Horticulture Research and Development in Ethiopia

Proceedings of the
Second National Horticultural Workshop
of Ethiopia

1-3 December 1992
Addis Abeba, Ethiopia

Edited by
Edward Herath
Lemma Dessalegne

Institute of Agricultural Research
and
Food and Agriculture Organization

Review of Entomological Research on Root and Tuber Crops in Southern Ethiopia

Emana Getu and Amanuel Girma
Institute of Agricultural Research
P.O. Box 2003, Addis Abeba

Abstract

Millions of people in Ethiopia depend on root and tuber crops as their major or supplementary food. Root and tuber crops also give greater yield per unit of land than the major grain crops used as basic food. On small plots of land, root and tuber crops can support greater density of population than other basic food crops. The production of these crops are limited by a number of factors among which insect pests are some. To alleviate the insect pest problem of root and tuber crops many entomological research activities have been conducted. Potato tuber moth on potato and sweet potato weevil and sweet potato butterfly on sweet potato are the major insect pests on these crops that were given research priority. Hence, in this paper research findings on these pests will be reviewed. Moreover the prospects of root and tuber crops for entomological research will be discussed.

INTRODUCTION

Millions of people in Ethiopia depend on root and tuber crops as their major or supplementary food. Root and tuber crops give greater yield per unit of land than the major grain crops used as basic food crops. Insect pests can be mentioned as one of the important factors in limiting the production of these crops. Thus, the objective of this paper is to review entomological research conducted on root and tuber crops since 1985 to alleviate the problem. The root and tuber crops which will be considered in this review are mainly sweet potato and potato and enset to some extent.

RESEARCH HIGHLIGHTS

Research work conducted on sweet potato and enset pests are categorized under survey, biology and control methods.

Survey

The result of a survey made in southern Ethiopia (Sidamo and Gamo Gofa) between 1986 and 1990 on sweet potato is shown in Table 1. According to the survey sweet potato weevil (*Cylas puncticollis*) and sweet potato butterfly (*Acraea acerata*) are the major insect pests of sweet potato. In addition to the previously recorded species of insects (*Poecilcarda nigernervis, Pentalonia nigronervosa* and *Planoccus ficus*) which are suspected as vectors of bacterial wilt of enset unidentified larvae of lepidoptera in Wolaita Awraja and grass hoppers in Gedeo Awraja were recorded on enset in outbreak forms (Emana and Adhanom 1989).

Biology

The biology of sweet potato weevil was studied in Awasa and Nazret research centers. The results are indicated in Table 2. According to these studies, it takes 30 days to complete its life cycle in Awasa and 31.5 days in Nazret. Moreover the number of generations recorded per year was nine in Awasa and 8 at Nazret (Emana 1987).

Control Methods

Biological Control

The Ichneumoid known as *Charops* sp. was reared from the larvae of sweet potato butterfly collected from the infested field of sweet potato. Though the percentage of parasitization was not exactly known, the population of the wasp was extremely abundant. So our current effort in this area is to conserve the wasp by the use of safe insecticides with the appropriate rate and frequency. To this end, an experiment is in progress (Emana 1989, IAR 1988/89).

Agronomic Practices

Time of harvesting, earthing up and crop rotation are the most important agronomic practices in preventing sweet potato from weevil damage. Because of poor storage technology and planting material preservation, farmers practice piecemeal harvesting. Although sweet potato reaches physiological maturity within 3–5 months from planting, it may be left unharvested for a further six months. Sweet potato weevil infestation increases as time of harvesting is delayed. In Awasa it was observed that as time of harvesting was delayed from 5 to 6 months the infestation of sweet potato weevil increases from 29% to 68% (Emana 1990).

Exposed tubers or shallow set tubers were found to be heavily infested by the sweet potato weevil. To determine the frequency of earthing up which minimizes the infestation of the pest, experimental work is in progress.

To know the effect of crop rotation on the infestation of sweet potato weevil, an observational trial was conducted at Awasa. The results obtained indicate that sweet potato grown on the same piece of land for four years continuously showed over 70% tuber infestation; whereas under a normal rotation pattern less than 20% infestation was recorded (Emana 1990).

Table 1. Insect pests of sweet potato recorded in southern Ethiopia

Scientific Name	Common Name	Pest status
Cylas puncticollis	Sweet potato weevil	Major
Acraea acerata	Sweet potato butterfly	Major
Agrius convolvuli	Sweet potato moth	Minor
Alcidodes dentipes	Striped sweet potato weevil	Minor
Aspidomorpha tecta	Sweet potato tortoise beetle	Sporadic
Bedellia somnulentella	Sweet potato leaf miner	Minor
Bemissa tabaci	White fly	Minor
Lagria villosa	Metallic leaf beetle	Minor

Source: Emana (1989)

Table 2. Mean period required for the development of *C. puncticollis* in Awasa and Nazret

	Days	
Developmental stage	Awasa	Nazret
Egg	6.5	8.0
Larva	11.5	10.5
Pupa	12.0	13.0
Egg to adult	30.0	31.5
No. of generations/year	9	8

Source: Emana (1987)

Varietal Screening

Thirty-four varieties of sweet potato at Areka and 29 varieties in Awasa were tested against sweet potato weevil between 1987 and 1989 (Table 3). The results obtained indicate that 38% of the varieties tested at Areka were found to be resistant 62% moderately resistant and 45% susceptible (Table 4). As shown in Table 3 sweet potato varieties Koka 9A, Koka 18 and Koka 26 showed good level of resistance to the pest in both locations (Emana 1990).

According to a preliminary observation made at Areka Research Center, sweet potato varieties respond differently to the attack of sweet potato butterfly (unpub. data). Hence, to determine the level of resistance of sweet potato varieties to sweet potato butterfly an experiment is in progress with 90 varieties at Areka.

Table 3. Mean percentage infestation (PI) of spw and the class rating (CR) of the varieties.

Varieties	Areka PI	Areka CR	Awasa PI	Awasa CR
Wenago I	34.37	3	52.65	4
Wenago II	32.43	3	48.35	3
Wenago III	30.20	3	64.36	4
AJAC I	29.14	3	46.96	3
AJAC II	30.81	3	42.41	3
AJAC III	28.82	3	45.18	3
AJAC IV	13.86	2	-	-
Koka 3	31.15	3	54.57	4
Koka 6	27.34	3	54.98	4
Koka 9	25.25	3	-	-
Koka 9A	23.42	2	46.08	3
Koka 9B	11.44	2	-	-
Koka 10	33.29	3	43.50	3
Koka 12	23.38	2	52.36	4
Koka 18	22.05	2	40.60	3
Koka 25	47.65	3	46.93	3
Koka 26	24.02	2	46.93	3
Koka 28	30.73	3	40.91	3
Arba Minch I	21.29	2	61.04	4
Arba Minch II	28.52	3	50.62	4
Arba Minch III	31.10	3	-	-
Wendogenet	27.36	3	55.76	4
Abosto	31.41	3	50.00	4
Melkasa I	31.52	3	42.24	3
Melkasa II	18.07	2	-	-
Cemesa	25.78	3	59.27	4
Variety A	27.38	3	46.36	3
Alemaya	15.05	2	-	-
Boracty	-	-	43.07	3
EPID	-	-	54.43	4
Bekula	28.86	2	-	-
TIS 2534	30.03	3	61.26	4
TIS 70683	13.96	2	-	-
TIS 2544 (28)	23.64	2	-	-
TIS 3270/74/	-	-	49.32	3
TIB 2 (26)	-	-	62.40	4
Areka local	34.37	3	-	-
Awasa local	-	-	48.19	3
	NS		NS	

Source: Emana (1990)

Table 4. Resistance levels of sweet potato varieties to sweet potato weevil

	Areka		Awasa	
Levels*	No. of varieties	%	No. of varieties	%
HR	-	-	-	-
R	13	38.24	-	-
MR	21	61.76	16	55.17
S	-	-	13	44.83
HS	-	-	-	-

Source: Emana (1990)

* Adopted from IITA where:

HR =Highly resistant and class rating (CR): 1 (No. of infestation)

R =Resistant and class rating = 2 (1-25% tuber infestation)

MR =Moderately resistant and class rating = 3 (26-50% tuber infestation).

S =Susceptible and class rating = 4 (51-75% tuber infestation)

HS =Highly susceptible and class rating = 5 (> 75% tuber infestation).

Chemical Control

Loss assessment experiments were carried out between 1984 and 1987 at Nazret and Melka Werer using various insecticides. The result indicates that dipping of the cutting at planting with DDT 75% WP and foliar spray of endosulfan gave good control of sweet potato weevil. However, DDT has been banned in Ethiopia as it was done in other countries many years ago. Thus, the result obtained with regard to DDT is not usable. The amount of losses incurred by sweet potato weevil ranged from 10 to 48% (Emana 1987).

Insecticidal screening against sweet potato weevil was carried out in Awasa and Areka between 1986 and 1988. The results are presented in Table 5. According to these studies cypermethrin and primiphos methyl gave better control of sweet potato weevil at both locations as lowest percentage infestation and highest marketable yield were recorded on the plots treated with these insecticides (Emana 1990). Attempts were also made to screen insecticides against sweet potato butterfly, at Areka and the one year data indicated that carbaryl 85% WP gave good level of control (Amanuel, unpub. data).

ENTOMOLOGICAL RESEARCH ON IRISH POTATO IN SOUTHERN ETHIOPIA

Survey

A survey was conducted in the potato-growing areas of southern Ethiopia, mainly Shashemene, Kuyera and Melge Wendo.

According to the survey, potato tuber moth, *Phthorimaea operculella*, was found to be the only pest of potato (Table 6).

Control Methods

The only experiment conducted in southern Ethiopia since 1985 with regard to potato tuber moth control is a varietal screening at Awasa Research Center in 1987/88. The experiment was discontinued because of lack of planting material. The results of a one year experiment is shown in Table 7. According to these studies, potato varieties AL-580 and AL-601 were found to be relatively resistant to leaf stem and tuber attack of potato tuber moth (IAR 1987/88). The overall mean percentage infestation ranged from 9 to 36% which is a wide gap that indicates the possibilities of getting more resistant varieties even with very lower percent infestation if larger number of varieties are included in various screening programs.

Table 5. Efficacy of insecticides against sweet potato weevil

Insecticides	Areka **PI	Areka ***MY/16m^2	Awasa PI	Awasa MY/16 m^2
Carbaryl	29.94^{ab}	12.58^{ab}	46.30^{b}	7.00^{a}
Cypermethrin	23.94^{a}	26.35^{a}	36.67^{a}	8.47^{a}
Endosulfan	28.01^{ab}	13.15^{d}	44.48^{b}	9.03^{a}
Primiphos methyl	25.01^{a}	21.57^{abc}	32.46^{a}	9.13^{a}
Karate	33.01^{ab}	13.50^{cd}	50.67^{b}	7.23^{ab}
Deltamethrin	23.54^{a}	17.71^{bc}	48.63^{b}	7.02^{ab}
Diazinon depping	28.56^{ab}	10.89^{d}	53.72^{b}	7.53^{ab}
Diazinin depping + spray	31.28^{ab}	14.41^{cd}	48.06^{b}	6.04^{ab}
Diazinon spray	31.61^{ab}	10.87^{d}	48.13^{b}	5.77^{ab}
Untreated check	41.13^{b}	8.16^{d}	53.46^{b}	2.12^{b}

Source: Emana (1990)

Means followed by the same letter(s) within a column are not significantly different from each other at 5% (DMRT).

** PI = Percent infestation of tuber

***MY = Marketable yield per 16 m^2

Table 6. Pests of Irish potato recorded in Ethiopia

Scientific name	Common name	Pest status
Phthonmaea operculella	Potato tuber moth	Major
Aphis gossypii	Cotton apmid	Minor
Macrosiphum euphorbiae	Pepper apmid	Minor
Myzus persicae	Peach apmid	Minor
Acherontia atropos	Death's head Hawk Moth	Minor
Agrotis segetum	Southem cut worm	Sporadic
Dorylus sp.nr. breyinodosus	Red cut	Sporadic
Epilachna fulvosignata	Eggplant epilachna	Minor
E. hirta	Potato epilachna	Minor
E. similis	Tef epilachna	Minor
Lagria villosa	Metallic leaf beetle	Minor
Mylabris flavoguttata	Pollen beetle	Minor

Table 7. Irish potato response to potato tuber moth in Awasa in 1986/87

	Mean percent infestation of		
Variety	Stem	Leaf	tuber
AL-100	10.00	20.33cd	21abc
AL-108	11.00	15.00abc	36c
AL-148	12.00	14.00abc	23bc
AL-212	10.00	13.33ab	29abc
AL-250	10.33	12.33ab	25abc
AL-253	10.33	16.33abcd	28abc
AL-305	10.67	14.00abc	19abc
AL-335	10.67	14.00abc	20abc
AL-404	12.00	12.67ab	23abc
AL-417B	10.33	12.67ab	11a
AL-517	10.33	15.00abc	19abc
AL-528	10.33	14.67abc	14ab
AL-531	10.00	15.00abc	18abc
AL-556	10.00	21.67d	15ab
AL-578	10.00	14.00abc	13ab
AL-580	11.00	10.33a	10a
AL-601	10.33	11.00a	9a
AL-615	10.33	13.33ab	13ab
AL-624	11.67	14.67abc	14ab
UK-803	10.00	15.33abcd	9a
MS-IC-2	10.00	16.00abcd	13ab
CIP-378367-4	10.33	14.00abc	29abc
CIP-378329-7	10.00	16.67abcd	22abc
CIP-37850/-3	10.00	18.33bcd	13ab
Awasa local	10.67	15.33abcd	15ab

* Means followed by the same letter in a column are not significantly different at 5% level (DMRT).

References

1. Emana Getu. 1987. The biology of sweet potato weevil and its importance in the production of sweet potato in Ethiopia. p. 18–24. *In*: Committee of Ethiopian Entomologists (eds.) Proceedings of the 7th Annual Meeting, Addis Abeba, Ethiopia, 14–15 April 1987. Committee of Ethiopian Entomologists, Addis Abeba.
2. Emana Getu. 1990. Integrated approach to control the sweet potato weevil, *Cylas puncticollis*. p. 110–116. In Committee of Ethiopian Entomologists (eds.) Proceedings of the 10th Annual Meeting, Addis Abeba, Ethiopia, 7–9 Feb. 1990. Committee of Ethiopian Entomologists, Addis Abeba.
3. Emana Getu and Adhanom Negasi. 1989. Survey of sweet potato insect pests in the southern Ethiopia Newsletter, Committee of Ethiopian Entomologists. 3(2):16–19.
4. IAR. 1988. Progress report of Awasa Research Center for the period 1987/88. IAR Progress Rep. IAR, Addis Abeba.
5. IAR. 1989. Progress report of Awasa Research Center for the period 1988/89. IAR Progress Rep., IAR, Addis Abeba.