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## Incidence of scarab beetles collected through light trap at Akola vicinity of Maharashtra with reference to Scarabaeidae of Coleoptera

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### Abstract

A survey conducted at Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola to study the incidence and diversity of scarabs during *khariif* 2014. Scarabaeid faunal activity was noticed from second week of June to third week of October. Peak activity of scarabs was noticed in 30th meteorological week (21<sup>st</sup>–27<sup>th</sup> July) scarab beetles population exhibited non-significant, negative correlation with maximum temperature, evaporation, bright sunshine hours and significant, positive with minimum temperature, relative humidity and rainfall. Four families viz; Scarabaeidae, Hybosoridae, Geotrupidae and Trogidae in superfamily Scarabaeoidea were registered. Family Scarabaeidae (84.58%) added affluent fauna to the Akola followed by Hybosoridae (7.31%) and Geotrupidae (4.74%) while Trogidae (3.35%) distributed least. Amongst the subfamilies, Scarabaeinae (36.56%) found dominant, followed by Cetoniinae (18.97%) and Rutelinae (16.40%). Diversity index of Scarabaeinae recorded abundance in population (0.3678), followed by Cetoniinae (0.3153) and Rutelinae (0.2964). However, moderate to rich Shannon biodiversity index ( $H' = 1.6903$ ) was noticed in terms of subfamilies.

**Keywords:** Scarabs beetles, Light trap, seasonal incidence, diversity

### Introduction

Coleoptera is the largest and most diverse order of class Insecta (Phylum: Arthropoda). They are functionally important, being the dominant above ground invertebrate in pastures and natural grassland when judged by biomass. The members commonly known as 'beetles' include about 3,50,000 species among which about 15,088 species are known from Indian region [14].

The family Scarabaeidae is second largest family within the order Coleoptera. These beetles are noticeable due to their relatively large size, bright colors, often elaborate ornamentation and interesting life histories. The species of this large family are often called scarabs or scarab beetles.

The Melolonthinae is the second largest subfamily of Scarabaeidae containing one-third of the species of family Scarabaeidae and is widely distributed throughout the world [15]. The species belongs to Melolonthinae are all phytophagous, many of them of great economic importance.

Lack of taxonomic understanding has been a major impediment to the study and management of scarabaeid beetles. Proper identification of the species and knowledge of their geographical distribution, population dynamics and biodiversity are the first steps in developing environmentally compatible/sustainable integrated pest management strategies. Correct identification of pests up to family, sub family, species level is necessary and taxonomy play an important role in this regards. The information on the activity of the particular fauna in particular agro-ecosystem is needed to generate the information on level of active fauna and its predominance in that crop ecosystem. Knowledge on species diversity, abundance, richness and dominance through surveys would be helpful in planning strategies for conservation of natural enemies, habitat management, design and develop pest management strategies.

### Materials and Methods

#### Collection of the beetles

Scarabs were collected through net, hand picking and light traps installed at various locations of Dr. Panjabrao Deshmukh Krishi Vidhyapeeth campus, Akola. A nylon mesh was fixed below the light trap for the collection of the trapped insects.

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Light trapped insects in the nylon mesh were collected each day, beetles were killed by 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 characters of different specimens, stereo zoom microscope (Nikon SMZ 800) with attached Nikon camera was used. The collected fauna sorted out and categorized under different families and subfamilies with the help of taxonomic key.

### Estimation of the population and correlation

Estimation of population was done by counting the population of collected beetles from various locations of Dr. P.D.K.V. campus, Akola. The collected data were employed for the statistical analysis to calculate seasonal incidence, correlation with weather parameters, diversity and abundance of scarab beetles. Shannon biodiversity index was worked out by the formula as below.

$P_i = n_i/N$  ----- (equation-1)

$H' = - \sum p_i \ln p_i$  ----- (equation-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

## Results and Discussions

### Collection of scarabaeid fauna

Specimens of scarabaeid fauna were collected from Dr. P.D.K.V. campus, Akola during *kharif* 2014 and categorized into families and different sub families (Table 2). The collected scarabaeid fauna was composed of four families i.e. Scarabaeidae, Hybosoridae, Geotrupidae and Trogidae. The members of Scarabaeidae family was further classified into Scarabaeinae, Cetoniinae, Rutelinae and Melolonthinae and Remaining three families i.e. Hybosoridae, Geotrupidae, Trogidae continued the members of only one subfamily each i.e. Hybosorinae, Geotrupinae, Troginae, respectively.

### Scarabaeid meteorological week wise activity during *kharif* season

Scarabaeid faunal activity was noticed during 2014 from second week of June i.e., 24<sup>th</sup> meteorological week to third week of October i.e. 42<sup>nd</sup> meteorological week (Table-1, Fig-1). It indicates from the data that, peak activity was noticed on 30<sup>th</sup> meteorological week (21<sup>st</sup>-27<sup>th</sup> July) during this period total 89 beetles were trapped/ hand picked and preserved. Second peak was recorded on 36<sup>th</sup> (75 beetles trapped) followed by 35<sup>th</sup> week (66 beetles trapped).

The second fortnight of June observed the peak period of emergence of the June beetles and emergence was continuing until the fortnight of August [11, 17] also stated that maximum numbers of white grubs were caught in the month of June-July [10] recorded maximum population of white grub in the month of June [1] reported white grub (larva) peak period found to be in the 1<sup>st</sup> fortnight of July. However, for adult was in the 2<sup>nd</sup> fortnight of July.

### Correlation

Studies on correlation of scarabs incidence with weather parameters during 2014 from first week of June i.e., 23<sup>rd</sup> meteorological week to fourth week of October i.e. 43<sup>rd</sup>

meteorological week (Table 1, Fig 1) revealed that, scarab beetles population exhibited non-significant, negative correlation with maximum temperature, evaporation, bright sunshine hours and significant, positive correlation with minimum temperature, relative humidity and rainfall. Whereas, wind velocity had a negative but significant correlation, respectively. Thus correlation studies in present investigation indicated that the scarab beetles population increased with increasing rainfall, relative humidity, minimum temperature but decreased with maximum temperature, minimum wind velocity, evaporation, bright sunshine hours. Emergence of *Holotrichia consanguinea* positively correlated with rainfall and wind velocity as reported by [21, 9] observed scarab beetles began to emerge just after the pre- monsoon showers and when the relative humidity had risen rapidly over several days but before the first monsoon rains.

### Family wise composition of scarabaeoid fauna collected from Akola

#### Scarabaeidae

Scarabaeidae emerged as largest family of superfamily Scarabaeoidea contributing 84.58% of the total scarabaeid fauna (Table-2) [2]. Surveyed 152 species under 101 genera belonging to 25 families of beetles, and concluded family Scarabaeidae to be dominant with 65 species from Amba Reserve Forest, Western ghat, Kolhapur [20]. Studied twelve species under four subfamilies of family Scarabaeidae from Melghat Tiger Reserve.

#### Hybosoridae

With 7.31% of the total Scarabaeid fauna this family found to be the second largest family of superfamily Scarabaeoidea in Akola [4]. Also studied new 29 species of two families viz. Scarabaeidae and Hybosoridae from Jabalpur, Madhya Pradesh (India) confirmed the availability of Hybosoridae fauna in Central India condition.

#### Geotrupidae

Geotrupidae family contributed about 4.74% (Table-2) of total scarabaeid fauna in study area [12]. Recorded Geotrupidae as smallest family (2.45%) from Akola vicinity. Earlier [3] studied taxonomic account of subfamily Geotrupidae from central India.

#### Trogidae

3.35% of the total Scarabaeid fauna was represented by this family. It was reported to be the smallest family of superfamily scarabaeoidea in Akola. Similar, results were reported by [22] from Turkey and [12] who recorded members of Trogidae family (4.44%) in Akola vicinity.

### Family: Scarabaeidae

#### Subfamily: Scarabaeinae

Maximum number of insects collected during the present study belongs to Scarabaeinae subfamily contributing to 36.56 of the total Scarabaeid fauna emerged as the largest subfamily of family Scarabaeidae (Table-2). Similar results have been reported by [16] reported cloud forest dung beetles of subfamily Scarabaeinae in the western ghat, a global biodiversity hotspot in southwestern India.

**Subfamily: Cetoniinae**

Subfamily Cetoniinae contributed to 18.97% of the total scarabaeid fauna (Table-2). Cetoniinae ranked as second largest subfamily of family Scarabaeidae [18] stated that the occurrence of chafer beetle *Oxycetonia versicolor* (Scarabaeidae, Coleoptera) damaging important grain such as pigeonpea (*Cajanus cajan*) and mung bean (*Vigna radiata*) from Punjab, India.

**Subfamily: Rutelinae**

Rutelinae subfamily contributes about 16.40% (Table 2) of total scarabaeid fauna. These beetles were handpicked on okra and cotton crops being typically diurnal [3]. Recorded highest number of beetles from subfamily Rutelinae followed by Melolonthinae, Cetoniinae and Dynastinae from Achanakmar-Amarkantak Biosphere Reserve, Chhattisgarh.

**Subfamily: Melolonthinae**

Out of the total scarabaeid fauna 12.64% was represented by subfamily Melolonthinae (Table 2) [5]. Reported five species of Melolonthinae from Maharashtra [6]. Recorded different white grub species with their dominance under genus *Holotrichia* Hope belonged to subfamily Melolonthinae from different agroclimatic zones of Maharashtra.

**Family: Hybosoridae****Subfamily: Hybosorinae**

Of the total scarabaeid fauna 7.31% was represented by this subfamily and represents the third largest subfamily in Akola. Similar results reported by [20]. They collected thirty-two species of scarab beetles belonging to twenty genera, eight subfamilies including Hybosorinae and three families under superfamily Scarabaeoidea from Melghat Tiger Reserve, Vidarbha, Maharashtra (India) [4]. also recorded Hybosorinae from Jabalpur.

**Family: Geotrupidae****Subfamily: Geotrupinae**

4.74% of the total scarabaeid fauna was represented by this subfamily (Table-2). Similar result were reported by [13] who described Geotrupinae species from North and Central America (NCA), representing an average of 0.41 species per year.

**Family: Trogidae****Subfamily: Troginae**

Troginae subfamily contributing about 3.35% (Table 2) of total scarabaeid fauna in Akola found to be the least dominant group [8]. Studied families and subfamilies of Scarabaeoidea including Troginae and carried out morphological characterization [12]. Reported (4.44%) members of Troginae from Akola vicinity [19]. Recorded subfamilies Scarabaeinae, Melolonthinae, Rutelinae, Dynastinae, Cetoniinae under family Scarabaeidae from Melghat Tiger Reserve, Amravati district of Maharashtra.

**Diversity of scarab beetles**

Shannon biodiversity index was worked out for the total collection. Calculated diversity index supports the quantitative data collection. Moderate to rich Shannon biodiversity index ( $H=1.6903$ ) was noticed in terms of subfamilies of scarabs in Akola (Table 3). The data (Table-3) indicates that Scarabaeinae subfamily fauna showed abundance in population (0.3678), followed by Cetoniinae (0.3153), Rutelinae (0.2964), Melolonthinae (0.2614) and Hybosorinae (0.1912). Whereas subfamily Geotrupinae (0.1445) had moderate abundance of Scarabaeids fauna. Troginae (0.1137) subfamily showed lower population of scarabaeid fauna. However, moderate to rich Shannon biodiversity index (1.6903) was noticed in terms of subfamilies of scarabs in Akola [7]. Calculated the biodiversity of white grub species by diversity indices in western Maharashtra, India [2]. Reported diversity of beetles by Shannon-weaver indices (2.29) in and around Amba reserve forest, western ghat, Kolhapur.

**Conclusion**

The present respective study concluded that the initiation of scarab beetles infestation (activity) from second week of June to third week of October in *kharif* season. Peak activity of scarabs was noticed in 30th meteorological week (21<sup>st</sup>-27<sup>th</sup> July). Scarab beetles population exhibited non-significant, negative correlation with maximum temperature, evaporation, bright sunshine hours and significant, positive with minimum temperature, relative humidity and rainfall. Superfamily Scarabaeoidea found most diverse group in Akola vicinity out of which family Scarabaeidae found dominant. This data helpful for planning integrated pest management strategies.

**Table 1:** Correlation between weather parameters and light trap catches of scarab beetles in Akola during *kharif* season, 2014

Sr No	Meterological Week	Date	Specimens collected	Weather parameters							
				Temperature (°C)		Relative Humidity (%)		Rainfall (mm)	Wind Velocity (km/hr)	Evaporation	Bright sunshine hours
				Max	Min	Max	Min				
1	24	9-15 June	18	43.9	29.1	50.6	24.6	4.5	9.3	14.7	7.8
2	25	16-22	13	39.9	26.2	62.1	27.4	22.5	10.6	14.0	6.9
3	26	23-29	9	37.5	26.7	65.3	32.4	1.5	12.6	12.8	5.6
4	27	30-6 July	6	38.2	26.9	60.6	30.7	1.7	15.6	15.4	5.6
5	28	7-13	50	38.4	26.5	68.4	37.1	1.2	15.3	14.4	5.5
6	29	14-20	36	34.5	25.2	80.1	46.7	46.1	9.1	7.4	2.5
7	30	21-27	89	31.8	24.2	88.0	67.6	39	7.7	4.3	1.9
8	31	28-3 Aug	37	28.9	22.5	90.3	71.4	187.9	12.6	3.7	1.2
9	32	4-10	25	30.2	23.7	90.3	63.7	32	6.5	5.0	2.4
10	33	11-17	15	31.7	23.9	88.3	55.1	13.9	11.8	7.8	4.5
11	34	18-24	27	33.7	23.6	88.0	48.6	4.2	11.1	7.9	7.0
12	35	25-31	66	33.9	23.6	92.9	51.9	31.1	3.6	4.7	6.0

13	36	1-7 Sep	75	30.6	22.8	91.7	71.7	49	3.0	4.6	3.7
14	37	8-14	16	29.8	23.0	91.9	66.7	49.6	6.5	6.9	3.3
15	38	15-21	4	28.4	22.4	90.6	72.4	85.4	9.6	5.9	2.7
16	39	22-28	7	32.2	22.8	91.3	58.1	0	6.2	5.2	5.5
17	40	29-5 Oct	7	33.8	21.4	82.7	41.4	2.5	2.5	4.3	8.1
18	41	6-12	4	36.0	21.1	78.7	30.6	0	1.0	4.7	7.5
19	42	13-19	2	34.5	22.1	69.0	37.1	0	2.1	6.8	5.3
Correlation coefficient (r)				-0.197	0.462*	0.542*	0.461*	0.651*	-0.470*	-0.263	-0.452

Table (r=0.456)

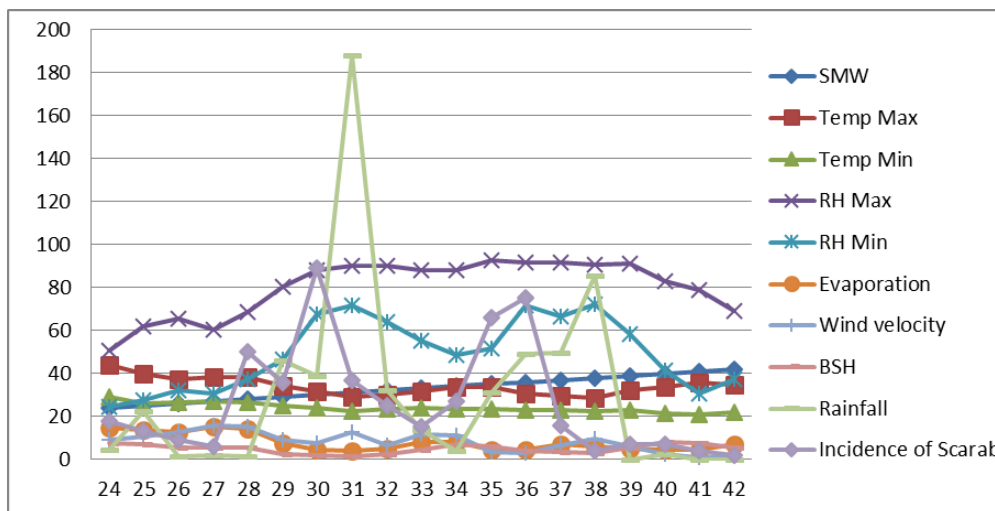


Fig 1: Correlation between weather parameters and light trap catches of scarab beetles in Akola during kharif season, 2014 (X- Meteorological Weeks, Y- No. of Scarab beetles trapped)

Table 2: Categorization of collected scarabaeid fauna and subfamily wise per cent composition of scarabaeid fauna in Akola 2014

Sr. No	Superfamily	Family	Percentage (%)	Subfamily	Percentage (%)
1.	Scarabaeoidea	Scarabaeidae	84.58	Scarabaeinae	36.56
2.				Cetoniinae	18.97
3.				Rutelinae	16.40
4.				Melolonthinae	12.64
5.		Hybosoridae	7.31	Hybosorinae	7.31
6.		Geotrupidae	4.74	Geotrupinae	4.74
7.		Trogidae	3.35	Troginae	3.35
				Total	100

Table 3: Subfamily wise Shannon Biodiversity Index of scarabaeid fauna in Akola during 2014

Subfamily	pi(ln(pi))
Scarabaeinae	-0.3678
Cetoniinae	-0.3153
Rutelinae	-0.2964
Melolonthinae	-0.2614
Hybosorinae	-0.1912
Geotrupinae	-0.1445
Troginae	-0.1137
H'	1.6903

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