AFRICA: BEAN ENTOMOLOGY

Activity 1. Verification of farmers' indigenous knowledge on the influence of *Ootheca* larval feeding on bean root development in northern Tanzania.

Introduction

The bean foliage beetle, *Ootheca* spp. (Coleoptera: Chrysomelidae) is a major insect pest of beans (*Phaseolus vulgaris*) in northern Tanzania. Adult beetles feed on foliage at seedling stage causing extensive defoliation. Eggs are laid in the soil and the larvae feed on roots of beans and other legumes where they cause stunted growth and premature senescence. The yield loss ranging from 18-30% reported by Karel and Rweyemamu (1984) to be due to adult *Ootheca* on beans is an underestimate considering the total damage caused by the adults and larvae on the bean plant in the same season.

Farmers in Hai and Arumeru districts in northern Tanzania, experienced substantial bean crop losses during the 2002 growing season. Some farmers observed that bean plants were stunted, some senesced pre-matured and the number of pods per plant and seeds per pod were relatively lower in fields that were infested by *Ootheca* adults at seedling stage compared to fields that had low pest numbers. These observations prompted for investigation into the effect of *Ootheca* larvae on root development.

Materials and Methods: Adult *Ootheca* mating pairs were collected from farmers' fields in Hai district and reared in the screenhouse at Selian Agricultural Research Institute (SARI), Arusha. Single pairs were each caged in Petri dishes (9 cm diameter) filled with 15 gm loose sterilised forest soil. The loose soil served as the oviposition substrate. Two tender and fresh bean leaflets were securely placed in each dish on daily basis to provide food for the adult beetles. Oviposition was monitored and all eggs collected daily using a soft camel hair brush. The eggs were incubated at room temperature (24-27^{o}C).

Two pre-germinated bean seeds were planted in perforated plastic pots (15cm bottom diameter, 20cm high, 20cm top diameter) filled with sterilised forest soil. There were 160 pots for 4 treatments (0, 20, 40, 80 larvae per pot) that were split into two sets. Each treatment had 20 replicates. One set of pots was infested with first instar *Ootheca* larvae and the second set with second instar larvae. In the first set, newly emerged larvae (neonates) were removed from the dishes and placed in sterilised forest soil with potted bean plants at the rate of 0, 20, 40 and 80 larvae per pot. With the second set, the neonates were removed from the dishes and placed in sterilised soil with potted bean plants where they were reared to the second instar.

The first and second instar larvae were introduced into potted bean plant roots at growth stage V4 (when beans have the fourth trifoliate leaf). At the end of third instar larval stage when beans were at R7 developmental stage (plants show first pods), 10 pots were randomly drawn from each treatment. The soil was carefully removed from the roots and observations were made on the nature of larval damage. The plants were thoroughly washed with water and all roots cut at soil surface level. The clean roots were dried in the oven (at 60^{o}C overnight) and weighed to

determine root biomass dry weight. A correlation analysis was carried out between larval numbers and root damage levels.

Results and Discussion: Observations on *Ootheca* larval feeding behaviour showed that the first instars prefer to feed and bore into root nodules while the second and third instars feed by chewing up root nodules and the epidermal tissue on lateral roots. The results also showed that second instars were more damaging than first instars. However, both stages caused significant (P= 0.01) reductions in root biomass weight compared to the control. As expected, increase in the number of larvae per pot resulted in higher root damage and hence biomass loss **(Table 1)**. Correlation analysis confirmed that root damage was positively correlated to the number of larvae per pot. Although this experiment was not extended to cover the third larval stage, it is likely that third instar larvae would cause higher damage than the second instars. These results on root damage can help to explain farmers' observations in their own bean fields.

Table 1. Bean root biomass dry weight loss (%) due to *Ootheca* spp. larval feeding at Arusha, Tanzania, 2003.

Infestation level (Number of larvae per pot)	% root biomass dry weight loss due to:	
	1st larval stage	2nd larval stage
0	0.00(0.00)*	0.00(0.00)
20	9.00(1.40)	39.58(1.5)
40	32.83(1.50)	69.89(1.7)
80	43.80(1.58)	73.23(1.8)
Mean	28.97(1.12)	45.68(1.29)
LSD (0.05)	16.03(0.24)	20.02(0.22)
CV(%)	60.29(23.26)	47.77(18.87)
Correlation coefficient	+0.602	+0.781

* Figures in brackets are transformed data $(X+3/8)^{0.5}$

Reference

Karel, A.K. and Rwenyemamu, C.L. 1984. Yield losses in field bean following foliar damage by Ootheca bennigseni (Coleoptera: Chrysomelidae). Journal of Economic Entomology 77: 761-765.

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Activity 2. Scale up and scaling out proven technologies through strategic alliances.

Achievements:

- Increasing farmers' knowledge about the biology and ecology of the key pests affecting their bean crops has enabled them to develop appropriate management practices
- Farming communities have been empowered to make IPM decisions with focus on indigenous knowledge systems, and to rediscover value in their traditional IPM strategies
- Individual farmers have gained confidence and have been enabled to disseminate IPM information through their participation in regional workshops
- Women farmers play key roles in the leadership of community groups and community based organisations

Scaling up participatory IPM development and promotion

Introduction

Many technologies have been developed for the management of pest problems in smallholder production systems but most have remained out of reach. Community participatory approaches, combining farmer field school and participatory approaches, are needed to increase farmer awareness of the availability of IPM technology and encourage adaptation, and to develop skills in national research and extension services.

Methods: The project on, "Participatory IPM development and promotion in Eastern and Southern Africa " supported by the DFID Crop Protection Programme, aims to scale up and scale out the approach developed by CIAT in northern Tanzania to Kenya, Tanzania and Malawi. The ECABREN and SABRN Networks have also linked their IPM subprojects to this activity and are funding the extension of the project to Democratic Republic of Congo, Madagascar, Mozambique and Sudan. Collaborative links for dissemination have been developed with the Ministry of Agriculture in Tanzania, African Highlands Initiative (AHI) at Lushoto, KARI and the Ministry of Agriculture in Kenya, and several NGOs including Farm Africa at Babati, World Vision International -WVI (Tanzania), Adventist Development and Relief Agency –ADRA (Tanzania), Concern Universal –CU (Malawi), Community Mobilization Against Desertification –CMAD (western Kenya).

Participating extension officers, adult education teachers and farmer extensionists were further trained in IPM methodologies including pest biology and ecology, and in the principles of participatory research. Traditional knowledge and available scientific information were discussed for their suitability in the management of major bean pest problems. The main principles were the use of community participatory approaches and the inclusion of traditional pest management strategies for evaluation and training. Farmer groups in collaboration with their research and extension personnel established demonstration and learning plots at target sites in western Kenya, northern and southern Tanzania and central Malawi.

The original pilot site in northern Tanzania is now fully led by farmer communities in collaboration with area based extensionists. CIAT, NGOs, private service providers and the national extension and research staff are now providing backstopping services on demand from

farmer groups through methodology and on-station research to address basic issues raised from farmers' field observations. Demonstrations, learning plots, field days, cross village and cross site visits, village information centres, seminars, radio messages and drama have been chosen by different farmer groups as their major approaches to share and exchange knowledge.

Results: Training representative farmers, village extension officers, adult education teachers, NGO personnel and community leaders have contributed to increased IPM awareness among communities within project pilot sites and beyond. Cross village and within site farmer group visits were facilitated in western Kenya as well as in northern and southern Tanzania. Cross site visits were facilitated for farmer groups in Kenya (western and south western Kenya) and Tanzania (Hai, Lushoto and Southern Highlands - Mbeya). In addition, 5 farmers, 1 extensionist (Concern Universal) and 1 research staff from Malawi were facilitated by SABRN and the IPM promotion Project to visit farmer groups in the Southern Highlands of Tanzania. In scaling out, farmer representatives from the former Participatory Plant Breeding (PPB) project in northern Tanzania (Makiba farmers in Arumeru district, Arusha region) and those involved with Farm Africa at Babati in Manyara region were facilitated to participated in one of a series of field days organised by farmer groups in Hai district. In the process, participating farmers were keen to share ideas and exchange information with other site group farmers and non-participating colleagues.

Farmer groups at different sites have demanded additional services from different stakeholders including farm inputs from NGOs and the private sector as well as information on markets, small enterprises, soil and water management, quality seed production and other technologies from CIAT and the national programmes. Other farmer groups have forged ahead and formed community based organisations (CBOs) to meet some of these demands. For example, the groups in Hai district have united to form and register their CBO (Union of Development Groups in Hai District – MUVIMAHA) while other groups in Lushoto and Southern Highlands of Tanzania have formed and registered Savings and Credit Accounts Societies- SACCOS.

All sites have strong collaboration between farmers, researchers, extension personnel and development NGOs, with regular meetings to monitor and evaluate observations in variety and other technology demonstrations and IPM learning plots. The national research and extension staff, ADRA, WVI and ZCC have collaborated in the translation of extension leaflets and handbooks while the ADRA and WVI have been involved in translating and meeting costs for printing initial copies of these materials. Additional leaflets and posters in Kiswahili were prepared. A series of farmer activity reports (17) have been also been prepared. Initial copies of the Kiswahili version of the CIAT field guide on 'Bean pests, diseases, and nutritional disorders of the common bean in Africa' are now available at CIAT Arusha and World Vision office at Hai district. All these materials have and will be distributed to village information centres at project sites in ECABREN and SABRN.

Visits by CPP, DFID, DG CIAT, CIAT Communication Unit, CIAT Africa at Kampala, Ministry of Agriculture Officials at district, region, zonal and national levels have further strengthened farmers' confidence and encouraged them to look forward to achieving their goal in alleviating poverty.

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Publications

Snapp, S.S., Jones, R.B., Minja, E.M., Rusike, J. and Silim, S.N. 2003. Pigeon Pea for Africa: A Versatile Vegetable – And More. HortScience, Vol 38(6): 1-7.

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Minja, E.M., Silim, S.N. and Karuru, O.M. 2002. Efficacy of *Tephrosia vogelii* crude leaf extract on insects feeding on pigeonpea in Kenya . International Chickpea and Pigeonpea Newsletter. Number 9:49-51.

Minja, E.M., van der Merwe, P.J.A., Ferguson, M.E. and Mviha, P.J. 2002. Screening wild *Arachis* for resistance to groundnut plant hopper *Hilda patruelis* in Malawi. International *Arachis* NewsletterNumber 22:49-51.

Conference

Minja, E.M. and Green, S.V. 2003. Armoured Bush Cricket Control – A Farmer Perspective. Paper presented at the Symposium on IPM of Armoured Bush Crickets 6-9th July 2003 at the Congress of the Entomological Society of Southern Africa, University of Pretoria, South Africa.

Workshops, Meetings and Seminars

Stakeholder workshop to monitor, review and plan for the future of the bean IPM project held at Arusha, Tanzania.

Training workshops/seminars (2 at Lushoto and 1 at Hai both in northern Tanzania) for farmer group representatives and extension officers, and for adult education teachers (1 in Kisii, Kenya).

A series of farmer group meetings/conferences and field days at project sites in Kenya, Tanzania and Malawi.

A farmer (woman) from Hai district represented project farmer groups in a regional workshop on Science and Technology in Agricultura held in Addis Ababa, Ethiopía.

Another lady farmer and village extension officer also from Hai, represented project farmer groups and village extension officers in the ECABREN regional workshop on priority setting held at Nairobi, Kenya.

Donor: DFID

Collaborating Partners:

For Bean IPM: Kenya, Malawi, Tanzania, Uganda and Rwanda; NGO partners – WV, ADRA and FA in northern Tanzania, CMAD in Kenya, and CU in Malawi).

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Acronyms and Abbreviations used:
WV= World Vision, ADRA= Adventist Development and Relief Agency, FA= Farm Africa, CMAD = Community Mobilization Against Desertification and CU= Concern Universal.