Study on the Population of Chafer Grub

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SHORT COMMUNICATION

Abstract

A trial was carried out in 1998 and 1999 at Tikur Inchini in Western Shewa, where barley is predominantly grown, to determine the population of the Chafer grub, *Coptognathus curtipennis*. Population counts were made after the crops (barley, tef and linseed) were harvested and on the fields left fallow for at least one year. Diggings were carried every 15 days in five quadrats per each crop or fallow land to about 20 cm depth. The larval, pupal and adult populations of the chafer grub were low in previously tef grown plots followed by barley and linseed grown plots and in plots left fallow for at least one year. The farmers at Tikur Inchini could follow cropping sequence: Fallow → Tef → Barley/Wheat → Linseed/Tef → Barley/Wheat → Linseed → Fallow. The low population of chafer grub in tef grown fields may be due to the intensive cultural practice in land preparation which usually include repeated plowings and trampling that exposed the different insect developmental stages to the adverse environmental conditions.

Introduction

Chafer grub is a serious pest whose larvae feed on the roots of many plant species including trees (Keller et al. 1997). Considerable damage was observed on barley due to Chafer grub, *Coptognatus curtipennis* Fairmaire (Coleoptera: Dynastidae) in Tikur Inchini area (Bayeh et al. 1996). The beetles feed on the roots of the barley and many other cereals and horticultural crops. In Tikur Inchini, the rotation crops are barley, wheat, tef and linseed separated by two to three seasons of fallow. This insect has a worldwide distribution such as Europe (Germany, Italy, Netherlands, and Switzerland), China and Africa (Kenya).

The adult is a fairly small beetle between 14 and 17mm long and six or seven mm wide, light brown in color (Pelley 1951). The normal sex ratio appears to be about 30% females and 70% males.

The sexually matured beetles fly for mating. After mating flight, the beetles dig into the ground and begin egg laying. Since egg laying occurs over a considerable period, there is some overlapping of instars. Keller (1993) indicated that the development of chafer grub takes three to four years depending on its geographical distribution. During the crop-growing season, when the soil is moist, nearly all the grubs are present in the top 15-20cm of soil. The third instar larvae go deeper for pupation. In dry weather it is normally found deep (more than 20cm) in the soil. Grubs may be found sometimes in large numbers, in areas of grass and bush that have never been under plowed. The insect is considered a normal constituent of the fauna of natural grasslands (Pelley 1951).

Raiser (1983) noted that considerable damage could be expected when there are more than 2-4 larvae/m^2 in beet fields and 4-6 in potato fields, more than 10/m^2 in cereal fields and more than 20/m^2 in grassland. The estimated loss on Rye and flax crops were 75% and 50%, respectively (Pelley 1951). Different control measures were tried or applied in

different countries. Control measures such as placement of nets (Brenner & Keller 1996), application of neem seed extracts, chemicals such as phosalone and deltamethrin (Rohde et al. 1996), aerial application of endosulfan (Szabad & Andrasi 1994), pathogenic micro-organisms (Keller et al.1992, Keller et al.1993) and sheep night penning (Yuan-QingHua et al. 1995) gave considerable results.

In Ethiopia, the pest was recorded on barely and on small cereals growing areas such as Tikur Inchini and very recently in Degem. In Tikur Inchini area, the pest has been causing considerable damag on barley seedlings. Farmers have been using different classes of insecticides including organochlorines as seed treatments. It was necessary to study the population of Chafer grub and this study was conducted with the objective of determining the population change of the Chafer grub, *C. curtipennis* in different fields, which were planted with different crops.

Materials and Methods

The trial was carried out in the off-seasons of 1998 and 1999. Fields previously planted with barely, tef, linseed and left fallow land for at least one year were selected after farmers had harvested their crops. Precaution was made not to select any field, which received any kind of seed or soil treating insecticide(s) in any of the above mentioned crops. A quadrat (1m x 1m) was thrown randomly in a field and digging was followed within the quadrat up to 20cm depth. Larval, pupal and adult stages of chafer grub were counted and recorded. These activities were replicated five times in each field. The counting was done every 15 days untilthe farmers started plowing their land (Middle of June).

Results

In 1998 cropping season, more number of pupae and adults were collected between January and March, which are the months that followed the crop harvest in the fields covered with barley, tef and linseed (Table 1). The high population in this period could be due to the fact that the adult beetles have the root systems of the harvested crops to feed on right after harvest. Their population starts to decline as the food reserve is getting depleted in the months between April and June. In the fallow field, the pupal and adult populations were observed to increase during May and June, which might be associated with shower of rain that enhanced the grasses and other vegetation to grow providing ample food for the adults and the larvae. Generally, the larval population was observed to decrease after March in all fields except in the field grown with linseed. The least larval population was recorded in the field grown with tef especially after April. In 1999, the highest pupal and adult counts were from fallow fields, while the lowest were from the tef fields. Highest pupal and adult counts were recorded between January and March in the fallow. The peak period for the pupal and/or adult populations was not clear in the fields on which the other crops were grown (Table 2). In 1999, higher larval population was observed between the months of February and March. Except in the fallow fields, the larval population steadily declined after March up to June. Similar to 1998, the tef fields had low population of larvae especially after April. Unlike 1998, the linseed planted fields had very low number of larvae.

Table 1. Monthly population density of chafer grub pupae, adults and larvae recorded in 5m² in 1998 cropping season.

Month	Barley field			Tef field			Linseed field			Fallow land		
	Pupa	Adult	Lavae	Pupa	Adult	Larvae	Pupa	Adult	Larvae	Pupa	Adult	Larvae
Jan	5	11	19	0	2	12	3	8	75	3	8	21
Feb	0	11	21	0	4	7	2	22	17	2	7	4
March	1	8	63	0	0	55	9	10	75	0	0	108
April	1	0	37	0	0	3	2	0	90	3	0	18
May	1	0	18	1	0	2	5	1	78	15	4	13
June	1	1	21	0	0	8	4	8	17	22	12	8
Total	9	31	179	1	6	87	25	49	352	45	31	172
Mean	0.82	2.82	14.9	0.09	0.55	7.3	2.27	4.45	29.3	4.09	2.82	14.3
S E ±	0.44	1.22	6.23	0.09	0.39	4.58	0.8	1.52	9.58	1.83	1.3	5.72

Table 2. Monthly population density of chafer grub pupae, adults and larvae recorded in 5m² in 1999 cropping season.

Month	Barley field			Tef field			Linseed field			Fallow land		
	Pupa	Adult	Lavae	Pupa	Adult	Larvae	Pupa	Adult	Larvae	Pupa	Adult	Larvae
Jan	11	1	43	1	0	17	9	5	76	23	28	39
Feb	0	5	68	0	0	105	0	1	139	0	10	86
March	1	3	78	3	1	24	3	5	125	21	12	117
April	11	3	34	5	0	7	7	0	59	3	3	91
May	0	3	29	4	1	6	4	12	71	5	7	105
June	12	4	32	9	3	8	5	4	34	11	3	96
Total	35	19	284	22	5	167	28	27	504	63	63	534
Mean	2.92	0.75	25.8	1.83	0.42	15.2	2.33	2.25	45.8	5.25	5.25	48.5
S E ±	1.18	0.4	10.43	0.72	0.26	6.72	0.53	1.01	16.63	1.88	2.08	12.85

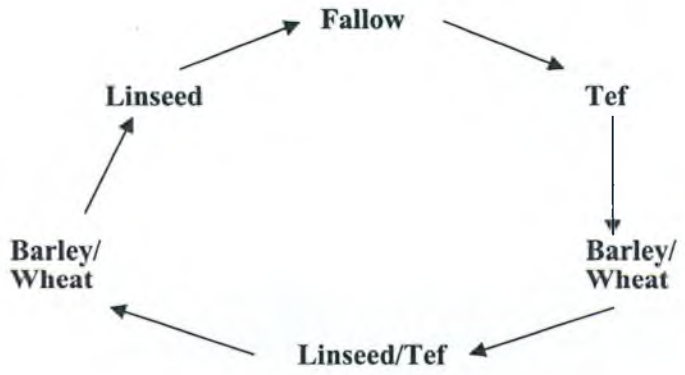

Fig. 1. Suggested cropping sequence for the reduction of Chafer grub damage in Tikur Inchini area.

Discussion

In both years, the larval, pupal and adult populations were the least in tef grown fields. This may be attributed to the cultural practice for tef sowing. Seedbed preparation for tef sowing needs a number of plowing, disking and trampling. Under this processes a large number of larvae could be physically damaged, exposed to predators, parasitoids (if any), and desiccation by sun heat. Compaction due to trampling by human foot will also hamper the movement of the larvae in the soil. In contrast to tef fields, the larval population in the fallow fields was the highest. This might be due to the undisturbed soil condition that was not exposed to the above-mentioned adverse conditions like tef fields. Keeping the land Fallow for at least one year is the usual practice in Tikur Inchini area. During this time, the different stages of chafer grub population will increase. The larval populations in previously linseed planted fields were inconsistent. It was very high in the 1998 while it was low in 1999. Previously barley sown fields showed similar trends in both years. Both linseed and barley are sown after a maximum of two plowings. Therefore, these two plowings may not be enough to decrease the larval population already in the soil of the fallow land. Tef should follow the fallow land in order to decrease already accumulated larval, adult and/or pupal population in the soil. Barley or wheat can follow tef for one or two years or may be followed by linseed because the insect population is expected to be low after tef. It could still be possible to plant for one more season before fallow. The suggested cropping sequence in and around Tikur Inchini area is presented in Fig. 1. This kind of crop rotation could minimize the chafer grub damage on the crops grown in the area. If the pest damage is still increasing, however, other option of using of chemical insecticides should be explored.

Reference

Bayeh Mulatu, Dereje Gorfu, Chilot Yirga, Elias Zerfu, Hailu Gebre H, Leur J van, Seid Ahmed, A Negash, J Van Leur. 1996. Chafer grub threatens barley in Tikur Inchini. IAR-Newsletter of Agricultural Research **11**: 11-12.

Brenner H, S Keller. 1996. Protection of orchards from white grubs (*Melolontha melolontha* L.) by placement of nets. Bulletin OILB SROP **19**: 79-82.(Abstract).

Keller S. 1993. Is there a two-year development of*melolontha?*Mitteilungen-der-chweizerischen-Entomologischen-Gesellschaft. **66**: 243-246. (Abstract).

Keller S, B Parli, M Lujan and C Schweizer. 1993. The influence of fungicides on the insect pathogenic fungus *Beauveria brongniartii* (Sacc.) Petch. Anzeiger-fur-Schadlingskunde, Pflanzenschutz, Umweltschutz.**66**: 108-114. (Abstract).

Keller S, C Schweizer, B Keller and H Brenner. 1992. Results of trials to control the cockchafer with the fungus *Beauveria brongniartii*. Mitteilungen-der-Deutschen-Gesellschaft-fur-Allgemeine-und-Angewandte-Entomologie. **8:** 99-103. (Abstract).

Keller S, C Schweizer, E Keller and H Brenner. 1997. Control of whit grubs (*Melolontha melolontha*) by treating adults with the fungus *Beauveria brongniartii*. Bio-control Science and Technology. **7:** 105-116.

Pelley R. 1951. Observations on the chafer grub-A serious pest of wheat, maize, flax and other crops in Kenya. East African Agricultural Journal. **17:** 89-97.

Raiser E. 1983. *Melolonthines*. Landtechnische-Zeitschrift. No. 6, 757. (Abstract).

Rohde M, U Bressem, G Bornholdt and U Brenner. 1996. Studies on the control of the forest chafer in southern Hessen in 1994. Forschungsberichte-Hessische-Landesanstalt-fur-Forsteinrichtung-Waldforschung-und-aldokologie. No. 22, 122pp. (Abstract).

Szabad G and Andrasi. 1994. Aerial control of maybug(*Melolontha elolontha)*.Novenyvedelem. **30:** 436-437.

Yuan-QingHua, Jiang-WenLan, Yuan-QH and Jiang-WL. 1995. Effect of sheep night penning on grass grub control and pasture recovery. Grassland of China.No. **2:** 15-19. (Abstract)