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Revision of *Holotrichia* hope (Scarabaeidae: Melolonthinae) in different agro – climatic zones of Maharashtra (India)

S M Dadmal and Suvarna Khadakkar

ABSTRACT
Holotrichia Hope is one of the most destructive genera affecting major field crops of India. Grubs of *Holotrichia* causes extensive damage to the roots of the field crops. A comprehensive study on the faunal composition of *Holotrichia* amongst different agroclimatic zones of Maharashtra revealed the presence of five species of *Holotrichia* viz., *Holotrichia akolana, H. nagpurensis, H. serrata, H. fissa* and *H. reynaudi* with varied taxonomical characters bearing distinct morphometric values and male genitalia. Besides, a pictorial key for the species of *Holotrichia* provided. *H. serrata* was found to be prevailing in almost all agro climatic zones except South Konkan. *H. nagpurensis,* was dominant in Western *Ghat* Hills, Northern Hills and Western Vidarbha plains. *H. fissa* was recorded from South Konkan, Western *Ghat* Hills and Northern Hills. *H. akolana* was found to be endemic to Western Vidarbha plains and *H. reynaudi* was confined to Western Vidarbha plains and Northern Hills.

Keywords: Faunal composition, *Holotrichia*, Scarab, Taxonomy.

1. Introduction
Genus *Holotrichia* belongs to subfamily Melolonthinae, family Scarabaeidae of order Coleoptera. It forms a noxious group of insect pests, damaging Groundnut, Soybean, Sugarcane, Pigeon pea crops etc. The grubs of Scarabaeidae are notorious as 'White grubs'. They are whitish in appearance and 'C' shaped in structure. These grubs damage the roots of plants while the adults are foliage feeders of *neem, ber, babool* etc. and breeding takes place during night on these trees. White grubs have attained a status of international pest. It has been found worldwide on groundnut crop in uplands of South Vietnam and many other countries [1]. In India it has been recorded earlier from Madhya Pradesh [2]. Besides, *H. serrata* and H. renaudi have been recorded from Horticulture crop ecosystems such as rose around Bangalore [3]. These Lamellicorn beetles are widely distributed in Govind Wildlife Sanctuary, Garhwal, Uttarakhand, Himachal Pradesh, Garhwal Hills of Western Himalayas [4, 5, 6]. As far as Maharashtra state is concerned; white grubs have been recorded in groundnut growing area of Khed *taluka*, a part of Northern Western *Ghats* of Maharashtra [7]. During 2012-13 an outbreak was recorded in sugarcane ecosystem in Western Maharashtra and in soybean ecosystem in Nanded district of Maharashtra.
As far as the systematic account is concerned, a systematic notes on Melolonthine beetles belonging to *Holotrichia* and other related genera were first given by Arrow [8, 9, 10]. Also description of some Indian species of *Holotrichia* was provided by Khan and Ghai [11]. In case of *Holotrichia* species of Maharashtra, the information on distribution and comprehensive description is lacking and these species are poorly described in terms of morphometry and genitalia characteristics. Therefore, the present study was planned in the light of above stated facts.

2. Materials and Methods
Maharashtra is an agriculturally important state of India, where the major occupation of people is agriculture. Despite various other reasons for low crop productivity, insect pest infestation is the major one. Since the comprehensive study about pest status of Scarabaeid beetles, particularly Melolonthine beetles is lacking, a team of NPIB – ICAR project undertook surveys to study the pest status of this group of insects during 2012-13 and aimed at to study the faunal diversity of these beetles in Maharashtra.

For this purpose, out of nine agro climatic zones of Maharashtra, 5 distantly placed zones were selected and extensive surveys were carried out during the monsoon. These agro climatic zones were,

1. South Konkan- of which places like Dapoli (N17° 76.67' E 073°18.33', 800 ft asl) were surveyed.
2. Western Ghat hills – of which places of Kolhapur districts were surveyed. (Bahubali, Kumbhoj N16° 45.29' E 74°25.19', 690 ft asl)
3. Northern hills – places like Dhule (N20° 53.967' E 074°48.292', 787 ft asl), and Nashik (N20° 01.415' E 073°49.856', 1840 ft asl) were investigated.
4. Western Vidarbha plains – Extensive surveys were carried out in Akola (N20.6533° E 077.0142°, 925 ft asl), Amaravati (N20.930° E 077.750°, 1125 ft asl), Hudi and Sangrampur (N19.5217° E77.3739°)
5. Eastern Vidarbha hills – of which Gadchiroli (N20.11° E 80.00°, 396 ft asl) was the major place surveyed.

For collection of white grubs, fields with symptoms like wilted crops of soybean and groundnut were surveyed and white grubs were handpicked from the fields by digging the soil. Besides, light trap collection of adult beetles also contributed to the collection.

The collected white grub larvae were reared in laboratory condition up to adult stage. The beetles emerged from rearing and those collected from light traps were then subjected to taxonomic studies.

The adults were cleaned by washing several times in plain water as well as soap solution, after then, dipped in absolute alcohol overnight. They were pinned appropriately, air dried, oven dried and labeled.

For taxonomic studies, external morphological characteristics along with male genitalia studies were undertaken. Likewise pictorial key of the same has been prepared. (Plate 1)

Male and female specimens were sorted on the basis of hind tibial spur (pointed and elongated in male and blunt and stout in female). Study focused on male genitalia dissection for the species confirmation in support to the external morphological characters. For further confirmation specimens were submitted at National Pusa collection, IARI, New Delhi and also kept at NPIB insect museum, Department of Entomology, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola in cabinet MR 1: MRSC 1 & MRSC 2.

2.1 Male genitalia dissection

Abdomen was removed from the dried Male specimens with the help of needles and forceps. Few drops of plain water were injected into the abdomen by syringe and the abdomen was kept as such for 10 – 15 min. Further aedeagus was removed from the abdomen carefully with the help of forceps by examining the specimen under Binocular (Nikon make stereo zoom microscope SMZ-800). The aedeagus was then boiled in 10% KOH solution for about 3 – 5 minutes, washed with few drops of Glacial acetic acid and further several times by plain water. It was then dried on tissue paper and studied under stereo zoom microscope in glycerol. Aedeagus along with speculum gastrale was preserved in genitalia vials into same solvent and placed along with the original specimens.

2.2 Morphometric studies

Identified *Holotrichia* specimens were then subjected to morphometric studies. The morphometry of external morphological characters was carried out with the help of Digital Microscope BW1008-500X installed with measurement software.

3. Results and Discussion

3.1 Occurrence of species of *Holotrichia* in different agro climatic zones of Maharashtra

Table 1: Agro- climatic zones of Maharashtra with species distribution

Sr. No.	Agro climatic zone (locations)	White grub fauna
1	South Konkan (Dapoli)	*H. fissa*
2	Western *Ghat* hills (Bahubali, Kumbhoj)	*H. fissa, H. nagpurensis, H. serrata*
3	Northern hills (Dhule, Nashik)	*H. fissa, H. nagpurensis, H. serrata, H. reynaudi,*
4	Western Vidarbha plains (Akola, Amravati, Hudi, Sangrampur)	*H. fissa, H. akolana, H. nagpurensis, H. serrata, H. reynaudi*
5	Eastern Vidarbha hills (Gadchiroli)	*H. serrata*

Information depicted in Table 1 revealed that, as far as the agro-climatic zones are concerned, in South Konkan, *H. fissa* was one and the only species encountered during the exploration. South Konkan area of Maharashtra is with prosperous flora and fauna where the major ecosystem is rice and plantation crops.

In Western *Ghat* Hills, *H. fissa* was accompanied by *H. nagpurensis* and *H. serrata.* It was earlier recorded in Northern Western *Ghats* of Maharashtra in the groundnut growing area [7]. In Northern Hills of Maharashtra with altitude more than 1500 ft., climatic conditions are with low temperature and major ecosystems are pigeon pea, cotton, sorghum, sugarcane and grapes etc. in which *H. fissa, H. nagpurensis, H. serrata* and *H. reynaudi* prevailed. Western Vidarbha plains are at an altitude of about 1000 ft with maximum temperature of about 45–48 ºC in summer and minimum of about 6–10 ºC in winter. The major ecosystems are cotton, soybean, sugarcane, pigeon pea, etc. In this region all the five species of *Holotrichia*, *H. fissa, H. nagpurensis, H. akolana, H. serrata* and *H. reynaudi* were encountered. Distribution of *H. serrata* was found in all agro climatic zones except South Konkan. *H. serrata* was found to be dominant at eastern Vidarbha hills with altitude about 400 ft. falls in high rainfall area with paddy, sugarcane as the major ecosystems.

Table 2 affirms that, with respect to different agro climatic zones in Maharashtra, *H. serrata* dominated the most (46.06%). *H. serrata,* a polyphagous pest had earlier been recorded on soybean ecosystem in Maharashtra [12]. *H. fissa* was found to be the 2nd dominant species (23.17%). It was earlier recorded along with *H. serrata* in groundnut ecosystem of Northern Western *Ghats* of Maharashtra [7]. *H. reynaudi* and *H. nagpurensis* were found to be equally dominant (11.53%), while *H. akolana* was registered to be the least dominant (7.69%) and occurred in the western Vidarbha plains only.

Table 2: Per cent composition of *Holotrichia* species in Maharashtra

Sr. No.	*Holotrichia* sp.	Percentage	Agro climatic zone
1	*H. serrata*	46.06	Western *Ghat* hills, Northern hills, Western Vidarbha plains, Eastern Vidarbha hills
2	*H. fissa*	23.17	South Konkan, Western *Ghat* hills, Northern hills, Western Vidarbha plains
3	*H. reynaudi*	11.53	Northern hills, Western Vidarbha plains
4	*H. nagpurensis*	11.53	Western *Ghat* hills, Northern hills, Western Vidarbha plains
5	*H. akolana*	7.69	Western Vidarbha plains

3.2 Redescription of *Holotrichia* species

Khan and Ghai had earlier described some of the species of *Holotrichia* in India [11]. Some of these have been poorly described which are redescribed in detail as below. As per literature reviewed morphometrical values of these species have not been published yet. Thus, in this paper morphometrical data have been generated (Table 3) to describe the species thoroughly along with a pictorial key to the species of *Holotrichia* (Plate 1).

Pictorial key to species of *Holotrichia*

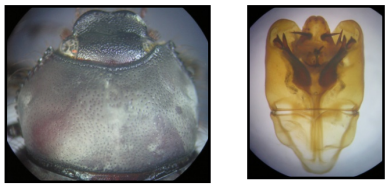
Large sized (>23 mm), lateral margins of pronotum sharply and deeply serrated

Medium to large sized, lateral margins of pronotum feebly serrated

Plate I

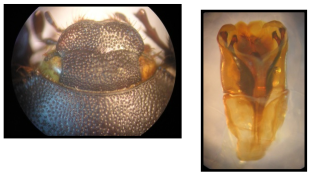
Dark brown, pronotum with or without setae on the punctures, male genitalia with two chitinized processes from lateral sides

Light brown, pronotum with or without setae, male genitalia with three chitinised processes that arise from lateral sides



H. nagpurensis

Clypeus broadly bent upwards, chitinised processes of male genitalia with round cap like tip



H. serrata

Plate I

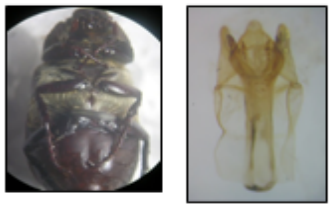
Abdomen bulged ventrally, thoracic sternum densely hairy, claws with first and second tooth widely separate

Abdomen flat ventrally, thoracic sterna less hairy; 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

Chest nut brown, clypeus small and narrow, pronotal punctations more concentrated anteriorly

H. consanguinea

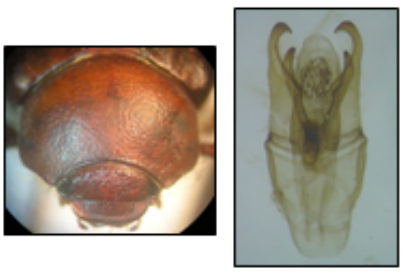
Dark brown, clypeus slightly longer, pronotum uniformly punctate



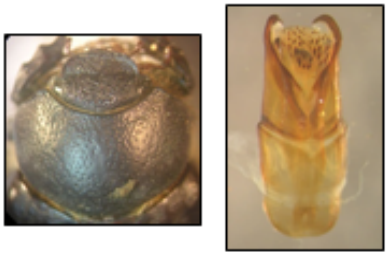
H. fissa

Anterior angle of pronotum sharply acute; Male genitalia consists of a broad Phallobase and elongate, symmetrical Parameres with two lateral process one on each side

Anterior angle of pronotum roughly obtuse, smooth area at centre; In Male genitalia chitinised lateral processes present one on each side, with blunt tips



H. reynaudi



H. akolana

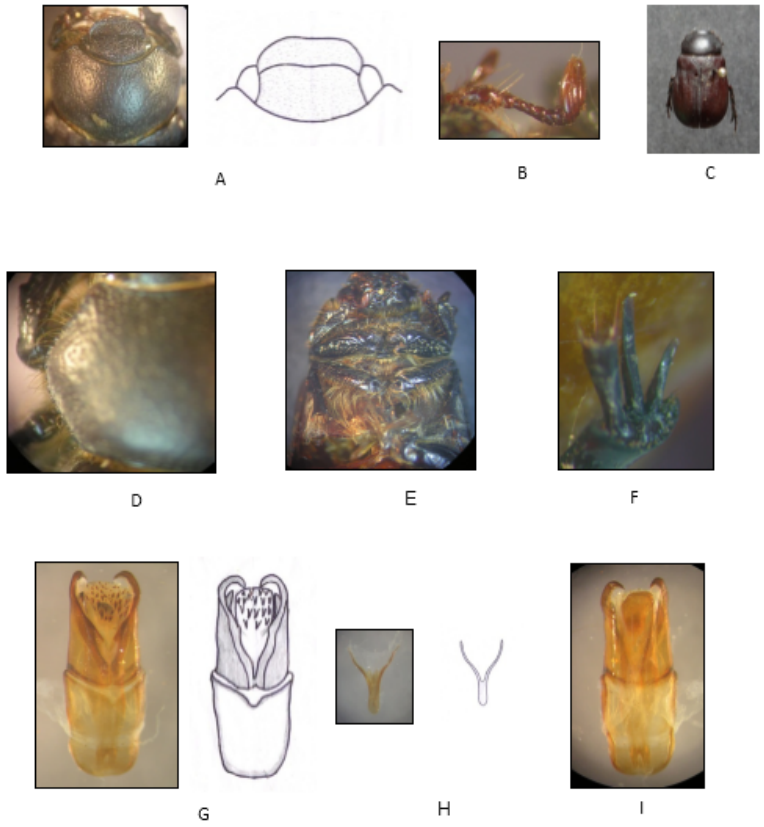


Plate 2: Figure showing morphological and anatomical characteristics of *Holotrichia akolana* (♂) A- Head, B- Antenna, C- Dorsal view, D – Lateral margin of Pronotum, E- Ventral surface of thorax, F- Hind tibial spur, G – Aedeagus, Dorsal view, H – Spiculum gastrale, I – Aedeagus, Ventral view,

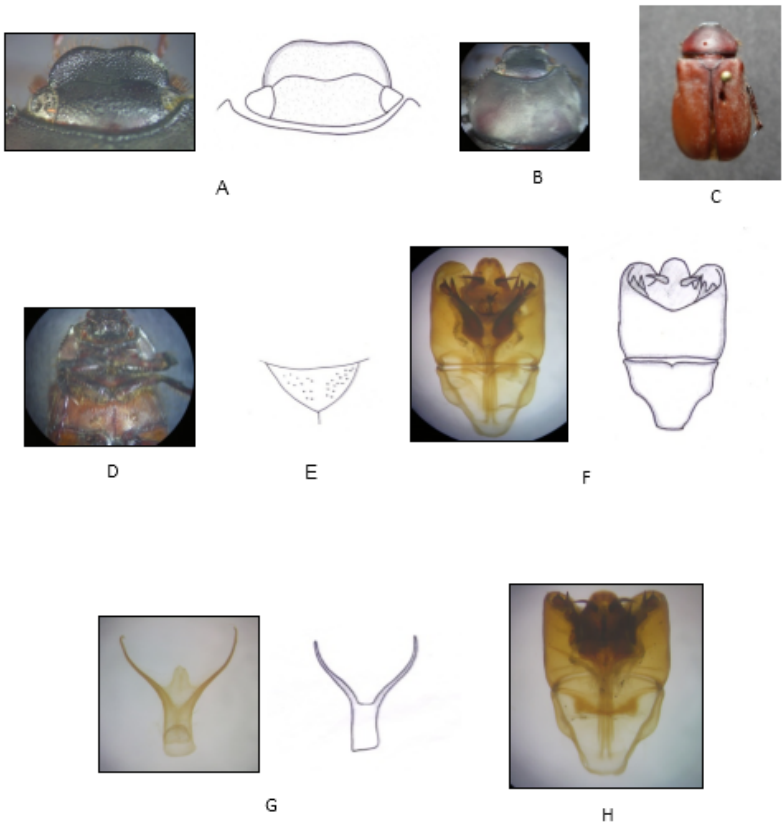


Plate 3: Figure showing morphological and anatomical characteristics of *Holotrichia nagpurensis* (♂) A- Clypeus, B- Pronotum, C – Dorsal view, D - Ventral surface of thorax, E – Scutellum, F - Aedeagus, Dorsal view, G –Spiculum gastrale, H– Aedeagus, Ventral view,

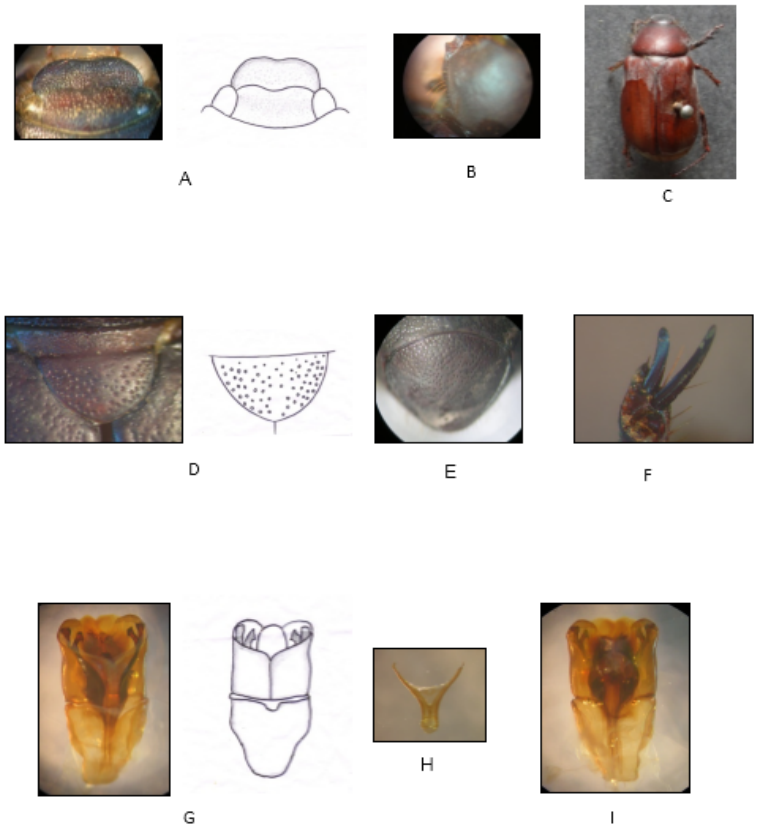


Plate 4: Figure showing morphological and anatomical characteristics of *Holotrichia serrata* (♂) A- Clypeus, B- Lateral side of Pronotum, C – Dorsal view, D- Scutellum, E- Pygidium, F - hind tibial spur, G – Aedeagus, Dorsal view, H–Spiculum gastrale, I– Aedeagus, Ventral view,

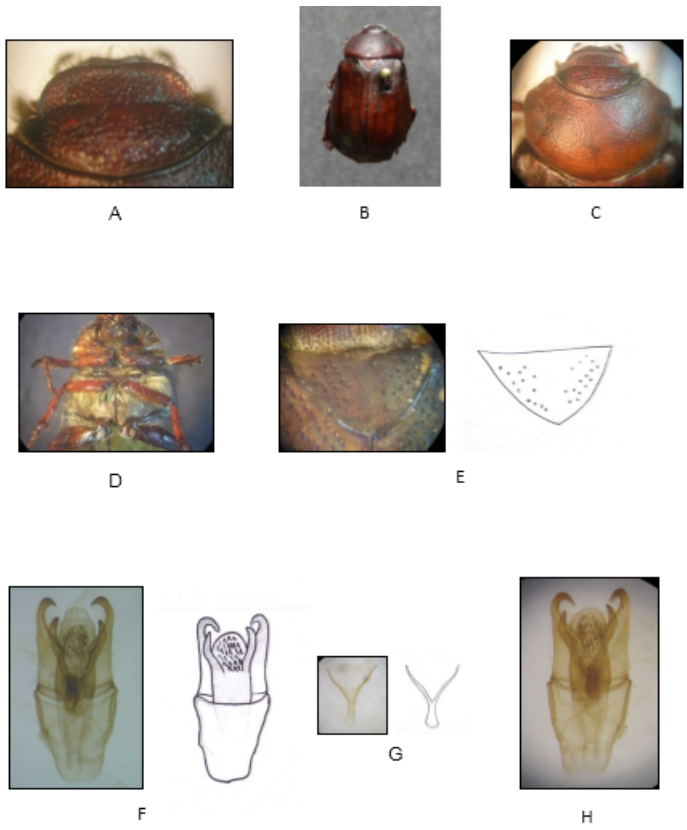


Plate 5: Figure showing morphological and anatomical characteristics of *Holotrichia reynaudi* (♂) A- Clypeus, B- Dorsal view, C- Pronotum, D- ventral side of Pronotum, E- Scutellum, F – Aedeagus, Dorsal view, G –Spiculum gastrale, H – Aedeagus, Ventral view,

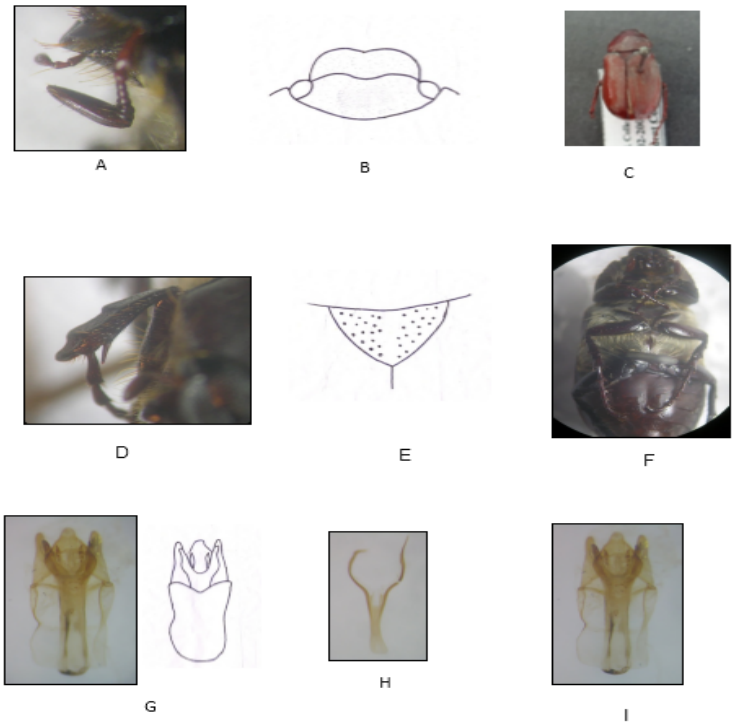


Plate 6: Figure showing morphological and anatomical characteristics of *Holotrichia fissa* (♂) A- Antenna, B – Clypeus, C- Dorsal view, D- Foretibia, E – Scutellum, F- ventral surface of thorax, G – Aedeagus, Dorsal view, H –Spiculum gastrale, I – Aedeagus, Ventral view,

3.2.1 Holotrichia akolana Khan and Ghai

Holotrichia akolana Khan and Ghai, 1982, Bull. Ent., **23**: 39
Medium sized, cylindrical; Dark brown, Appendages reddish brown. Antenna 10 segmented, 3 segmented club, 1st segment elongated, has fringes of hairs ventrally, 2nd to 7th globular, 8th to 10th forms club, scattered hairs on antennal segments; Clypeus shorter than Frons, less bent upward anteriorly; Frons and Vertex deeply and thickly punctate.
Pronotum with lateral margin broadly and uniformly serrated, long setae between serrations, finely punctate, smooth at centre; Appendages reddish brown, punctate, setaceous; Foretibia tridentated with blunt tooth's, single pointed spur; Mid tibia with two pointed spur, Claws toothed; Hind tibial spur elongated, pointed in Males, blunt in Females; Metasternum with long whitish setae. Scutellum feebly and uniformly punctate; Ventral sclerites light colored; Pygidium shallowly and feebly punctate.

3.2.1.1 Male Genitalia

Spiculum gastrale 'Y' shaped, arms widely separate, straight, united by membranous region. Phallobase broad at centre; almost straight laterally. Parameres elongated, same length as that of Phallobase; straight laterally; united basally for short distance; arms bent inwards towards tip; chitinised lateral processes present one on each side, with blunt tips; long and reaches up to the tip of paramere; ventrally both lobes are connected. (Plate.2)

3.2.1.2 Distribution

Maharashtra, Rajasthan

3.2.1.3 Materials Examined

India: Maharashtra: 1(♂), 1(♀) Akola, July 2006, S M Dadmal; 1(♂), 1(♀) Sangrampur, 17.x.2012, S S Khadakkar; 1(♂), 1(♀) Akola, 10.x.2012, P A Ghuge

3.2.1.4 Registration No. NPIB, Akola database

Auto key 1076, Key No. Col 21

3.2.2 *Holotrichia nagpurensis* Khan and Ghai

Holotrichia nagpurensis Khan and Ghai, 1983, Bull. Ent., 23: 38
Large sized, cylindrical; pastel brown, Head and Pronotum dark brown, appendages reddish brown.
Antenna 10 segmented, 3 segmented club, 1st segment elongated, has fringes of hairs ventrally, 2nd to 7th globular, 8th to 10th forms club, scattered hairs on antennal segments, 1st segment has fringes of hairs ventrally; Clypeus equal in size as Frons, deeply and thickly punctate, broadly bent upwards.
Pronotum strongly serrated, serrations almost equal in size, long setae between serrations, thickly punctate along anterior margin, uniformly and finely punctate all over the pronotum, somewhat smooth at centre; Metasternum setaceous; Appendages reddish brown, punctate, with scattered setae; Foretibia tridentate, blunt tooth, single inner foretibial spur; Mid tibia with 2 elongated spur, Claws toothed; Hind tibia with two elongated pointed spur, Claws toothed.
Scutellum finely and uniformly punctate; Suture in between the Elytra and Pronotum broad, setaceous marginally, punctate in middle with scattered setae; Elytra pruinose, with 4 costae, finely and uniformly punctate; Ventral sclerites pastel brown, feebly, finely punctate and setaceous along margins; Pygidium finely and uniformly punctate, posterior margin with a row of setae ventrally. (Plate. 3)

3.2.2.1 Male Genitalia

Spiculum Gastrale 'Y' shaped, with broad stem, two arms widely separated; Phallobase broad at base; as long as paramere; Paramere symmetrical, darker than Phallobase; Three chitinised process present on both sides; ventrally

both lobes are jointed together; Endophallus with long sclerotised process that arise laterally and at the centre.

3.2.2.2 Distribution
Maharashtra, Uttar Pradesh

3.2.2.3 Material Examined
India: Maharashtra: 1(♂), 1(♀) Nashik, 12.ix.2012, S M Dadmal; 1(♂), 1(♀) Amravati, 7.v.2012, Panjab Ghuge; 1♂, 2♀ Amravati 11.vi.2012 S S Khadakkar

3.2.2.4 Registration No. NPIB, Akola database
Auto key 1072, Key No. Col 17

3.2.3 *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, Dalla torre, 1912, *Col. Cat.,* **49:** 206

Large sized, cylindrical, Ovate; Elytra brown, Head, Clypeus, Blackish brown, Legs, antennae, light brown.
Antenna 10 segmented, 3 segmented club, 1st segment elongated, has fringes of hairs ventrally, 2nd to 7th globular, 8th to 10th forms club, scattered hairs on antennal segments; Clypeus strongly punctate, curved upwards anteriorely and laterally; Frons less punctate.

Pronotum feebly punctate, strongly serrated laterally, serrations decrease posteriorly, setae between serrations. Metasternum setaceous with fine small setae. Legs punctate, with scattered setae; Foretibia tridentate, punctate, setaceous, single inner foretibial spine, Claws toothed; Mid tibia with two pointed, elongated spur, Claws toothed; Hind femur feebly punctate, Hind Tibia shallowly punctate, two pointed elongated spur, Claws toothed.
Scutellum feebly shallowly punctate, smooth at centre; Elytra pruinose, with four costae, finely punctate; Abdominal sclerites finely punctate; Pygidium feebly punctate with row of setae along posterior margin. (Plate.4)

3.2.3.1 Male genitalia
Spiculum gastrale 'Y' shaped, widely separate, bent towards tip; stem broad, arms longer than stem, elongated, connected at centre by membranous region.
Phallobase broad at base, as long as parameres; Parameres with apex broadly folded, a pair of short lateral chitinised process on each side with round cap like end; Endophallus sclerotised, membranous at anterior end, spines are present at the anterior margin, one group of spines facing dorsal side, two groups laterally on each side.

3.2.3.2 Distribution
Maharashtra, Karnataka, Andhra Pradesh, Tamil Nadu

3.2.3.3. Materials Examined
India: Maharashtra: 3♂, 1♀ Kumbhoj 10.ix.2012 S M Dadmal; 1♂, 1♀ Dhule 4.x.2012 P A Ghuge; 2♂, 2♀ Amravati 7.vii.2012 S S Khadakkar; 2♂, 2♀ Amravati 7.vii.2012 P A Ghuge; 3 ♀ Hudi S S Khadakkar

3.2.3.4 Registration No. NPIB, Akola database
Auto key 1057, Key No. Col 2

3.2.4 *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

Medium sized insect; Dark brown, elytra dark brown, pruinose, appendages reddish brown.
Antenna 10 segmented, 3 segmented club, 1st segment elongated, has fringes of hairs ventrally, 2nd to 7th globular, 8th to 10th forms club, scattered hairs on antennal segments; Clypeus shorter than frons, broadly bent upwards, deeply and thickly punctate; Frons deeply and thickly punctate.
Pronotum uniformly and deeply punctate, weakly serrated laterally, long setae between serrations; Metasternum setaceous with long whitish setae; Legs punctate, setaceous with whitish elongated setae scattered; Foretibia tridentate, single inner foretibial spur; Claws toothed; Mid tibia with 2 inner mid tibial spurs; Claws toothed; Hind tibia with 2 pointed spur, elongated in (♂) and blunt in (♀).
Scutellum uniformly, feebly punctate; Elytra pruinose with four costae, shallowly punctate. 6 ventral abdominal sclerites with shallow punctuations; Pygidium finely punctate, broad at tip, with a row of setae along the ventral margin.
The species very much similar in appearance to *H. akolana.* (Plate 5)

3.2.4.1 Male genitalia
Spiculum gastrale with arms longer than the stem; distance between the arms less, slightly bent at separation.
Male genitalia consists of a broad Phallobase and elongate, symmetrical Parameres with two lateral process one on each side; Endophallus sclerotised with small spines.

3.2.4.2 Distribution
Maharashtra, Karnataka, Andhra Pradesh, Tamil Nadu

3.2.4.3. Materials Examined
India: Maharashtra: 1(♂), 1(♀) Akola 10.x.2012 S M Dadmal; 1(♂), 1(♀) Dhule 04.x.2012 Dharne; 1(♂), 1(♀) 07.vii.2012 A R Mankar

3.2.4.4 Registration No. NPIB, Akola database
Auto key 1075, Key No. Col 20

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

Medium sized; Dark brown, Elytra pruinose, dark brown, in some specimens blackish brown, Appendages reddish brown.
Antenna 10 segmented, 3 segmented club, 1st segment elongated, has fringes of hairs ventrally, 2nd to 7th globular, 8th to 10th forms club, scattered hairs on antennal segments; Clypeus and Frons equal in size, thickly, uniformly punctate, Clypeus bent upwards, Frontal suture broad; Dark brown.
Pronotum weakly, broadly serrated, long setae between serrations, deeply and uniformly punctate, smooth at centre; Foretibia tridentate, punctate with scattered setae, single

inner foretibial spur, Claws toothed; mid tibia and Hind tibia with paired spur; Hind tibial spur pointed and elongate in middle, Claws toothed. Metasternum with whitish elongated setae.

Scutellum shallowly punctate; Elytra pruinose with four costae, finely and deeply punctate; Ventral sclerites dark coloured, finely setaceous; Pygidium finely punctate, broad posteriorly. (Plate. 6)

3.2.5.1 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.

3.2.5.2 Distribution

Maharashtra, Karnataka, Uttar Pradesh, Andhra Pradesh, Kerala.

3.2.5.3 Material examined

India: Maharashtra: 1(♂), 1(♀) Bahubali, 12.ix 2012, S M Dadmal; 1(♂), 1(♀), Nashik, 12.ix.2012 S S Khadakkar; 3(♂), 2(♀) Dapoli, 08.ii.2007 Student collection; 1(♂), 1(♀) Akola, 2.ix.2010 S M Dadmal.

3.2.5.4 Registration No. NPIB, Akola database

Auto key 1083, Key No. Col 28

4. Conclusion

From the foregoing description and discussion it is concluded that five species of *Holotrichia* were found to be dominant in different agroclimatic zones of Maharashtra. Out of which *H.serrata* was most predominant in entire Maharashtra except Konkan. Morphological characteristics with varied morphometric vaules and male genitalia were found crucial to differentiate the *Holotrichia* species.Pictorial key developed and provided through this paper would be helpfull to identify the five species of *Holotrichia* of Maharashtra . Besides,the information from this paper would be helpfull to plant protection workers to undertake the strategic measures in different agroclimatic zones of Maharashtra to manage these economically important pests.

Table 3: Morphometric values (in mm) of different species of *Holotrichia* Hope (♂)

S No.	Species	Total body length	Length of Clypeus	Width of Clypeus	Length of Pronotum	Width of Pronotum	Length of Elytra	Width of Elytra	Length of Scutellum	Width of Scutellum	Length of Tibial spur	Length of Pygidium	Width of Pygidium
1	***H. serrata***	23.83 ±0.94	0.74 ±0.08	4.05 ±0.09	5.03 ±0.78	8.87 ±0.23	16.54 ±0.92	11.15 ±0.76	1.83 ±0.54	3.36 ±0.27	1.33 ±0.06	4.90 ±0.30	6.35 ±0.32
2	***H. fissa***	18.11 ±1.02	0.88 ±0.06	3.45 ±0.21	5.25 ±0.22	8.35 ±0.44	12.86 ±1.00	10.53 ±0.78	1.49 ±0.13	2.77 ±0.17	1.51 ±0.20	4.09 ±0.35	4.87 ±0.39
3	***H. reynaudi***	19.68 ±1.54	0.88 ±0.04	3.86 ±0.21	5.41 ±0.33	8.58 ±0.37	13.26 ±0.56	11.92 ±0.45	1.57 ±0.08	3.08 ±0.17	1.40 ±0.21	3.65 ±0.45	3.99 ±0.25
4	***H. akolana***	18.68 ±0.44	0.89 ±0.03	3.73 ±0.14	5.33 ±0.21	8.59 ±0.30	12.53 ±0.36	12.20 ±0.84	1.63 ±0.12	2.78 ±0.13	1.42 ±0.22	3.69 ±0.46	4.88 ±0.32
5	***H. nagpurensis***	26.7 ±0.46	1.33 ±0.07	4.68 ±0.13	6.99 ±0.47	11.39 ±0.32	18.02 ±0.79	11.50 ±0.25	2.16 ±0.10	3.74 ±0.17	2.60 ±0.19	4.69 ±0.14	7.90 ±0.21

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