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Population density of white grubs (Scarabaeidae: Coleoptera) in different crop ecosystem

Sushil Kumar and Ajay Kumar Pandey

Abstract
Comparative studies on the density of white grub community (Coleoptera: Melolonthidae) occurring in different crop ecosystem fields in Uttarakhand (U.S. Nagar, Nainital and Champawat) and Uttar Pradesh (Bareilly), are presented. Sampling was carried out in different crops during August, October and December, 2019 and 2020. The selected crop was chosen in each locality. The grubs were collected and counted to determine the population density. In the month of August, 2019, the highest mean population of white grub in U.S. Nagar and Bareilly was recorded from sugarcane with 2.92/m^2 and 3.00/m^2 at 18.30cm and 18.60 cm of soil depth, while in Nainital and Champawat the highest mean population of white grub was observed from the Litchi with 3.80/m^2 and 3.13/m^2 at 14.60cm and 15.00cm of soil depth, respectively. These results showed that the population density of white grubs increases, and their community composition is affected in cultivated areas.

Keywords: White grubs, population density, sugarcane, litchi

Introduction
White grubs are polyphagous and attack several crops grown during the monsoon season in India *viz*., Bajra (pearl millet), castor, chillies, groundnut, sorghum, maize sugarcane, soybeans and number of leguminous plants (Srivastava and Khan, 1963; Chandra *et al*., 2015) [16, 3]. Three species *viz*., *A. dimidiata* (Hope), *H. longipennis* (Blanch.) and *H. seticollis* (Moser) are predominant species in the state damaging almost all vegetables like cabbage, cauliflower, brinjal, tomato, capsicum, cucurbits, okra, pea, potato, garlic, rose, carnation, gladiolus, chrysanthemum and marigold grown during August-April (Singh *et al*., 2002) [14]. Out of many agro-ecological regions of India, Uttarakhand, Himachal Pradesh and Jammu-Kashmir constitute North Western Himalayan region is identified as hotspot for white grub diversity. The hilly areas of these states with unique topography, floral diversity, soil types and climatic condition help in sustenance of sufficient diversity of white grubs. The first epidemic of white grubs in hills was noticed in Shimla during the year 1980, and recorded about 85% potato tuber damage (Mishra and Chandel, 2003) [9]. It has been recorded adult scarabaeid are nocturnal in nature and also cause economic damage along with the immature stages to the crops grown in different parts of the world (Guppy and Harcourt, 1970; Potter *et al*., 1992; Chandra *et al*., 2012) [5, 11, 2]. It may cause losses to the extent of 40-80 per cent (Prasad and Thakur, 1959) [13], due to which white grub is declared as pests of national importance in India (Yadav and Vijayavergia, 1994, ICAR, 1974) [18, 6]. Therefore, an All India Coordinated Research Project on white grubs with its centres in Maharashtra, Karnataka and Rajasthan was started. In these areas the grub stage was considered to be the main damaging stage and major emphasis was given on the insecticidal control of this pest (Prasad, 1983) [12]. In Tamil Nadu the yield loss due to white grubs was reported to be as high as 100 per cent (Chelvi *et al*., 2010) [4]. As white grubs cause severe damage to different crop ecosystem, the farmers of India, mainly in Uttarakhand and Uttar Pradesh were facing the threat of white grubs, that decreases the production of different crops, thus the work was chosen to manage the menace of white grub. To increase the crop productivity, management of insect-pest, there is need to know the population density of white grub in various crop ecosystem and their biology. Due to diversity in agro-ecological conditions the importance of insect pests varies and therefore, management strategy should be adopted accordingly.

Material and Methods
For infestation of white grub, different stages of white grub were collected from different location. The monthly survey was conducted in August, October and December from

Uttarakhand (Udham Singh Nagar, Nainital and Champawat district) and Uttar Pradesh (Bareilly district) to observe the population density of white grub in different crops by using quadrat sampling method. For the field study, a pit sample size of 1 × 1 m^2 area of pit was made in five different locations in each available crop field at various locations of selected areas (Valmorbida *et al*., 2018) [17]. During the sampling process grubs stages was collected. Finally, mean population density of grub was worked out for all five spots, fields and locations.

Results and Discussion

Average population density of white grub per square meter area in different crop ecosystem in the month of August, 2019 and 2020

The survey was conducted in the month of August, 2019. In U. S. Nagar, the highest mean population of white grub (2.92/m^2) was recorded from sugarcane at 18.30cm of soil depth followed by Litchi, mango, guava and chilli with 2.73/m^2, 1.36/m^2,1.32/m^2 and 1.24/m^2 at 14.00cm, 13.40cm, 13.20cm and 13.80cm of soil depth, respectively. In Nainital, the highest population was recorded from Litchi with 3.80/m^2 at the soil depth of 14.60cm followed by guava, mango, sugarcane and chilli with 2.25/m^2, 1.96/m^2, 1.60/m^2 and 1.56/m^2 at 14.68cm, 15.30cm, 15.50cm, and 12.42cm of soil depth, consecutively. At the same time in Champawat, the highest mean population of white grub was recorded from litchi with 3.13/m^2 at 15.00cm of soil depth followed by mango, guava and sugarcane with 2.15/m^2, 1.93/m^2 and 1.80/m^2 at 15.45cm, 15.13cm, and 16.60cm of soil depth, respectively. The lowest mean population 1.30/m^2 was recorded from the chilli at the soil depth of 14.50cm. Similarly, In Bareilly the maximum mean population of white grub per square meter was recorded from the Sugarcane with 3.00/m^2 at 18.60cm of soil depth followed by mango and chilli with 2.08/m^2, 1.28/m^2 and 1.16/m^2 at 15.72cm and 13.00cm of soil depth, consecutively (Table 1).

During in the month of August (2020), the highest population of white grub in U.S. Nagar was recorded from the sugarcane with 2.68/m^2 at 16.30cm of soil depth followed by Litchi and mango with 2.15/m^2 and 1.56/m^2 at 12.50cm and 17.30cm of soil depth, respectively. While the same population density of white grub (1.52/m^2) was recorded from the Guava and chilli at different soil depth *i.e*., 15.20cm and 12.72cm, consecutively. In Nainital district, the highest population of white grub was recorded from the Litchi (2.70/m^2) at 14.50cm of soil depth followed by mango, guava and sugarcane with 1.96/m^2, 1.95/m^2, and 1.40/m^2 at 16.62cm, 14.88cm and 17.30cm of soil depth, consecutively. The lowest population density of white grub was recorded from the chilli (1.40/m^2) at 12.88cm of soil depth. At the same time in Champawat district the highest population of white grub i.e., 3.60/m^2 was recorded from the Litchi at 15.33cm of soil depth followed by sugarcane, mango, Guava and Chilli with 2.60/m^2, 2.05/m^2, 1.53/m^2 and 145/m^2 at 19.10cm, 16.48cm, 14.80cm and 11.93cm of soil depth, respectively. In Bareilly, the maximum population of white grub was recorded from the sugarcane with 1.64/m^2 at 17.94cm of soil depth followed by mango and chilli with 1.48/m^2 and 1.12/m^2 at 17.16cm and 13.44cm of soil depth, consecutively.

Average population density of white grub per square meter area in different crop ecosystem in the month of October, 2019 and 2020

The survey was conducted in the month of October, 2019. In U. S. Nagar, the maximum mean population density of white grub (3.12/m^2) was recorded from sugarcane at 20.40cm of soil depth followed by Litchi, guava, mango and chilli with 2.85/m^2, 1.28/m^2, 1.24/m^2 and 1.00/m^2 at 23.40cm, 22.20cm, 24.75cm and 16.72cm of soil depth, respectively. In Nainital, the highest population of white grub was recorded from Litchi with 3.95/m^2 at the soil depth of 25.45cm followed by sugarcane, mango, guava and chilli with 2.50/m^2, 1.76/m^2, 1.35/m^2 and 1.00/m^2 at 22.30cm, 24.98cm, 23.00cm and 19.15cm of soil depth, consecutively. During the same time in Champawat, the highest mean population of white grub was recorded from litchi with 2.33/m^2 at 25.60cm of soil depth followed by mango, sugarcane, Guava and chilli with 1.55/m^2, 1.30/m^2, 1.13/m^2 and 1.00/m^2 at 26.27cm, 25.20cm, 21.00cm and 20.60cm of soil depth, respectively. Similarly, In Bareilly the maximum mean population of white grub per square meter was recorded from the Sugarcane with 2.28/m^2 at 23.08cm of soil depth followed by mango and chilli with 1.24/m^2 and 0.88/m^2 at 26.36cm and 19.24cm of soil depth, consecutively (Table 1).

During in the month of October (2020), the highest mean population density of white grub in U.S. Nagar was recorded from the sugarcane with 2.80/m^2 at 21.40cm of soil depth followed by Litchi, guava, mango and chilli with 2.00/m^2 1.24/m^2, 1.20/m^2 and 1.08/m^2 at 21.25cm, 21.92cm, 27.60cm and 20.80cm of soil depth, respectively. In Nainital district, the maximum population of white grub was recorded from Litchi (2.15/m^2) at 23.18cm of soil depth followed by sugarcane and chilli with 2.10/m^2 and 1.20/m^2 at 21.00cm and 18.84cm of soil depth respectively. While the same population 1.60/m^2 was recorded from the mango and guava at different soil depth of 23.24cm and 20.83cm, consecutively. At the same time in Champawat district the highest population of white grub i.e., 1.70/m^2 was recorded from the sugarcane at 20.70cm of soil depth followed by litchi, mango and chilli with 1.27/m^2, 1.10/m^2 and 0.90/m^2 at 25.00cm, 25.70cm and 22.75cm of soil depth, consecutively. The lowest mean population density of white grub was recorded from the guava with 0.73/m^2 at 25.00cm of soil depth. Similarly, In Bareilly the maximum average population of white grub was recorded from the sugarcane with 1.56/m^2 at 22.24cm of soil depth followed by mango and chilli with 1.16/m^2 and 0.76/m^2 at 24.60cm and 20.88cm of soil depth, consecutively.

Average population density of white grub per square meter area in different crop ecosystem in the month of December, 2019 and 2020

The survey was conducted in the month of December, 2019. In U. S. Nagar, the highest mean population density of white grub (2.70/m^2) was recorded from litchi at 31.75cm of soil depth followed by mango and chilli with 1.35/m^2 and 1.00/m^2 at 35.20cm and 30.02cm of soil depth, respectively. While the same mean population of white grub was recorded from the sugarcane and guava with 1.12/m^2 at different soil depth of 32.52cm and 30.52cm, respectively. In Nainital, the highest

population of white grub was recorded from Litchi with 2.55/m^2 at the soil depth of 33.45cm followed by sugarcane, guava, mango and chilli with 2.50/m^2, 2.10/m^2, 1.60/m^2 and 1.16/m^2 at 32.00cm, 29.60cm, 33.55cm and 28.88cm of soil depth, consecutively. At the same time in Champawat, the maximum mean population of white grub was recorded from mango with 2.50/m^2 at 33.55cm of soil depth followed by sugarcane, litchi and Guava with 2.40/m^2, 2.27/m^2 and 1.47/m^2 at 31.70cm, 32.00cm and 32.27cm of soil depth, respectively. The lowest mean population of white grub 0.70/m^2 was recorded from the chilli at the soil depth of 27.35cm. Similarly, In Bareilly the maximum mean population of white grub per square meter was recorded from the Sugarcane with 2.60/m^2 at 30.84cm of soil depth followed by mango and chilli with 1.72/m^2 and 1.00/m2 at 31.00cm and 28.20cm of soil depth, consecutively (Table 1).

During in the month of December (2020), the highest mean population density of white grub in U.S. Nagar was recorded from the litchi with 2.10/m^2 at 29.00cm of soil depth followed by mango and chilli with 1.64/m^2 and 0.92/m^2 at 33.72cm and 29.36cm cm of soil depth, respectively. while the same mean population of white grub (1.20/m^2) at 31.88cm of soil depth was recorded from sugarcane and guava. In Nainital district, the maximum population of white grub was recorded from sugarcane (3.30/m^2) at 32.10cm of soil depth followed by litchi, guava and mango with 1.90/m^2, 1.85/m^2 and 1.56/m^2 at 30.65cm, 33.00cm and 33.50cm of soil depth respectively. The lowest mean population of white grub was recorded from the chilli with 0.60/m^2 at 27.92cm of soil depth. At the same time in Champawat district the maximum mean population of white grub i.e., 2.90/m^2 was recorded from the sugarcane at 32.40cm of soil depth followed by litchi, guava, mango and chilli with 1.47/m^2, 1.33/m^2, 1.10/m^2 and 0.50/m^2 at 29.33cm, 34.00cm, 34.95cm and 28.50cm of soil depth, consecutively. Similarly, In Bareilly the maximum average population of white grub was recorded from the sugarcane with 1.76/m^2 at 30.68cm of soil depth followed by mango and chilli with 1.28/m^2 and 0.80/m^2 at 32.62cm and 25.92cm of soil depth, respectively. It is evident from the above findings that all the given host are damaged by white grub and the similar result was agreement with Mishra and Singh (1991) [8]; Mishra and Singh (1996) [7]. Similarly, Chandel *et al.* (2003) [1] was also reported that white grub (*Brahmina coriacea*) infestation in Shimla hills is predominating species. They noticed that egg, grub, pupae stages occur in the soil during May, June-July, September-April, respectively. The result was partially agreement with Sood *et al.* (2010) [15] observed that the increase in grub population from June-August in kidney bean fields. The average grub population of *B. coriacea* and *H. longipennis* in soil was maximum (1.665 grubs/ft^3 area) in the month of August. Similar trend in grub population in adjoining pea and buck wheat fields was also noticed. Pathania *et al.* (2012) [10] was also reported that six species of white grubs *viz., B. coriacea, B. flavosericea, M. indica, H. longipennis, P. dionysius* and *A. dimidiata* causing damage to potato in Himachal Pradesh. There was 42.5 per cent tuber infestation of *B. coriacea* grubs at Shillaroo in Shimla hills.

Table 1: Average population density of white grub per square meter in different crop ecosystem during 2019 and 2020

Months and seasons	Population & soil depth	U.S. Nagar					Nainital					Champawat					Bareilly		
2019		Mango	Guava	Litchi	Sugar cane	Chilli	Mango	Guava	Litchi	Sugar cane	Chilli	Mango	Guava	Litchi	Sugar cane	Chilli	mango	Sugar cane	Chilli
August	Population (m2)	1.35	1.32	2.55	2.92	1.24	1.96	2.25	3.80	1.60	1.56	2.15	1.93	3.13	1.80	1.30	2.08	3.00	1.28
	Soil depth (cm)	13.00	13.20	13.00	18.30	13.80	15.30	14.68	14.60	15.50	12.42	15.45	15.13	15.00	16.60	14.50	15.72	18.60	13.00
October	population (m2)	1.25	1.28	2.85	3.12	1.00	1.76	1.35	3.95	2.50	1.00	1.55	1.13	2.33	1.30	1.00	1.24	2.28	0.88
	Soil depth (cm)	24.75	22.20	23.40	20.40	16.72	24.98	23.00	25.45	22.30	19.15	26.27	21.00	25.60	25.20	20.60	26.36	23.08	19.24
December	Population (m2)	1.35	1.12	2.70	1.12	1.00	1.60	2.10	2.55	2.50	1.16	2.50	1.47	2.27	2.40	0.7	1.72	2.60	1.00
	Soil depth (cm)	35.20	30.52	31.75	32.52	30.02	32.84	29.60	33.45	32.00	28.88	33.55	32.27	32.00	31.70	27.35	31.00	30.84	28.20
2020																			
August	Population (m2)	1.56	1.52	2.15	2.68	1.52	1.96	1.95	2.70	1.50	1.40	2.05	1.53	3.60	2.60	1.45	1.48	1.64	1.12
	Soil depth (cm)	17.30	15.20	12.50	16.30	12.72	16.62	14.88	14.50	17.30	12.88	16.58	14.80	15.33	19.10	11.93	17.16	17.94	13.44
October	population (m2)	1.20	1.24	2.00	2.80	1.08	1.60	1.60	2.15	2.10	1.20	1.10	0.73	1.27	1.70	0.90	1.16	1.56	0.76
	Soil depth (cm)	27.60	21.92	21.25	21.40	20.80	23.24	20.83	23.18	21.00	18.84	25.70	24.87	25.00	20.70	22.75	24.60	22.24	20.28
December	Population (m2)	1.64	1.20	2.10	1.20	0.92	1.56	1.85	1.90	3.30	0.60	1.10	1.33	1.47	2.90	0.50	1.28	1.76	0.80
	Soil depth (cm)	35.72	31.88	29.00	31.88	29.36	33.5	33.00	30.65	32.10	27.92	34.95	34.00	29.33	32.4	28.50	32.62	30.68	25.92

Conclusion

A survey was conducted in the month of August, October and December in Uttarakhand (U.S. Nagar, Nainital and Champawat) and Uttar Pradesh (Bareilly) during 2019 to 2021 to assess the population density of white grubs in various crop ecosystem like Mango, Guava, Litchi, sugarcane and chilli etc. It can be concluded that first, second and third instars grubs was observed in months of August to November. The knowledge of which white grub species are present in a field and its population densities assist farmers to take proper management decisions.

References

1. Chandel RS, Chandla VK, Sharma A. Population dynamics of potato white grubs in Shimla hills. Journal of Indian Potato Association. 2003;30(1-2):151-152.
2. Chandra K, Gupta D, Uniyal VP, Bharadwaj M, Sanyal AK. Studies on scarabaeid beetles (Coleoptera) of Govind wildlife sanctuary, Garhwal, Uttarakhand, India. Biological Forum-An International Journal. 2012;4:48-54.
3. Chandra K, Gupta D, Goel SC. On Scarab beetles (Coleoptera: Scarabaeidae) from Sidhi district of Madhya Pradesh, India. Uttar Pradesh Journal of Zoology. 2015, 235-243.
4. Chelvi CT, Thilagaraj WR, Kandasamy R. Laboratory culture and virulence of Beauveria brongniarti (Metschinikoff) isolates on sugarcane white grub, Holotrichia serrata F (Coleoptera: Scarabidae). Journal of Biopesticides. 2010;3:177.
5. Guppy JC, Harcourt DG. Spatial pattern of the immature stages and teneral adults of Phyllophaga sp. (Coleoptera:

Scarabaeidae) in a permanent meadow. The Canadian Entomologist. 1970;102(11):1354-1359.
6. Indian Council of Agricultural Research. Minutes of meeting of workshop group on white grub, 1997, held on March,16 1974 in I.C.A.R.
7. Mishra PN, Singh MP. Studies on the white grubs (Coleoptera: Scarabaeidae) prevalent in Uttar Pradesh hills. Annals of Agricultural Research. 1996;17(4):411-413.
8. Mishra PW, Singh MP. Evaluation of some insecticide against the white grub beetle, Holotrichia longipennis (Melolonthidae coleopteran) damaging apple trees. Indian Journal of Entomology. 1991;53(2):210-215.
9. Mishra SS, Chandel RS. Potato white grubs in India. Technical Bulletin No. 60, CPRI, Shimla, India. 2003, 47.
10. Pathania M, Chandel RS, Verma KS, Mehta PK. A survey study of potato white grubs in Himachal Pradesh. In: Proceeding of National Seminar on Indian Agriculture, Remedies and Road map, CSK HPKV, Palampur. 2012 Aug 4-5, 60.
11. Potter DA, Patterson CG, Redmond CT. Influence of turf grass species and tall fescue endophyte on feeding ecology of Japanese beetle and southern masked chafer grubs (Coleoptera: Scarabaeidae). Journal of Economic Entomology. 1992;85:900-909.
12. Prasad MS. In: M.Sc. thesis Population estimation of white grubs (Coleoptera: Scarabaeoidea) in the ground nut crop at Pantnagar and relative efficacy of some granular insecticides. Submitted to G. B. Pant University of Agriculture and Technology, Pantnagar (Nainital), U.P. 1983.
13. Prasad SK, Thakur C. White grub Lachnosterna consanguinea (Blanch): a new menace to sugarcane. Indian Journal of Entomology. 1959;(21):184-189.
14. Singh SS, Mishra PN, Nainwal NC. Status and management of white grub Coleoptera: Scarabaeidae) in horticultural crops. Progressive Horticulture. 2002;34(1):6-16.
15. Sood P, Chandel RS, Mehta PK, Chaudhary A. Diversity of soil insects in kidney bean ecosystem and their management in north-western Himalaya. Journal of Food Legumes. 2010;23(1):66-70.
16. Srivastava BK, Khan KM. Bionomics and control of Holotrichia insularis (Melolonthinae: Coleoptera). Indian Journal of Entomology. 1963;25:347-354.
17. Valmorbida I, Cherman MA, Perini CR, Cavallin LDA, Guedes JVC. Population analysis of white grubs (Coleoptera: Melolonthidae) throughout the Brazilian Pampa biome. Revista Brasileira de Entomologia. 2018;62:275-282.
18. Yadava CPS, Vijayvergia JN. Bio-ecology of white grubs and their management in different cropping systems. Ecology and biology of soil organisms. Udaipur, Agro-tech Publishing Academy. 1994, 179-200.