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PRELIMINARY RESULTS OF BEAN INSECT PESTS IN KARONGA AGRICULTURAL DEVELOPMENT DIVISION AND SOME PARTS OF LILONGWE AND SHIRE VALLEY AGRICULTURAL DEVELOPMENT DIVISIONS IN MALAWI

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ABSTRACT

Surveys of field and storage bean insect pests were conducted from 1998 to 2000 in Karonga Agricultural Development Division (ADD), Dedza Hills and Thiwi-Lifidzi Rural Development Projects (RDP) in Lilongwe ADD, and parts of Shire Valley ADD. Surveys were made on rainfed and winter-grown crops using 0.01 ha. plots on farmers' fields and at ecological planning areas (EPA's). A questionnaire was used to identify problems that farmers face regarding bean storage and bean production. Many field pests were found in the surveyed areas, but jassids, thrips, and aphids were present in the highest levels. M*ylabris, Ootheca,* and *Ophiomyia* were also widespread, and were present in over 80% of the fields sampled. *Ophiomyia spencerella* was the predominant species of the *Ophiomyia* spp. complex and was found in 72.7% of the samples and in Lilongwe ADD, *O. spencerella* was found in 66.6% of the samples. Termites (several unidentified species) seemed the most predominant insect pest after *Ophiomyia spp, and* caused relatively high mortality of beans. Of the storage pests, A*canthoscelides obtectus* was the most predominant bruchid, whereas *Zabrotes subfasciatus* was found in samples from the Shire Valley ADD only. *A. obtectus* was found in only 3.4% of the samples from Agricultural Development and Marketing Corporation (ADMARC) which treat their produce warehouses regularly with pesticides. Other institutions sampled for this insect had low levels, mainly because these other institutions bought their beans from ADMARC.

INTRODUCTION

Limited consistent research has been conducted on bean insect pests in the field and in storage facilities, resulting in limited written or published work. Past research includes that conducted by Ross (1998) and Letourneau (1994) to identify the distribution of bean insect pests and determine measures used to control bean stem maggot (*Ophiomyia* spp.). Although it is known that insect pests are one of the most important constraints in bean production, efforts to understand and reduce the problems have been limited. To address this issue, the Malawi National Bean Research Programme recently recruited an entomologist who it is felt will improve information on bean insect pests. In 1997, the East Africa Bean/Cowpea CRSP team recognized the need for bean insect research work, and at the B/C CRSP workshop we agreed to monitor bean stem maggot and bean bruchids (*Acanthoscelides obtectus* and *Zabrotes subfasciatus*) using continuous surveys of bean crops in rainfed and winter seasons.

The general aim of this research study was to establish the distribution and status of bean stem maggot and other bean insect pests in Malawi. The specific objectives were

to establish the (a) seasonality and status of the bean stem maggot in beans grown at different times of the year by smallholder farmers, (b) levels of parasitism of the bean stem maggot in smallholder farmers' fields, and (c) the status and distribution of other insect pests of beans including bean bruchids.

MATERIALS AND METHODS

Surveys were conducted at selected ecological planning areas (EPA's) in all Agricultural Development Divisions (ADD'S), in important bean growing Rural Development Projects (RDP's), and at research stations. One extension or research field assistant or a development officer conducted the survey on plots measuring approximately 0.01 ha. in farmer's fields, at EPA's and at research stations. The sites at EPA's and research stations were chosen primarily to provide a basis for comparing results at farmers' fields. Twenty plants were sampled weekly at each site, the whole plant was inspected for pests, and insect pests including bean stem maggot were counted. Dead plants in the plots were dissected to establish the cause of death.

A questionnaire was used to determine insect pest problems that farmers face in bean production and bean storage, and also the techniques that farmers use for insect control in bean storage. Three samples were collected from stored beans at two monthly intervals from each farmer, and samples were sent to Bunda College. A Bunda M.Sc. student conducted a survey of bean storage facilities at Agricultural Development and Marketing Corporation (ADMARC), government hospitals, prisons, secondary schools and colleges to establish the status, distribution, and species of bean bruchids prevalent at these institutions.

RESULTS

Field pests. Numbers of foliar insect pests that were identified in the surveys are presented in Table 1. The list excludes unidentified pests that were sent for identification to appropriate institutions. The results suggest that *Empoasca, Thrips, Aphis, Mylabris, Ootheca* and *Nezara* are numerically important pests. Other important pests are *Maruca, Anoplocnemis, Alcidodes* and *Clavigralla*. In order to establish the cause of death of plants, dead plants were uprooted and examined. The percentage of plants killed by termites[+] and whitegrubs[+] are presented in Table 2. In Chikwawa, in the Shire Valley ADD, termites killed 96% of the plants in the sample area. In Chitipa in the Karonga ADD, 42% of the plants in the sample area were killed by termites. It is interesting to note that in Chitipa no plants were killed by whitegrubs.

The pupae of *Ophiomyia* were classified into black representing *O. spencerella* and brown representing *O. phaseoli* and c*entrosematis*. The populations of *O. spencerella* were found to be much higher than that of the other two species (Table 3). It is felt that *O. phaseoli* populations may be higher than those of *O. centrosematis* (Kapeya, unpublished) however this observation needs confirmation. The results seem to suggest no strong relationship between rainfed and winter-grown crops and populations of *Ophiomyia*. The results also seem to suggest that in Karonga ADD, populations of *O. phaseoli* and *O. centrosematis* are lower than in Lilongwe ADD, but these results also need confirmation.

Table 1. Mean number of foliar insect pests per plant in samples collected in bean fields in four Agricultural Development Divisions (ADD's) in Malawi.

ADD's	Lilongwe	Karonga	Karonga	Shire Valley	
RDP's	Dedza Hills	Chitipa	Karonga	Chikwawa	
No of plants in samples	2180	420	520	300	
Insect pests	**No. of insects per plant**				**Mean**
Anoplocnemis	0.244	0.045	0.042	0	0.082
Mylabris	0.207	0.067	0.185	0.047	0.127
Ootheca	0.192	0.042	0.201	0	0.109
Maruca	0.245	0.02	0.065	0	0.083
Nezara	0.191	0.006	0.198	0.029	0.106
Chrisodeixes	0.046	0.025	0	0.013	0.021
Plusia	0.043	0	0	0	0.01
Clavigralla	0.163	0.02	0.052	0.01	0.061
Alcidodes	0.24	0.02	0.008	0.022	0.073
Euproctis	0.046	0.006	0	0	0.013
Coryna	0.091	0.017	0.019	0.013	0.035
Helicoverpa	0.067	0	0.06	0.01	0.034
Thrips	0.506	0	0.095	0.447	0.262
Aphis	0.442	0.004	0.21	0	0.164
Empoasca	0.38	0	0.19	0.541	0.278
Loopers	0.23	0	0.048	0	0.07

Table 2. Percent of bean plants killed by termites and whitegrubs in sampled bean fields in Agricultural Development Divisions (ADD's) in Malawi.

		Total No.	**No. Plants Killed by**		**% Plants Killed by**	
ADD	**RDP**	**Dead Plants**	**Termites**	**Whitegrubs**	**Termites**	**Whitegrubs**
Lilongwe	**Dedza Hills**	361	93	58	26.8	16.1
Karonga	**Chitipa**	154	65	0	42.2	0
	Karonga	845	336	183	28.9	21.7
Shire Valley	**Chikwawa**	130	125	5	96.2	3.8

Table 3. Percent (distribution) of *Ophiomyia* spp. found in beans sampled from fields in various Agricultural Development Divisions (ADD's) in Malawi

Name of farmer	Lilongwe ADD	O. spencerella	*O. phaseoli* and *O. centrosematis*
A. Magombe (W[x])	Dedza Hills	67.2	32.8
L. Patheretu (W)	Dedza Hills	70.0	30.0
G. Mlonda (W)	Dedza Hills	78.8	21.2
Mean		**72.0**	**28.0**
E.Banda (R[y])	Dedza Hills	63.6	36.4
J. Kakhulabwera (R)	Dedza Hills	72.2	27.8
M. Bonongwe (R)	Dedza Hills	100.0	0.0
F. Mgombe (R)	Dedza Hills	50.3	49.7
E. Mtuluka (R)	Dedza Hills	61.3	38.7
S. Richard (R)	Dedza Hills	53.6	41.4
G. Mlonda (R)	Dedza Hills	53.3	46.7
Mean		**65.6**	**34.4**
A. Jale (R)	Thiwi-Lifidzi	52.2	47.8
N. Mwandauka (R)	Thiwi-Lifidzi	87.5	12.5
Chimdiala (R)	Thiwi-Lifidzi	60.0	40.0
Mean		**66.6**	**33.4**
	Karonga ADD		
B. Kanyika (W)		94.4	5.6
W. Chiona (W)		66.2	33.8
B. Mwenibungu (W)		100.0	0.0
W. Msongole (W)		100.0	0.0
B. Mwenechanya (W)		97.4	2.6
Mean		**91.6**	**8.4**
A. Nyondo (R)		87.9	12.1
Mwamkumbwa (R)		100.0	0.0
K. Ng'ambi (R)		49.9	50.1
Mean		**79.3**	**20.7**
Research Stations			
Makoka (R)		70.4	29.6
Kasinthula (W)		51.9	48.1
Mean		**61.2**	**38.9**
Grand mean		**72.7**	**27.3**

[x]W=Winter
[y]R= Rainfed

Bean storage. Survey results of insect damage during on-farm bean storage in Dedza Hills and part of Thiwi-Lifidzi in Lilongwe ADD are presented in Table 4. These results, however, need to be taken with caution. In this survey, storage damage decreased with time, suggesting that the beans were either treated or samples were taken from different batches. The number of shriveled or rotten beans was also very low, reflecting good grading. In samples collected by research field assistants elsewhere, damage rose from a mean of 1.6 to 18.0% over a 2-month period (data not shown). It is felt this result more accurately reflects common storage losses observed in Malawi.

Table 4. Percent damage and damage categories measured during bean storage in Lilongwe Agricultural Development Division (ADD) in Malawi

	Damage Categories[x]					
Name of farmer	**Clean**	**Slight**	**Moderate**	**Heavy**	**Severe**	**Others**
J. Liwamba	63	36	1	0	0	0
G. Amosi	97	3	0	0	0	0
Siyasiya	33	-	-	35	-	33
M. Giliyoni	34.9	46.8	11.9	8.7	0	0
G. Kalonga	38.6	30.8	12.8	14.1	3.7	0
F. Masache	98.8	1.2	0	0	0	0
Y. Lekiasi	64.6	0	0	0	0	35.4
N. Mbala	73.8	11.2	0	0	0	15
D. Linje	84	3.5	0	0.1	0	12.4
A. Chikunkhudza	88.5	4.7	0	0	0	6.8
T. Magombe	88.2	4.8	0	0	0	7
R. Kawamba	100	0	0	0	0	0
E. Mtusutsa	100	0	0	0	0	0
G. Gedisoni	44.1	30.1	19.1	5.9	0	0
M. Imfayachedwa	99.7	0	0	0	0	0.9
M. Mwandawi	66.7	33.3	0	0	0	0
F. Mnthembwe	94.5	5.8	0	0	0	0
M. Mofati	33.3	33.3	33.3	0	0	0
P. Gobede	67.3	20.2	12.5	0	0	0
Grand mean	**71.63**	**13.62**	**5.5**	**3.5**	**0.21**	**2.3**

[x]Clean - no damage holes
Slight - 1-3 damage holes
Moderate - 4-5 damage holes
Heavy - 7-10 holes, farmer may consider still edible
Severe - more than 11 holes, inedible
Others - i.e., shriveled or rotten

A Bunda College M.Sc. student conducted a survey of insect species and damage by bean bruchids in institutional storage facilities. Institutions were selected in relatively high, medium and low altitude areas. Some produce sheds or storage facilities of Agricultural Development and Marketing Corporation (ADMARC), government hospitals, prisons and some secondary schools and colleges were also sampled. *Zabrotes subfasciatus* was only found in the Shire Valley ADD, and only at low levels (1.4%) (Table 5). It is suspected that this insect species may have been introduced through food aid during the drought and through the resulting refugee influx from Mozambique. *Acanthoscelides obtectus* was found throughout Malawi but the estimated damage (% weight loss) was estimated at only 3.4% (Table 6). The low loss level is attributed to the fact that the source of beans in all cases was ADMARC, which treats its product regularly with insecticides.

Table 5. Percent distribution of *Acanthoscelides obtectus* and *Zabrotes subfasciatus* in bean samples collected from storage facilities at institutions in three altitude areas of Malawi.

Altitude	**% *A. obtectus***	**% *Z. subfasciatus***
Low	98.86	1.14
Medium	100.00	0
High	100.00	0

Table 6. Estimated damage (% weight loss) of beans sampled at institutions in Malawi.

Category of institutions	No. of institutions	Mean % weight loss
ADMARC	16	3.03
Hospitals	27	3.50
Prisons	13	3.06
Schools/Ed. Inst.	32	4.37
Overall mean	22	3.49

DISCUSSION

Although there were problems with survey implementation, such as limited supervision, the results suggest that many bean insect pests are found at levels that may be economically damaging. To confirm this conclusion, bean insect pest population levels, damage to the beans, impact on yield, and quality loss should be better established. For sucking pests such as aphids, thrips, *Nezara* (stink bug), and *Clavigralla*, transmission of viruses and other pathogens would also result in reduced yields and quality. The information from the inspection of dead plants calls for the development of techniques that will identify cause of death more easily. This will result in more realistic estimates of the status of *Ophiomyia* spp., termites and whitegrubs. Finally, there seems to be no relationship between cropping season (rainfed and winter), and *Ophiomyia* spp. population levels. This finding needs to be confirmed through further studies.

CONCLUSIONS

The results presented here are part of continuing surveys and therefore may be affected by incoming results. There is a need to establish the status of some more common and important insect pests, including bean stem maggot, in beans grown in different cropping seasons in the year. Of the dead bean plants sampled in these studies, over 40% were killed by *Ophiomyia* spp.. *Acanthoscelides obtectus* was found throughout Malawi whereas *Zabrotes subfasciatus* was found only in Shire Valley Agricultural Development Division. The loss to stored beans due to bruchids was below 4% in institutions. A number of foliar pests including bean stem maggot were found in high levels and may have economic impact on the bean crop.

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