. *H. serrata* observed to be the most

predominant species and distributed in all agro-climatic zones of Maharashtra. The information generated during the investigations on male genitalia variation would be useful to the researchers in the area of *Holotrichia* systematics for species confirmation in addition to the morphological characteristics.

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