

Population Ecology of White Grub — A Soil Pest of Groundnut in East Uttar Pradesh, India

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The groundnut [*Arachis hypogea* L.] is a monsoon based, principal edible vegetable oil seed crop of India. It's cultivation, because of leguminous cash crop has been encouraged during the rainy season since 1970 in East Uttar Pradesh. It has replaced the cultivation of pearl millet [*Pennisetum typhoides*] and encouraged the cultivation of wheat in sandy loam soil of the Indogangetic belt. This change in the cropping system coupled with developmental activities which have accelerated the multiplication and distribution of different species of insect pests, including white grubs /NATH and SINGH, 1979-1980; VEERESH, 1980; NATH, 1987/. It is interesting to state that *Holotrichia* spp. is a serious pest of this crop in different parts of the country /RAO et al., 1976; KUSHWAHA, 1976; YADAVA et al., 1977; REDDY, 1982; REDDY and GHEWANDE, 1986/ but remained unreported from East Uttar Pradesh. Instead many other species of white grubs are common in groundnut fields of this area /NATH and SINGH, 1983/. Such distribution and abundance of white grubs mainly depend on the soil characteristics and availability of host plants /REINHARD, 1946/. Therefore, the present study was aimed to identify the prevalent white grub species associated with groundnut, their temporal distribution and the biomass along with natural enemies.

Materials and methods

The groundnut fields were selected in the white grub infested area of Varanasi and Mirzapur districts of East Uttar Pradesh. Five random samples each of 1 m² were taken at monthly intervals from the selected fields. In the process the soil was dugout to 30 cm depth and sieved for grubs and other stages of the pest. The physico-chemical properties of the soil were determined according to the methods of WALKLEY and BLACK /1934/ and BUCKMAN and BRADY /1968/. The mechanical properties were determined as described by PIPER and DOVAL /1966/.

Results and discussion

Qualitative composition

A total of 14 species of white grubs belonging to 3 subfamilies were recorded from the groundnut fields of both districts viz Varanasi and Mirzapur. The white grub species encountered identified familywise are given hereunder:

Melolonthinae: Apogonia ferruginea Fab., A. uniformis B., A. roucca, Autoserica nathani Dalla Torre, A. insanabilis Br., Schizonycha ruficollis Fab.

Rutelinae: Anomala bengalensis Blanch., A. dorsalis Fab., A. ruficapilla Burm., Adoretus versutus Ha., A. decanus., A. limbatus BL., A. lasiopygus. Em.

Dynastinae: Clyster trachipygus.

All these species were observed in the groundnut fields but their population varied in the different fields. However, the more prevalent white grubs in groundnut fields were Apogonia spp., Schizonycha ruficollis and Anomala ruficapilla.

Temporal population distribution

The population of different stages of white grub /i.e. egg, grub and adult/ recorded during different months from July to December in different groundnut fields are given in Tables 1 and 2.

The temporal distribution of white grub population varied among the sites, the maximum number of eggs occurred in the month of July, followed by August /Table 1/. Thereafter, no eggs were noticed from any groundnut fields. However, the grubs remained prevalent during July to December in all the groundnut fields, except in the village Tikari where the samples were taken only up to November /Table 2/. White grub population was maximum in August and declined in subsequent months in all the groundnut fields. But

Table 1
Monthly population of adult and egg of white grub per m² in groundnut fields

Months	Sites					
	Tikari	Bahadurpur	Chandauli	Dharmalpur	Majhawa	Taras
	<u>Adult</u>					
1978 July	7.6	8.2	7.0	8.4	8.8	
August	5.6	3.6	5.4	6.6	5.8	
September	1.0	1.2	2.0	1.4	1.4	
1979 July	7.2	7.4	6.4	7.2	7.8	
August	4.0	4.6	4.8	5.6	4.0	
September	0.8	1.0	1.0	1.4	0.8	
	<u>Egg</u>					
1978 July	3.8	8.2	7.4	10.4	12.4	
August	4.8	3.6	3.4	5.4	5.0	
1979 July	7.8	7.4	6.2	9.6	11.4	
August	4.2	4.6	4.2	4.0	8.4	

Table 2

Monthly population and biomass /mg/ of white grub per m² in groundnut fields

Sites	1978			1979								
	July	Aug.	Sept.	Oct.	Nov.	Dec.	July	Aug.	Sept.	Oct.	Nov.	Dec.
<u>Tikari</u>												
Population	10.0	13.4	12.0	10.4	9.4	--	8.0	11.6	10.4	9.8	8.8	--
Fresh weight	49.4	307.0	676.2	720.0	820.6	--	82.8	119.4	609.2	630.6	774.8	--
Dry weight	8.8	85.6	157.4	177.0	206.8	--	17.2	87.8	138.6	156.4	188.4	--
<u>Bahadurpur</u>												
Population	12.0	15.6	13.2	11.2	10.6	10.2	11.0	14.2	13.0	10.6	9.0	8.4
Fresh weight	144.2	691.0	655.0	778.6	858.6	885.0	104.6	602.4	635.0	701.2	709.4	720.2
Dry weight	43.0	159.6	197.0	220.0	235.6	248.4	85.2	144.2	189.4	199.4	215.0	235.0
<u>Govt. Farm Chandauli</u>												
Population	12.4	14.0	12.8	12.0	11.2	9.4	11.2	13.0	11.0	10.0	9.2	6.8
Fresh weight	107.2	529.0	854.6	906.8	1037.8	980.0	86.4	448.4	687.6	688.6	747.4	645.8
Dry weight	30.6	103.0	200.2	214.2	228.4	219.2	26.6	80.5	162.6	147.6	155.2	169.2
<u>Dharanmalpur</u>												
Population	5.0	12.6	12.0	11.4	10.6	10.2	4.2	12.0	11.6	11.4	9.4	9.0
Fresh weight	126.4	830.4	846.2	942.6	966.0	985.0	105.8	750.2	785.0	821.0	888.2	893.6
Dry weight	26.8	190.8	230.2	269.2	272.4	287.6	24.4	172.0	208.8	231.8	247.6	254.0
<u>Majhawa Taras</u>												
Population	8.8	15.6	13.6	11.0	10.8	10.0	7.0	13.8	13.4	11.6	10.4	10.2
Fresh weight	99.2	756.8	827.0	942.2	996.8	980.0	73.4	657.0	871.6	932.2	988.6	980.8
Dry weight	20.4	135.8	170.2	203.0	221.0	218.2	16.0	112.0	152.0	205.0	225.6	218.4

the grub biomass was maximum and minimum during December and July, respectively. The fresh and dry biomass of the grub registered increasing trends in the subsequent months after July. The life cycle of white grub starts with the onset of monsoon during the second fortnight of June. The adult beetles emerged out from the soil after 7.30 p.m. and feed on the host trees i.e. *Acacia arabica* Ugarkhurd and *Azadirachta indica* /L./ Pers commonly available in the fields or in the proximity. The female beetles after feeding and mating lay eggs in the groundnut fields. Accordingly the numbers of eggs were maximum in July. After hatching, the grubs population were maximum during August. PAL and DOVAL /1970/ have also reported it's maximum density during this month. The variation in the grub population encountered in the groundnut fields of different sites may be due to the availability of host plants, cultivation practices and the soil type. The maximum numbers of grub /i.e. 15.60 per m²/ were recorded in the fields of the villages Bahadurpur and Majhawa Taras. The soil type of the selected fields are sandy loam /Table 3/, and the host trees /*Acacia arabica*/ are abundantly distributed in and around the groundnut fields, with the exception of the Government Farm, Chandauli, where the soil is loam and *Azadirachta indica* trees are more common than the *Acacia* trees. The decline in grub population after August is attributed to abiotic soil factors that govern the insect activity in the soil. The organic matter content and the pH of the soil recorded during different months did not vary much under the present study /Table 3/. The white grubs usually move downwards in the soil with the gradual decline of soil moisture. The soil temperature is also known to regulate the vertical movement of the grubs but recorded negligible variation in the groundnut cropping season of East Uttar Pradesh /Table 3/. In general, they go under pupation during March to May. Hence, the pupae could not be recorded as the crop was harvested. The populations of adult beetles were maximum during July, followed by August and September because of their emergence in in-

Table 3
Mechanical and physico-chemical properties of groundnut fields

Properties	Sampling sites				
	Tikari	Bahadur- pur	Govt.Farm Chandauli	Dhammal- pur	Majhawa Taras
Sand /%/	62.00	67.60	53.30	71.50	72.50
Silt /%/	22.50	18.10	25.65	17.90	11.05
Clay /%/	15.50	14.30	21.04	10.60	16.45
Soil texture	Sandy- loam	Sandy- loam	Loam	Sandy- loam	Sandy- loam
Bulk density	1.60	1.59	1.25	1.65	1.58
True density /%/	2.42	2.39	2.50	2.38	2.44
Pore space /%/	33.88	33.47	50.00	30.67	35.25
Water holding capacity /%/	35.88	33.62	43.25	30.45	29.85
Soil temp. °C	20.1- 30.8	14.3- 30.4	15.2- 28.7	17.0- 31.5	18.8- 30.7
Soil Moisture /%/	6.3- 29.9	3.3- 29.3	5.2- 32.9	3.7- 29.5	3.9- 28.5
Organic matter /%/	0.71- 0.96	0.62- 0.82	0.54- 0.85	0.61- 0.77	0.5- 0.77
pH	7.5- 7.9	0.74- 0.78	7.3- 7.8	7.4- 7.8	7.5- 7.9

creased numbers soon after monsoon rains during the second fortnight of June /Table 1/.

The natural enemies of white grubs also play an important role in declining the grub population. A grub parasite Scolia sp. and an unidentified ant predator have been recorded from the groundnut fields. The frequent hoeings in the groundnut fields also expose the grubs for predation by crow /Corvus splendens/ and Indian mynah Acridotheres tristis. These natural biological control agents also help in minimizing the white grub density under field conditions in subsequent months.

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