INSECT SPECIES ASSOCIATED WITH SWEET POTATOES (*Ipomoea batatas* (L.) LAMK) IN EASTERN KENYA

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Accepted for publication: November 18, 2008

ABSTRACT

John Nderitu, Martha Sila, Gideon Nyamasyo and Muo Kasina. 2009. *Insect Species Associated with Sweet Potatoes (Ipomoea batatas (L.) Lamk) in Eastern Kenya.* **Int. J. Sustain. Crop Prod. 4(1):14-18**

This study was conducted in Kibwezi, Eastern Kenya during 20 November 2002 to 04 June 2003 to document the insects associated with sweet potatoes *(Ipomoea batatas* (L.) Lamk) and delineate the most important pests responsible for the crop damage so that control measures against them can be developed. Sweet potato vines (cv Kemp) were planted in three plots of 4m x 4 m, which was a major growing area of the crop in Eastern Kenya. Infestation of the crop by different insect species started immediately after the crop establishment and continued for five months in each year. More than 50 insects belonging to several orders and at different stages of development infested the crop. About eight insect species caused major damage on the crop leaves, vines and tubers. The most destructive and important economic pest species were sweet potato weevil (*Cylas puncticollis* Boh.) and the clearwing moth (*Synanthedon dascyeles*). Some 21 insect species were of minor importance, as their damaging effects were not noticeable on the plant and they had low effects on the yield. Other than pests, seven insect species were found to be beneficial as predators or parasitoids of the insect pests, implying that any management practice employed for control of the major pests should consider conservation of the natural enemies.

Key words: Crop damage, *Cylas* spp., parasitoids, predators

INTRODUCTION

Sweet potato (*Ipomoea batatas* (L.) Lamk) crop is a main staple food and makes significant contribution to poverty alleviation and household food security in Kenya. The crop is grown mainly by small-scale farmers especially in marginal areas. It includes many varieties that are drought resistant. Although there are several varieties that have been bred for high yields, the production has been stagnant (MOA, 2007). The main reason has been reported as adverse weather conditions (MOA, 2007). This factor has masked the role of pests in reduction of the crop yield, especially because the crop is grown by low input users, who rarely manage pests. Sweet potatoes are usually inhabited by many insect species. Talekar (1982) reported at least two hundred species of insects that feed on sweet potatoes both in field and storage worldwide. The roots, foliage and even seeds of the plant were found to be vulnerable to the damage by these pests. There is a possibility of improving the sweet potato yields if pests are managed well. However, this can occur only if the pests are known particularly in terms of their damaging effects. The growth habit of sweet potatoes allow for the growth of different biota. Useful insects accompany such biodiversity, and they can be manipulated to form part of management options for the pests.

This study was, therefore, done with the intention of formulating cost effective management strategies for pests of sweet potatoes. It was done to specifically document the insects that infest the crop, and determine the main pests among these. The study was also done to elucidate the useful insects that can be used in an IPM system for pests of sweet potatoes.

METHODOLOGY

Sweet potato crop was planted in plots of (4m x 4 m) and replicated three times in Kibwezi, Eastern Kenya on 20 November 2002 and repeated on 04 June 2003. Sampling of insect infestation started one and half months after the sweet potato crop had established. This was done at an interval of 14 days for 5 months. During sampling, four metal-frame square quadrants (0.5m x 0.5 m) were thrown randomly in a plot to make one sampling unit representing a total area of 1m x 1 m. All insects within the quadrant were identified and counted (Sutherland *et al.*, 1996). Those that could not be identified immediately were taken to the National Agricultural Research Laboratories, Kenya, for identification. For whiteflies and scales, 5 leaf samples were picked randomly from each quadrant and the number of nymphs counted to give an estimate of the population. A damage scale on leaves, tubers and stems (1-5) was used to classify the pests as major or minor; 1= 0-10% damage, 2= 11-25% damage, 3= 26-50% damage, 4= 51-75% damage and 5= 76-100% damage. Insects in the category scale of 1 and 2 were classified as minor pests while those in the scale 3, 4 and 5 were regarded as major pests.

RESULTS

Insects representing more than 50 species of six orders and in different stages of development were found to be associated with sweet potato crop in the study area (Table 1). Their infestation level was, however, different. Individuals belonging to 9 species of 6 families were noted as major pests of sweet potato. Further individuals of 21 species were minor pests while 8 species belonging to six families were represented by beneficial insects.

From the beginning of sampling, the vines were always infested by different insects throughout the growth period of the crop. The crop attracted a wide spectrum of pests and was a refuge of several other insects. Coleopteran pests were the most abundant and widely distributed, representing over 40% of the total insect count (Table 1). *Systates pollinosus* and *Blosyrus obliquatus* Dev were the most abundant coleopterans pests in the first season. While *S. pollinosus* was the predominant coleopteran during the first season, its defoliating effect was, however, minimal on the crop. *Cylas punticollis* and *Blosyrus obliquatus* were the most dominant in the second season and both caused serious damage on the tubers, greatly affecting yield and quality of tubers.

The major coleopteran defoliators were cassid beetles, the most frequent being *Aspidomorpha cocinna* Use. Others were *Laccoptera afrata* and *Aspidomorpha matalensis*.

Hemipterans were the most abundant insects between the third and sixth sampling periods, which represented the vegetative stage of the crop. They were also the most frequent insect pests during the first season. The most frequent scale pest (*Pulvinaria* spp), was also the most abundant pest during the first season. Their abundance was closely followed by attendant ants mainly *Polyrharchis gagates, Schistacea gerstaecler* and *Phoeidole* spp. Low frequency occurrence of hemipterans was observed during the second season.

The lepidopterans were less varied compared to the other orders. As far as damage to the crop is concerned the clearwing moth (*Synathedon dascyceless*) was the most important pest in this group. The pest also recorded the highest frequency during the second season and was the second most economic pest recorded after *C. puncticollis.* The infestation was heavy resulting in vines breaking off easily at the base, and damage to the storage roots. The leaf-rolling caterpillar (*Brachmia convolvuli*) was also frequent during the second season compared to the first.

Apart from the giant cricket (*Eugaster loricatus*), which was only observed during the first season, all the other insects were observed during both seasons but with varying degree of occurrence. The abundance of the insects was, however, higher in the first season compared to the second season. Pests that caused damaging effects on the roots included sweet potato weevil, dust brown beetles and the rough sweet potato beetle. The clearwing moth was occasionally observed on the tip of the storage roots. Pests that affected the vines included the clearwing moth, *Alcidodes dentipes* and *Alcidodes erroneous*, sweet potato butterfly *(Acrea acerata*), and *Agrius convolvule.*

There was a considerable range of the beneficial insects that were observed on the crop. They included predators such as individuals belong to Formicidae, pollinators (Apidae) and parasitoids (such as Braconidae, Tachnidae). Those insects that were classified as minor pests had lower population levels and the damage they caused was minimal compared with those that were recognized as the major pests.

Table 1. Mean number of insect individuals found infesting sweet potato crop in Kibwezi, Eastern Kenya, 2002-2003

Order/ Family	Scientific name	Mean count		Part damaged	Pest status
		Season 1	Season 2		
Hemiptera					
Aleyrodidae	*Bemisia tabaci* Genn	1792	6	Leaves	Major
Aphididae	*Myzus persicae* Sulzer	642	8	Leaves	Major
Coccidae	*Pulvinaria* spp	6442	11	Leaves, Vines	Minor
Coreidae	*Acanthomia tomentosicolis* Stal.	158	132	Leaves	Minor
Coreidae	*Cletus fuscescens* Wlk	160	391	Leaves	Minor
Margarodidae	*Icerya purchasi* Mask	1632	0.0	Leaves, Vines	Minor
Pentatomidae	*Aspavia armigera* (F.)	93	285	Leaves	Minor
Pentatomidae	*Eysarcoris inconspicuus* (H.-S.)	485	171	Leaves	Minor
Pentatomidae	*Nezara viridula* L.	79	55	Leaves	Minor
Pyrrhocoridae	*Dysdercus nigrofasciatus* Stal.	123	213	Leaves	Minor
Reduviidae	*Harpactor segmentarius* (Germ.)	82	231	Leaves	Minor
Reduviidae	*Harpactor tibialis* Stal.	21	83	Leaves	Minor
	Sub-Total	11709	1586		
Orthoptera					
Acrididae	*Chrohongonus senegalensis* Bol	184	118	Leaves	Minor
Acrididae	*Morpharic fasciata*	168	90	Leaves	Minor
Acrididae	*Zonocerus variegatus*	203	148	Leaves	Minor
Gryllidae	*Gryllidae cicindeloide* Rambur	172	463	Leaves	Minor
Tetttigoniidae	*Eugaster loricatus* Gerst	139	0	Leaves	Minor
	Sub-Total	866	819		
Lepidoptera					
Gelechiidae	*Branchmia convolvuuli*	226	548	Leaves	Major
Nymphlidae	*Acraea acerata Hew.*	132	12	Vines	Minor
Sessidae	*Synathedon dascyleles*	102	571	Vines	Major
Sphingidae	*Agrius convolvuli* (L.)	54	28	Leaves, Vines	Major
	Sub-Total	514	1159		
Coleoptera					
Carabidae	*Cocarabomorphus* Spp	12	174	Tubers	Minor
Carabidae	*Harpalus gregoryi* Alluaud	7	159	Tubers	Minor
Cassididae	*Laccoptera atrata* Spaeth	15	12	Leaves	Minor
Chrysomelidae	*Aspidomorpha concinna* Weise	41	146	Leaves	Minor
Chrysomelidae	*Aspidomorpha natalensis* Boheman	165	194	Leaves	Minor
Coccinalidae	*Cheilomensis lunata* F	96	81		Beneficial
Curculionidae	*Alcides erroneus* Thomson	8	101	Vines, Tubers	Major
Curculionidae	*Cosmopolites sordidus* (Germ)	7	8	Leaves	Occasional
Curculionidae	*Systates pollinosus* Gerst	323	361	Leaves	Minor
Curculionidae	*Systates sauberlichi* Faust	89	297	Leaves	Minor
Curculionidae	*Sternochetus mangiferae* (F)	12	7	Leaves	Occasional
Curculiunidae	*Alcides dentipes* Olivier	12	157	Vines, Tubers	Major
Curculiunidae	*Blosyrus abliquatus* Duv	197	401	Leaves, Tubers	Major
Curculiunidae	*Cylas puncticollis* Boh.	273	577	Leaves, Vines, Tubers	Major
Curculiunidae	*Prezotrachellus gestackerii* Faust	145	462	Leaves	Minor
Epiladininae	*Chnootriba chisomelinae*	51	82	Leaves	Beneficial
Galeradae	*Auracophora foreicallis*	7	83	Leaves	Minor
Meloidae	*Epicuata albovit lata* Gestro	45	87	Leaves, Flowers	Minor
Meloidae	*Coryna apiciconis* Guen	137	206	Flowers	Minor
Meloidae	*Mylarbris* sp.	14	96	Flowers	Minor
Staphylanidae	*Paederus sabaeus*	123	77	Leaves	Beneficial
Tenebrionidae	*Gonocephalum* spp	252	182	Tubers	Minor
Tenebrionidae	*Raytinota acuticollis*	88	112	Leaves, Tubers	Occasional
	Sub-Total	2119	4062		
Hymenoptera					
Apidae	*Apis adansoni* Lartr.	11	15		Beneficial
Braconidae	*Iphiaulux vanpalpus* Cam.	86	464		Beneficial
Formicidae	*Pheidole* sp.	1982	215		Beneficial
Formicidae	*Polyrhachis gagates* Sn.	896	301		Beneficial
Formicidae	*Schistalla gerhadae*	1859	106		Beneficial
	Sub-Total	4834	1101		
Diptera					
Diopsdae	*Diopsis tenuipes* Westw.	485	151	Leaves	Minor
Tachniidae	*Tachna* sp.	80	171		Beneficial
	Sub-Total	565	322		
	Grant Total	20607	9049		

DISCUSSION

Most of the major and minor insect pests reported by this study have also been noted by earlier studies such as Kibata (1973) with the exception of *Systates* spp. In Zimbabwe, thirteen pests are reported to infest sweet potato tubers, stems, crowns and leaves. However, among these, only *Cylas formicarius elegantulus* and termites were not observed in this present study. Most of the insect pests identified on sweet potato in this study have been reported by Ames *et al*. (1996). In his book, Hill (1975) indicates that *Bermisia tabaci*, *Synathedon dasysceles*, *Agrius convolvuli*, *Acraea acerata*, *Cylas puncticollis*, *Alcidodes dentipes* and A*spidormorpha* spp. are the major pest of sweet potato in Africa.

Although many insect species were recorded, only a few were important pests of sweet potato. The key coleopteran pests included *Cylas puncticollis*, *Blosyrus obliqutus*, *Systates polinosus*, and Cassid beetles. Coleopterans have also been recorded as major pests of sweet potatoes in Tanzania (Bohlen, 1973). *Prezotrachelus gestackerii* (Coleoptera: Curculionidae) was the only observed pest that had not been recorded in many places. It was the sixth most important pest observed during the second season. It's however a very minor pest and its effects do not cause any economical loss to the sweet potato. However, it has been recorded as a major pest in legumes (Panizzi and Slansky, 1985).

Among the homopterans pests observed, white fly (*Bemisia tabaci*) and Aphids (*Myzus persicae*) are vectors of diseases. Whitefly-borne virus infecting sweet potatoes include Sweet potato Chlorotic Stunt Virus crinivirus (SPCSV), a closterovirus (Cohen *et al*., 1992, Hoyer *et al*., 1996, Schaefers and Terry, 1976, Gibson *et al*., 1998) and Sweet Potato Mild Mottle Virus (SPMMV) (Hollings *et al.*, 1976). The only known aphid-borne viral disease in Africa is the Sweet potato Feathery Mottle Virus (SPFMV) (Cali, 1981, Brunt *et al*., 1996). Sweet potato Virus Disease (SPVD), the most important disease of sweet potato in sub-Saharan Africa (Geddes, 1990) is caused by dual infection of SPFMV and SPCSV (Sheffield, 1957). These diseases have been reported in most parts of the country. This points out to the need for proper management of Sweet potato pests including the disease vectors.

Most of the minor pests observed are cosmopolitan, polyphagous and are pests of other crops. These include *Nezara viridula*, *Myzus persicae*, and *Acanthomia tomentosicollis* (Hill, 1975) and they infest many crops grown in the study site.

Some insects present at the time of sampling were transients (tourists), which had no direct effect on the crop. These included banana weevil (*Cosmopolites sordidus* (Germ.), Mango weevil (*Sternochetus mangiferae* (F)) and *Dysdercus nigrofasciatus***,** which is a major pest of okra and cotton. The study revealed that *Synathedon dascyceles* was a serious pest of sweet potato in the region, and there is need to study the biology and management of this moth. Though the study did not assess yield loss, continued infestation of the crop by these insects evidently showed that there were losses which could be incurred overtime.

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