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A SIMPLE REARING UNIT FOR DIAMONDBACK MOTH AND ITS *PARASITOID (APANTELES PLUTELLAE* KURDJ.)

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RINGKASAN

Cara pemeliharaan yang telah diselidiki dapat membekalkan *Plutella xylostella* serta parasitoid-nya, *Apanteles plutellae* Kurdj., secara berterusan dan dengan banyak. Unit pemeliharaan mengandungi tiga komponen struktur asas iaitu dua bekas plastik berbentuk cawan dan satu komponen silinder berdawai.

Bermula dengan 60–70 biji telur *P. xylostella* dalam satu unit pemeliharaan, hampir 70% akan mencapai peringkat kepompong sementara 78% parasitoid mencapai peringkat tersebut.

INTRODUCTION

The diamondback moth (DBM), *Plutella xylostella* (L.), is a serious pest of crucifers (TALEKAR, YANG, LEE, CHEN and SUN, 1985). Many methods for rearing it have been described. Some which use mature food plants or foliage, or large cages (SWINGLE, GAHAN and PHILLIPS, 1941; WAY, SMITH and HOPKINS, 1951; CHI and SUN, 1975) are relatively less easy to handle. Several others involve artificial or semi-synthetic diets (BIEVER and BOLDT, 1971; AGUI, OGURA and OKAWARA, 1975; HSIAO and HOU, 1978; HOU and HSIAO, 1979) which seem too sophisticated and are not readily adoptable in developing countries. More recent techniques that employ seedlings as food source have, however, greatly simplified the rearing of DBM (KOSHIHARA and YAMADA, 1976; LIU and SUN, 1982; 1984). In the method developed by KOSHIHARA and YAMADA (1976), the DBM larvae become easily infected by bacteria (LIU and SUN, 1984) while that of LIU and SUN (1982; 1984) still requires a large cage for better ventilation to overcome the bacterial infection. Arriving at a compromise should prove advantageous and this is achieved in the rearing unit described here. In addition, the same rearing unit could also accommodate the rearing and production of a major parasitoid of DBM, *Apanteles plutellae* Kurdj. (Hymenoptera: Braconidae).

THE BASIC COMPONENTS AND THEIR ASSEMBLY

The rearing unit *(Plate 1)* comprised essentially three basic structural components, namely the lower feeding chamber (LFC), the inter-connecting ring

Plate 1. The Inter-Connecting Joint Rearing Unit.

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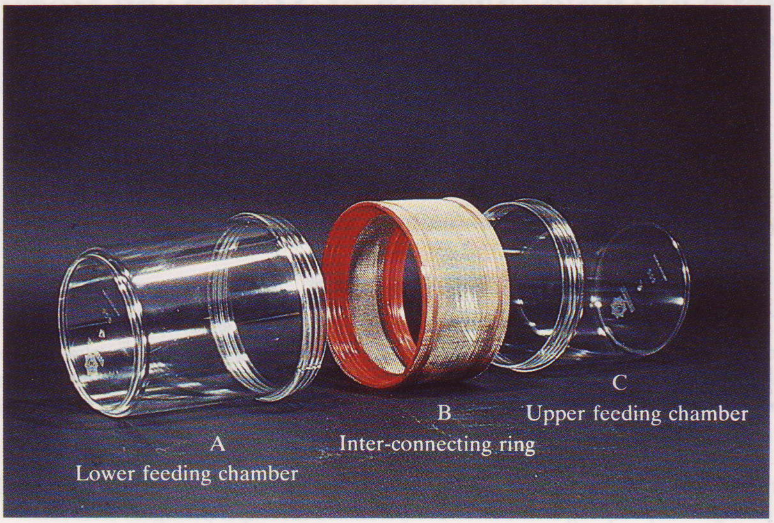

Plate 2. The three basic structural components of the Inter-Connecting Joint Rearing Unit.

(IR) and the upper feeding chamber (UFC) *(Plate 2)*. It was made up of two plastic cup-like containers[+] of dimension 9.3 cm x 8.6 cm diameter, complete with their screwed-in covers. For rearing parasitoids, a glass vial (3.6 cm x 1.0 cm diameter) containing a 'feeding wick' and diluted honey was inserted into a hole in the UFC to provide a continuous supply of food to the adult parasitoids *(Plate 1)*.

Assembling the basic components was simple. The IR was first screwed onto the LFC which held the food source for the larvae. The UFC was then screwed over the other open end of IR after the appropriate stage of the insect had been introduced. This was maintained as such or the UFC might subsequently be replaced by another when the food in the former needed replenishment.

When the rearing cycle was completed, the basic unit could be easily dismantled for cleaning, storage or reuse. Owing to its joint flexibility, such an Inter-Connecting Joint Rearing Unit (IJoRU) has the simplicity not only for rearing DBM but also its parasitoid.

REARING PROCEDURE

Rearing of Diamondback Moth

Initially, the seedling food source was prepared by germinating 0.4 g of 'sawi' (*Brassica juncea* Cosson) in approximately 4-cm depth of moist vermiculite[++] within the lower feeding chamber. After *ca* nine days, a small paper strip with 60–70 eggs of DBM was placed over the seedlings. Feeding on the cotyledons soon began when the tiny young larvae hatched. After three to five days when the cotyledons and parts of the seedling stalks had been consumed, the UFC was replaced with another containing fresh seedlings. When this supply was consumed the LFC was replaced, wherein the feeding larvae would eventually move down again to feed on the fresh supply.

Usually, by the second food change (between two and three days) most of the larvae (between 80% and 90%) would have pupated on the gauze of the inter-connecting ring.

For adult collection, the IR was removed and placed in a pupal emergent

[+]WINNER® Code 305
[++]VERMICULITE (Lightweight Insulating Aggregate), Grade A3, from MBP Manufacturers.

jar. The latter was lined with paper so that the emerging adults could lay their eggs on it. This would facilitate egg collection for the next rearing cycle.

Based on four-generation studies, one rearing unit with 60–70 eggs could produce an average of 45 pupae, of which 76% emerged as adults. Although not quantified experimentally, there appeared to be no observable difference in the behaviour and general biology of the different developmental stages.

Rearing of Parasitoid

The procedure for rearing the DBM parasitoid, *A. plutellae*, was similar to that of its host. Five pairs of the parasitoids were introduced into a rearing unit for 24 hours when the host larvae were at the second-instar stage. Parasitoid introduction was conveniently made through the hole normally used for holding the 'feeding vial'.

As with DBM, parasitoid pupation occurred mostly (77%) on the gauze, making cocoon collection especially convenient. As high as 82% (average: 78%) survival may be obtained from each rearing unit. Under conditions of 29.2°C ± 1.1°C and 60%–87% RH, high mortality because of diseases was never experienced.

DISCUSSION

The major difference between the KOSHIHARA and YAMADA (1976) method and that of LIU and SUN (1984) is that in the latter there is no cover for the container in which rape seedlings are grown. Instead, the seedlings are placed inside a larger cage for better air circulation which apparently helps to prevent bacterial infection (LIU and SUN, 1984). However, by this modification to overcome bacterial infection, the method has become more restrictive in its manoeuvrity because of the need for a large cage. These separate limitations in both the methods (bacterial infection and limited manoeuvrity) are, however, overcome in the IJoRU method described here. This is made possible largely by the interconnecting ring *(Plate 2)*, wherein the gauze permits adequate ventilation to overcome bacterial infection (which persists in the KOSHIHARA and YAMADA method) while at the same time, dispenses with the big cage (needed in the LIU and SUN method) to preserve the manoeuvrity.

Like other methods using seedlings as food (KOSHIHARA and YAMADA, 1976; LIU and SUN, 1982; 1984), the IJoRU method has advantages over those using mature food plants. The latter requires cultivation and bigger space, and usually an insect-proof house. Otherwise, use of insecticides is unavoidable, as often is the case in many developing countries. Under this situation, because of spray residues the continuous production of DBM becomes uncertain. With the IJoRU method, however, such uncertainty is removed.

That DBM can be raised by the IJoRU method on food source totally free of insecticidal contamination is especially crucial in research on insecticide toxicology, particularly for studies on insecticide resistance in diamondback moth. It ensures that each strain can be maintained pure and remain unaffected by possible influence from unwarranted traces of insecticides, which otherwise can result if mature (and often treated) foliage is used.

The IJoRU method, because of its versatility for rearing both DBM and *A. plutellae*, has also opened the avenue for more intense attempts on biological control of the moth. Mass production of the parasitoid is feasible for possible studies on inundative release. Although not fully investigated, some preliminary observations have indicated it to be also useable for mass breeding of other parasitoids of diamondback moth.

In developing countries where research manpower and facilities are limited, the IJoRU method should prove especially useful. As with the method of LIU and SUN (1984), no other associated expensive equipment is necessary. Handling of the larvae (*e.g.* transfers) is minimal while the procedure involved is simple with no repeated watering necessary. Moreover, a considerable degree of flexibility is possible. 'Sawi' seeds are cheap and generally available all year-round. They germinate rapidly and the seedlings grow quickly. Although yet to be evaluated, other cruciferous seedlings could possibly be used as well.

ABSTRACT

This paper describes an Inter-Connecting Joint Rearing Unit (IJoRU) which can facilitate a continuous supply of *Plutella xylostella* (L.) and its parasitoid, *Apanteles plutellae* Kurdj. It is simple, comprising three basic structural components: two plastic cup-like containers and an inter-connecting cylindrical gauze component.

From one rearing unit beginning with 60–70 eggs of *P. xylostella, ca* 70% will attain pupation while that for parasitoid *ca* 78 per cent.

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