

## METHODS OF REARING *HELIOTHIS* SPECIES, AND ATTEMPTED CROSSBREEDING

The four species of *Heliothis* in Queensland—*H. armigera* (Hübner) *H. punctigera* Wallengr., *H. assulta* Gn. and *H. rubrescens* (Walk.)—show a remarkable morphological similarity in pre-adult stages, and a high degree of similarity in adult stages (Kirkpatrick 1961). Accordingly, at Nambour during 1957-58, species status was examined further by crossbreeding. This involved methods of rearing all species.

To prevent cannibalism and escape by chewing, larvae were enclosed in separate containers of glass or other hard material: 2-oz wide-mouth glass jars, 2½ in. high and 1½ in. in diameter, with metal or bakelite lids, proved most suitable.

Foods for the successful rearing of *armigera*, *punctigera* and *assulta* were green French bean pods (*Phaseolus vulgaris* L.), green linseed bolls (*Linum usitatissimum* L.), young maize cobs (*Zea mays* L.), young tobacco seed pods (*Nicotiana tabacum* L.) and unripe tomato fruit (*Lycopersicon esculentum* Mill.). The best of these, considering convenience of size and shape, ready availability throughout the year and good keeping qualities, were French bean pods. Simple experiments demonstrated that in the laboratory development times on this host were no different from those on normal field hosts (see Table 1). Accordingly, French bean pods were used as the standard food.

TABLE 1

DURATION OF LARVAL AND PUPAL STAGES OF *Heliothis* SPECIES WHEN FED ON DIFFERENT HOSTS

Species	Host	Month Tested	No. of Larvae	Duration in Days			
				Larval Stage		Pupal Stage	
				Mean	Range	Mean	Range
<i>H. armigera</i>	Linseed* .. .. .	September	6	27	25-30	17	15-19
	Bean* .. .. .	September	10	27	26-28	17	16-20
<i>H. punctigera</i>	Linseed* .. .. .	September	10	25	23-29	15	13-17
	Bean .. .. .	September	10	25	23-28	14	13-16
<i>H. assulta</i>	Cape gooseberry ( <i>Physalis peruviana</i> L.)* .. .. .	March	5	20	16-25	20	18-23
	Bean .. .. .	March	10	19½	17-24	21	19-23
<i>H. rubrescens</i>	Indian weed* .. .. .	March	10	21½	17-25	23	21-26
	Bean .. .. .	March	20	23	21-24	24	21-27†

\* Normal field host

† Only 2 larvae pupated

*H. rubescens* larvae, with few exceptions, failed to reach maturity on French bean pods. For convenience, larvae were allowed to develop to the second instar on this food, and were then transferred to Indian weed (*Sigesbeckia orientalis* L.).

Cleanliness was maintained by the regular supply of washed jars to replace those soiled by larvae. Bean pods were washed in 70 per cent. alcohol and dried before being cut up and presented as food. Uneaten food and frass were removed from jars in which larvae were pupating, for which purpose a small quantity of pine sawdust was provided.

Newly emerged adults were placed in wire-gauze covered cages 15 in. high and 12 in. square at base and top. A potted food plant was provided for each cage. A mixture of water and honey (10:1), which was taken readily at all times of the day, was fed to adults. Food containers were removed at night to prevent gorging.

The most successful breeding unit of many combinations tried consisted of two females to one male, and was used for all crossbreeding attempts. When eggs first appeared females were transferred to small cardboard boxes, where oviposition continued. These eggs were removed singly for rearing.

The following cross-matings were attempted: *armigera* x *punctigera* (5 times), *punctigera* x *armigera* (5), *armigera* x *assulta* (5), *assulta* x *armigera* (5), *armigera* x *rubescens* (2), *punctigera* x *assulta* (2), *assulta* x *punctigera* (2), and *assulta* x *rubescens* (2). Concurrent with all attempts, control matings of the species and sexes involved were carried out.

In no instances were fertile eggs produced from cross-breeding, although infertile eggs resulted from the following crosses: *armigera* x *punctigera* (4 out of 5), *punctigera* x *armigera* (4/5) and *armigera* x *rubescens* (1/2). This is not necessarily significant, as in the laboratory unmated moths occasionally oviposit. Fertile eggs resulted in every instance from control matings.

From these results, there is no reason to suspect the validity of the species status of the four species of *Heliothis* in Queensland.

#### REFERENCE

- KIRKPATRICK, T. H. (1961).—Comparative morphological studies of *Heliothis* species (Lepidoptera: Noctuidae) in Queensland. *Qd J. Agric. Sci.* 18: 179-94.

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