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RESEARCH ARTICLE :

Diversity of white grubs (Coleoptera: Scarabaeidae: Melolonthinae) from Maharashtra

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SUMMARY : The present work provides information on distribution of white grub species from different seven agroclimatic zones of Maharashtra. A total of thirteen species from subfamily Melolonthinae under five genera *viz.*, *Holotrichia serrata* (Fabricius), *Holotrichia fissa* Brenske, *Holotrichia reynaudi* (Blanchard), *Holotrichia akolana* Khan and Ghai, *Holotrichia nagpurensis* Khan and Ghai, *Holotrichia rufoflava* Brenske, *Holotrichia ferinosa* Nonfried, *Sophrops karschi* (Brenske),*Sophrops sculpticollis* (Blanchard), *Schizonycha ruficollis* (Fabricius), *Schizonycha fuscescens* (Blanchard), *Leucopholis lepidophora* (Blanchard) and *Amiridiba cocaabiae* recorded during the study period. The single dominant species, *Holotrichia serrata* was observed upto 29.20 per cent of all individuals followed by *Holotrichia fissa*, *Schizonycha ruficollis*with abundance of 23.89 per cent and 19.17 per cent, respectively. The lowest abundance was observed in species *Leucopholis lepidophora*. Diversity index of subfamily Melolonthinae recordedabundance in population *Holotrichia serrata* (0.3594). Whereas, *Leucopholis lepidophora* with minimum abundance (0.0523). However, moderate to rich Shannon biodiversity index (H^{1}=1.9897) was noticed in terms of subfamily Melolonthinae in Maharashtra.

KEY WORDS :
Melolonthinae, Diversity, Distribution, White grubs

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BACKGROUND AND OBJECTIVES

Coleoptera is the largest and most diverse order of class insecta (Phylum: Arthropoda). The superfamily Scarabaeoidea is the largest superfamily of order Coleoptera includes approximately 31,000 species worldwide, of which the family Scarabaeidae composed of about 91% of all scarabaeoids. White grubs (Coleoptera: Scarabaeidae) are the soil inhibiting and root feeding immature stages of scarab beetles of which larval stage is destructive in nature. The white grub's family (Scarabaeidae) is second largest family which includes over 30,000 species (Khanal *et al.*, 2012). Near about 300 species of white grub were recorded from India (Bhawane *et al.*, 2011).

White grubs are broad, fleshy, whitish and the body is curved in the form of 'C' shape. Most of the white grubs especially from the sub-family Melolonthinae are most destructive and troublesome soil insects in many parts to certain endemics pockets in the states of Rajasthan, Uttar Pradesh, Gujarat,

Maharashtra and Karnataka (Bhawane *et al.*, 2012). The larvae of white grub damage practically all types of crops. But their damage to tap root crops, specially the leguminous ones, is more serious as they do not merely cut the tap roots from which the plants hardly recover but they eat away the nodules also for which the plants suffer from proper nitrogen supply.

The grubs of *Holotrichia serrata* feed on the roots and cause losses upto 40 to 70% (Theurkar *et al.*, 2013). Recently, (Dadmal *et al.*, 2013) reported heavy attack of *Holotrichia serrata* (F.) in soybean crop ecosystem of Pusad *taluka* of Vidarbha, the most predominant and notorious pest. In Kolhapur district of Maharashtra, *Leucopholis lepidophora* Blanch is serious phytophagous pest damaging mainly sugarcane crop located along the bank of rivers of Western Maharashtra. Scarabs causes economic loss to the crops like Jowar, Bajra, Maize, Cotton, Sugarcane, Mung bean, Udid, Groundnut, Sesamum, Rala (finger millet), Okra, Brinjal, Pumpkin and Soybean etc.

In Maharashtra this pest has become serious problem in Kolhapur, Sangli, Satara, Solapur, Ahmednagar, Buldhana, Dhule, Jalgaon, Nanded, Osmanabad, Parbhani, Beed, Wardha and some part of Pune district. The white grubs becoming very serious threat in sugarcane cultivation in Western Maharashtra *viz.*, Sangali, Satara, Solapur and Kolhapur districts (Bhawane *et al.*, 2012). Insect identification is a fundamental part of recognizing and describing biodiversity. The information regarding the biodiversity of scarabs, that too in agriculture sector is scanty. The present study aimed to clarify the uncertainties of species identity and distribution.

RESOURCES AND METHODS

Seven agroclimatic zones of Maharashtra *viz.*, Western ghat zone, Scarcity zone, assured rainfall zone, Transition zone II, Eastern vidarbha zone, Moderate rainfall zone, South kokan costal zone were selected for collection of white grubs. The collection of beetles was carried out after receiving first showers of rain. The beetles were collected from host trees like *Neem* (*Azadirachta indica*), Wild ber (*Zizyphs* sp.), babhul (*Acacia arabica*) and khair (*Acacia catechu*) *viz.*, located on roadside and from commercial growing crops and by donation from the authorities of different agriculture colleges of Maharashtra.

The scarab beetles were comes out from soil at dusk time, 6:45 pm to 10 pm for feeding and mating purpose on onset of rains. Considering this period, the host trees commonly found on roadsides and around infested fields were surveyed and beetles were collected for further study. The collection of beetles was undertaken by following techniques:

- Use of light traps
- Hand collection during emergence
- Collection of the grubs and rearing
- Collection by donation/ loan from from the authorities of (Department of Entomology) different agriculture collegesof Maharashtra.

The adults were collected from the farmer's field/ Agriculture colleges at different locations/districts of Maharashtra and killed by Potassium cyanide or Ethyl acetate in a killing jar;pinned and dried in hot air oven, labeled appropriately and stored in the insect collection wooden showcases. For studying the distinguishing morphological andgenitalic characters of different collected specimens, stereo zoom microscope (Nikon SMZ 800) with attached Nikon camera was used. The collected fauna then categorized under different genus and specieswith the help of taxonomic key given by Kumar *et al.* (2010).

Estimation of population/ diversity :

The estimated population of different species was done by counting the population of adults. The collected data were employed for the statistical analysis to calculate abundance and species diversity/richness by applying Shannon biodiversity index. Shannon biodiversity index was worked out by the formula as below.

$$Pi = ni/N \quad (1)$$

$$H' = -\sum_{j=1}^{S} p_i . \ln p_i \quad (2)$$

n_i = number of individuals of species "*i*"
N =total number of individuals of all species
p_i = relative abundance of species "*i*"
S = total number of species
H' = The Shannon Diversity Index

OBSERVATIONS AND ANALYSIS

The results obtained from the present study as well as discussions have been summarized under following heads:

Table 1 : Species wise Shannon Biodiversity Index of different species under subfamily Melolonthinae in Maharashtra

Sr. No.	Species	Percentage (%)	pi(ln(pi))	
1.	*Holotrichia serrata*	29.20	-0.3594	
2.	*Holotrichia fissa*	23.89	-0.3420	
3.	*Schizonycha ruficollis*	19.17	-0.3166	
4.	*Holotrichia reynaudi*	4.71	-0.1441	
5.	*Holotrichia akolana*	4.42	-0.1379	
6.	*Holotrichia nagpurensis*	3.53	-0.1182	H'=1.9897
7.	*Sophrops karschi*	2.94	-0.1039	
8.	*Schizonycha fuscescens*	2.65	-0.0963	
9.	*Holotrichia rufoflava*	2.35	-0.0884	
10.	*Holotrichia ferinosa*	2.35	-0.0884	
11.	*Sophrops sculpticollis*	2.06	-0.0801	
12.	*Amiridiba cocaabiae*	1.47	-0.0621	
13.	*Leucopholis lepidophora*	1.17	-0.0523	

Abundance of white grubs in Maharashtra :

A total of 13 species *viz.*, *Holotrichia serrata* (Fabricius), *Holotrichia fissa* Brenske, *Holotrichia reynaudi* (Blanchard), *Holotrichia akolana* Khan and Ghai, *Holotrichia nagpurensis* Khan and Ghai, *Holotrichia rufoflava* Brenske, *Holotrichia ferinosa* Nonfried, *Sophrops karschi* (Brenske),*Sophrops sculpticollis* (Blanchard) *Schizonycha ruficollis* (Fabricius), *Schizonycha fuscescens* (Blanchard) *Leucopholislepidophora* (Blanchard) and *Amiridiba cocaabiae* were recorded during the study period under five genera distributed in subfamilyMelolonthinaeand one tribe (Melolonthini Leach). The collected beetles were taxonomically identifiedupto species level on basis of morphological and genitalic characterization at Biosystematic laboratory, Department of Agril. Entomology, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola.

The results show that beetle emergence was started after receiving first pre monsoon showers in May and June month onwards. The present findings were in conformity with the results of (Kumar *et al.*, 2009). Among all the genera, *Holotrichia* was found to be most abundant and dominant. The results were in agreement with Theurkar *et al*. (2013) and Dadmal *et al*. (2013).

The abundance of white grub was studied for the population collected in different agroclimatic zones/ districts of Western Maharashtra. Diversity and reciprocal index were calculated by Shannon biodiversity index. This index considers both the abundance and richness of the species. The diversity of white grubs by Simpson's method is presented in Table 1. The single dominant species, *Holotrichia serrata* was observed upto 29.20 per cent of all individuals followed by *Holotrichia fissa*, *Schizonycha ruficollis* with abundance of 23.89 per cent and 19.17 per cent, respectively. The lowest abundance was observed in species *Leucopholis lepidophora* (1.17 %). Diversity index of subfamily Melolonthinae recored abundance in population *Holotrichia serrata* (0.3594). Whereas, *Leucopholis lepidophora* with minimum abundance (0.0523) in Maharashtra. However, moderate to rich Shannon biodiversity index (H$^{|}$=1.9897) was noticed in terms of subfamily Melolonthinae in Maharashtra.

The species were newly recorded *viz.*, *Schizonycha fuscescens*, *Sophrops sculpticollis* from Akola district of Maharashtra, *Holotrichia ferinosa* from western Maharashtra, *Amiridiba cocaabiae* from south Kokan costal zone from Maharashtra. The white grub species *Leucopholis lepidophora* was observed to cause damage to sugarcane near the rivers bank of Western Maharashtra.

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