Development and Rearing

Laboratory cultures of bollworms, beet armyworms, pink bollworms, saltmarsh caterpillars, tobacco budworms, and cabbage loopers are maintained in the laboratory. These cultures are used for studies of parasites and predators and also for maintenance of these parasite and predator cultures in the laboratory.

Microplitis croceipes (Cresson)

During 1975, work has been done toward improving the rearing of Microplitis croceipes in the laboratory. Individual cups for rearing the parasites have not been used for about six months. Slices of diet used for rearing pink bollworms have been substituted instead. This has resulted in a lower return of parasites, approximately 30% as opposed to 65% with individual cups; but it has resulted in over a 60% decrease in the labor involved. Work is being continued to improve the efficiency of this system.

Exorista mella (Walker)

A laboratory culture of Exorista mella was increased to determine the effectiveness of this parasite of the saltmarsh caterpillar, Estigmene acrea (Drury), in a field release against the range caterpillar, Hemileuca oliviae Cockerell, in New Mexico. The parasites were reared in the laboratory on saltmarsh caterpillar larvae. To insure greater numbers of flies for release, tests were conducted to determine the effects of cold storage on the puparia. Puparia were stored in a cold box which averaged 48° F. They were left in the box for one, two, three, four, five and six-week periods. Puparia left one and two weeks in the cold box showed no difference from unrefrigerated puparia with respect to emergence, adult longevity, and progeny production. Puparia stored three weeks and over had lower emergence, shorter longevity, and over three weeks did not produce progeny. Puparia production for a five-week period from July into August averaged over 800/week and averaged 0.66 puparia per larva.

Lygus hesperus Knight

Lygus hesperus nymphs were fed on plant and insect materials to determine their effect on survival and development. Five diets were tested: (1) green beans, (2) lettuce, (3) green beans + heat-killed beet armyworms, (4) lettuce + heat-killed beet armyworms, and (5) heat-killed beet armyworms. The results showed that green beans were better than lettuce for both survival and developmental time and that the addition of beet armyworms was an improvement over both plant foods alone. Nymphs fed on beet armyworms alone developed faster than on any other diet, but survival to adults was reduced. The best diet in terms of both survival and developmental time was green beans + beet armyworms.

A study is presently under way to test the effects of the different nymphal diets on longevity and fecundity of the adults and on egg fertility. Preliminary data show that the addition of dead beet armyworms to the plant foods increases adult longevity by 10% and fecundity by 35-45%. Egg fertility appears to be the same for all diets.

## MONITORING INSECT PARASITES IN A COTTON PEST MANAGEMENT PROGRAM

F.G. Werner and C.E. Mason

Objective: To develop a feasible technique for incorporating the monitoring of adult parasitic insects into a pest management program, and to provide a means of evaluating and disseminating the information.

During the first year of this project, Dr. Mason and his assistants routinely sampled the parasitic insects in cotton and in adjacent fields in the Pinal County Pest Management Program. They identified all of the parasitic insects taken in the sampling, and were able to describe the parasite situation very soon after they took the samples. However, we came to the conclusion that routine sampling was too time-consuming an activity to become part of a Pest Management program as currently practiced.

Sampling of the smaller parasitic wasps and flies associated with the insects of cotton and other crops was accomplished fairly readily by the use of the conventional insect sweep net. But it was necessary to transfer the contents of the net to alcohol for us to learn which parasitic insects had been taken. Very few are large enough that they can be identified as they leave the net. The technique used in this project was to bring the samples to the laboratory, sift out plant parts and larger insects, and examine the residue under a stereomicroscope. Most of the parasitic insects are in the size range of thrips or smaller.

Sampling the larger species is much more difficult, and is probably best accomplished by holding host insects in containers long enough for adult parasites to emerge. The sweep net method is definitely not useful unless extremely large populations of the adult parasites are present, a very unlikely event.

As has been indicated, we do not visualize sampling for parasites to be feasible on a routine basis, at least under ordinary management practices. But it would be most desirable that someone at the supervisory level in a pest management program be prepared to undertake sampling and evaluation at critical times. The main objective for the remainder of this project has thus become to develop a manual for the identification and evaluation of the parasitic insects on cotton and associated crops in Arizona.

As we have emphasized in a previous report, it is fully as important to avoid protecting a population of parasites of no importance to the target crop as it is to protect those that regulate pests. This manual will cover all the groups of parasites that we took in a year of sampling, as well as many others that we have obtained only by rearing or by other means. The known hosts will be indicated for every group, to permit rapid evaluation.

Identification of all parasitic species would be an immense task, actually impossible at the present state of knowledge. The keys, descriptions, and illustrations we have developed concentrate on abundant or important species, and the ways in which they can be told from the numerous unimportant species. By developing keys for particular situations, we have usually been able to limit the number of choices to a reasonable level. In some cases, such as known host associations based on rearing, one need know only the group to which a species belongs to be reasonably sure what species it is.

An important part of the manual is a concise summary of known parasite-host associations and appropriate indexes. We have been using these in one form or another for some years, and have found them extremely useful, especially by using the list of known parasites of a pest to narrow the choices for a reared parasite. We have had the advantage of having identified specimens for comparison. By providing illustrations, descriptions, and keys, we hope to simplify the job for others.

We are in the final stages of verifying identifications, preparing keys and illustrations, and choosing methods of presentation. The manual should be completed and available in 1976.

## CULTURAL PRACTICES TO MAINTAIN EFFECTIVE NATURAL ENEMY/PEST RATIOS

T.F. Watson, E.B. Jackson, R.E. Briggs,
Dale Fullerton, F.M. Carasso, S.C. Young, and T.M. Pack

Objective:
1. To investigate cultural practices to maintain beneficial insects in the area.
2. To determine the control capabilities of common predators.
3. To determine the effect of crop production practices and rotations on both pests and beneficial insects.
4. To determine crop production efficiency in this system.

Summary of Progress:

Initiation of this research during the first year has consisted of establishing the rotation sequences that will be used for implementation of this project. The rotation system that was established follows:

1. Continuous cotton, planted March 1975.
2. Rotation cotton (one-year rotation), planted March 1975.