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Technical Report 20

AGRICULTURAL PRODUCTION - PHASE II

INDONESIA

INSECT ECOLOGY STUDIES AND INSECT PEST CONTROL

Report prepared for
the Government of the Republic of Indonesia

by

the International Atomic Energy Agency
acting as Executing Agency for
the United Nations Development Programme

**UNITED NATIONS DEVELOPMENT PROGRAMME
INTERNATIONAL ATOMIC ENERGY AGENCY**

VIENNA 1992

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INTERNATIONAL ATOMIC ENERGY AGENCY

VIENNA 1992

Agricultural Production, Phase II, INS/88/013-11, 63 (INS/5/021-11, 63)

INSECT ECOLOGY STUDIES AND INSECT PEST CONTROL

23 June - 3 August 1990,

END-OF-MISSION REPORT

B. Butt
P.O. Box 1137
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USA

Terms of Reference

Assist Batan in developing an effective F-1 sterility programme or other control methods related to the use of isotopes. Work involves insect rearing, sterilization, laboratory and field evaluation and pheromone studies.

Background Information

Previous expert visits include J.L. Gringorten (April 1983 - June 1984), B.A. Butt (November 1988) and A.M. Shelton (October - November 1989). The programme has developed slowly, partly because of changes in the programme following visits by Agency personnel. The Pest Control Research Group has a staff of 11 including 6 professionals. One entomologist, Nasroh Kuswadi, is in Athens, GA., USA in graduate studies. The senior entomologists (Hoedaya and Sutrisno, Group Head) spend very little time in the laboratory. Hoedaya spends 2 afternoons/week and Sutrisno about the same amount with the Group. The remaining time is spent doing administrative work for Batan.

A.M. Shelton's report on his 1989 visit has not been received.

Work Programme

1. Diamondback moth - Plutella xylostella

A. Rearing

An effective mass rearing system is required to conduct laboratory and field studies. The present system of rearing on cabbage leaves is not dependable. The disease was reduced by dipping the leaves in a 1% Chlorox solution. Vermiculite was not available to rear Plutella on rape seed as reported by Lim and Chan. We were able to produce rape on sawdust. A source of vermiculite for future work was located. Artificial diet was prepared. The larvae in the first cups infested did not develop well. A second group of cups were infested by placing cabbage leaves containing eggs directly upon the diet. The larvae were developing very well at the end of the mission.

The second group of larvae may have been more healthy or the cabbage leaf could have provided a feeding stimulate or a minor nutrient. If the present larvae do not complete their development, the remaining ingredients should be returned to A.M. Shelton to determine if the failure is due to defective materials.

B. Sex Pheromone

Four types of sex pheromone traps were evaluated at Cipanas. A trap made at the laboratory was as effective as commercial traps. Traps and pheromone ordered by the Agency has not arrived.

C. Sterilization

Male larvae were dissected and their testis removed. The chromosomes were examined using the squash method.

In F-1 field cage tests, P-1 and F-1 releases were compared. Results were not available at the end of the mission.

2. Rice stem borer - Chilo suppressalis

The rice stem borer rearing was reviewed. Present rearing is good, but labourious. A system of transferring the larvae from old rice seedlings to new rice seedlings with a minimal amount of labour was developed.

3. Sugar cane borer - Chilo auricilius

Sugar cane borer is being reared on a semi-artificial diet. Agar is a major cost in the diet. An Indonesian source of agar was identified. Rearing conditions should be improved to reduce disease and labour. Insects are now being reared in glass tubes. If this is continued, the tubes and stoppers should be autoclaved. Several locally made plastic disposable containers were purchased for evaluation in rearing the sugar cane borer.

4. Bean fly - Agromyza sp.

In cooperation with the Plant Breeding Research Group, soy beans and mung beans are being evaluated for resistance to the bean fly. The varieties are first evaluated in the laboratory and then the more promising ones in the field. Experimental design was discussed and the field plots in Kumingan visited. The programme is well organized, but the field plots should be artificially infested to assure a high bean fly population. The varieties are also evaluated for resistance to leaf and pod feeding insects.

5. Tobacco insects - Heliothis armigera and Spodoptera litura

The tobacco producing area near Jember was visited. Tobacco is grown in open fields and shade tobacco in large screen cages 4 meters high and about 20 H/cage. We visited a plantation growing 300 H of tobacco in cages and 500 H in open fields. Caged tobacco is sprayed each week unless an insect infestation is found. Then it is sprayed more often. Since the insect populations are very low, the 2 lepidopteron insects, Heliothis and Spodoptera may be controlled by sterile insect releases at a very low cost.

This would allow the remaining insect, an aphid, to be controlled by the release of parasites. The result could reduce the cost of insect control and lead to the production of "insecticide free" tobacco. I feel that "insecticide free" tobacco would receive a premium price.

A.A. Agro Gothama of the Tobacco and Fibre Crops Institute in Malaysia is rearing Heliothis and Spodoptera on artificial diet. He could cooperate on research using sterile marked moths to determine movement of moths in and out of the large cages and the moth population inside the cages.

After being bailed, the tobacco receives a post harvest fumigation treatment for stored product insects. If fumigants are banned, radiation should be considered for post harvest treatment.

6. Cotton insects

A.A. Agro Gothama also works with cotton insects and is interested in controlling pink bollworm by pheromones on F-1 sterility.

Seminars

Weekly seminars were held in which I discussed SIT and F-1 sterility programmes, transportation and release methods, requirements for SIT and F-1 sterility programmes, area-wide control and review of the Group programmes.

Regional Training Course

A regional training course on F-1 sterility is scheduled for the South-East Asia - Pacific Region in 1991. I recommend that the course be offered in July - August 1991. Priority of locations would be:

1. National Atomic Energy Agency
Jakarta, Indonesia
2. MARDI, Kuala Lumpur, Malaysia
3. Seameo-Biotrap
Bogor, Indonesia

Facilities and Support Personnel

The facilities are adequate for the present programmes and the support personnel exceptional.

Conclusions

Insects can be reared on several different systems from natural diets, semi-synthetic diets to synthetic diets. Each location must determine which diet is best considering the facilities, cost of labour and cost of ingredients. In the case of Plutella the present methods of rearing on cabbage is not effective. Future rearing should probably be on rape seedlings or artificial diet, depending on local economics. The Group has been very slow in picking up on the rearing technology although it has been published years ago. Rearing of rice stem borer and sugar cane borer and bean fly should have minor improvements.

The major research effort of the Group should be in population and dispersal studies as well as the degree of isolation. This information must be known to determine the feasibility of SIT or F-1 sterility on the target insects before additional radiation work is done.

Cooperation should be developed with other Groups or locations such as the Research Institute for Tobacco and Fibre Crops in Malang, the Horticultural Research Center, Lembang and the Malaysian F-1 sterility programme on Plutella. The bean fly programme is an excellent example of cooperation between Groups within the project.

The 2 senior entomologists Sutrisno (Group Head) and Hoedaya spend 80% of their time in administrative work outside the Group. As a result, the Group suffers from a lack of leadership and direction.

Training should include 2-3 months for Ali Rahayu on evaluating insect resistance in plants at AVRDC. Singgih Sutrisno should receive training in insect dispersal assuming that he will be able to conduct research upon his return. Details of his training in the USA are near completion. Staff doing hands-on rearing of Plutella should make a 4-week visit to MARDI in Malaysia.

Experts are required on insect population and dispersal research. John Schneider, Mississippi State University, Mississippi State, Mississippi 39762, USA may be a good expert based on his publications.

Equipment needs to include a computer with colour printer. Software should include dBase IV, Lotus 1-2-3, M Start and Wordstar Ver. 6.0. The computer and software should be purchased locally for good service. Four more field cages should be purchased. Insect flight mills are needed, but may be made in the Centre workshop. Pens, humidity hair and charts are needed for a thermohygrograph. A 5 liter cold water bath operating at 5° is needed. Rearing rooms should be painted with epoxy paint.

Recommendation

Institute

The Pest Control Research Group should be supported. Programmes should be limited to those insects in which there is a high probability of success. This can only be determined by collecting field data on the insects. If this is not done, a large amount of money and effort will be wasted.

There should be a full-time Head of the Pest Control Research Group. Presently there is a lack of direction and leadership in the Group. This is in part due to the Group Head, Singgih Sutrisno, and the other senior entomologist Muh. Hoedaya being detailed to administrative programmes 80% of their time.

The library system should be up-graded to include routing journals of interest to scientists and monthly print-outs of computer data searches. The number of journals in the library should be expanded. The staff should be informed of Batan's information services. The research standards should be improved and published in referenced journals.

Cooperation within the Centre and between institutes should be encouraged. This includes cooperation with the Research Institute for Tobacco and Fibre Crops, Horticulture Research Centres in Cipanas and in Lembang, and MARDI in Malaysia.

Ali Rahayu should receive training in plant insect resistance at AVRDC. Personnel doing "hands-on" rearing of Plutella should receive training at MARDI.

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