# MIXED PREY AS A FOOD SOURCE FOR MASS REARING OF THE BAGWORM PREDATOR, *Sycanus dichotomus*

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Interest in biological control has increased considerably in response to the various effects of pesticides on the environment. Biological control favours conservation and the sustainable use of biological resources. Mass rearing and release of natural enemies are needed to attain sufficiently low pest populations.

Often the success of biological control through an increased release of natural enemies depends on feasible mass-rearing techniques. Ensuring the availability of the natural food sources (in this case, bagworms) for the mass rearing of the predator is expensive and not feasible to carry on a sustained basis. Thus, attempts were made to utilise common and easily available resources which can enhance growth and development of the predator in a mass rearing system.

The suitability of two live insect preys as food sources for the mass rearing system of the predator, *Sycanus dichotomus* (*Figure 1*), was assessed. This was to ensure that the mass rearing system would be able to produce a large number of vigorous predators at a low cost.

*Figure 1. The female* Sycanus dichotomus.

## DESCRIPTION OF THE PREDATOR

*Sycanus dichotomus* (Hemiptera: Reduviidae) is commonly found as a predator which attacks bagworms and nettle caterpillars in oil palm plantations. The average body length (head to abdomen) of the adult is 23 mm. The entire body is brownish black, while the female has a more rounded abdomen (Norman *et al.*, 1998).

The life cycle of *S. dichotomus* is up to 200 days, depending on available food sources. The insect has five stages of nymphs before moulting to the adult stage. The main difference between *S. dichotomus* with other Hemipteran predators is the rostrum. *S. dichotomus* can penetrate the cases of the bagworms with its very long rostrum (de Chenon *et al.*, 1989; Zulkefli *et al.*, 2004).

## BENEFITS

- Easy to rear and requires low maintenance.
- Reduces chemical usage for controlling bagworms and nettle caterpillars.
- Maintains bagworm populations at low levels.
- Is an element in the Integrated Pest Management (IPM) programme for bagworm.

## METHODOLOGY

The *Sycanus dichotomus* cultures were maintained in an environment-controlled room (day temperature, 27°C±1°C; night temperature, 24°C±1°C; photoperiod, 12:12 (L: D) hours and relative humidity, 50%-70%). The parent populations of *S. dichotomus* were collected from a nearby oil palm plantation. Individuals were mated and placed in transparent plastic cylinders with a ventilated lid.

For diet assessment, two types of prey were evaluated: the mealworm, *Tenebrio molitor*, larvae (*Figure 2*), and the rice moth, *Corcyra cephalonica*, larvae (*Figure 3*). The predators were reared individually in similar plastic cylinders (*Figure 4*), and supplied daily with enough prey and honey solution. The mealworms were reared on oats and bread, while the rice moth larvae were reared on blended corn and rice. Using the same rearing

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conditions, the predator nymphs were reared by feeding them with the larvae of *T. molitor* (*Figure 5*) or *C. cephalonica*, or mixtures of both larvae, until they reached the adult stage.

The developing *S. dichotomus* nymphs were monitored daily for moulting or death. The suitability of the food sources for *S. dichotomus* was evaluated by measuring its body weight and the duration of all its developmental stages, from each moulting to the next stage.

*Figure 2. Mealworm,* T. molitor, *larvae.*

*Figure 3. Rice moth,* C. cephalonica, *larvae.*

*Figure 4. A single predator in a transparent cylinder with a ventilated lid.*

*Figure 5. Adult* Sycanus dichotomus *feeding on a* Tenebrio molitor *larva.*

## RESULTS

The influence of the larvae of *C. cephalonica* or *T. molitor*, or their mixed larvae, as food sources on developmental time and body weight at the six developmental stages of the predator, *S. dichotomus*, is shown in *Figures 6* and *7*. Of the food sources given, the mixed prey consisting of *C. cephalonica* and *T. molitor* larvae performed better in supporting the growth and development of *S. dichotomus*. Different food sources showed different degrees of influence on the predator's developmental stages; *C. cephalonica* larvae reduced the developmental period of the early nymphs (stages 1 and 2), but reduced adult longevity compared with *T. molitor* larvae. This result indicates that *C. cephalonica* larvae may be a suitable diet for early nymph development (first and second nymph stages), but a mixed diet is more suitable as food for the final nymph stages (third to fifth) and for adult longevity. The predator's body weight increased when supplied with the mixed prey. A quick growth response to the nymph developmental stages was observed in response to the mixed prey (94.9 days) over diets of *C. cephalonica* and *T. molitor* larvae alone at 97.6 and 116.1 days, respectively.

## COST OF PRODUCTION

A comparison of the estimated cost of rearing prey and the price of commercially available prey is shown in *Table 1*. It is cheaper to raise the predator on live prey reared in the laboratory at RM 0.15 per predator (*Table 2*). This is 76% lower compared to using commercially available prey which would cost RM 0.63 per predator. The total cost of producing one adult *S. dichotomus* is calculated based on prey preference as shown in *Table 2*. The cost is also based on the number of live prey consumed throughout nymphal development and for maintenance of the adult.

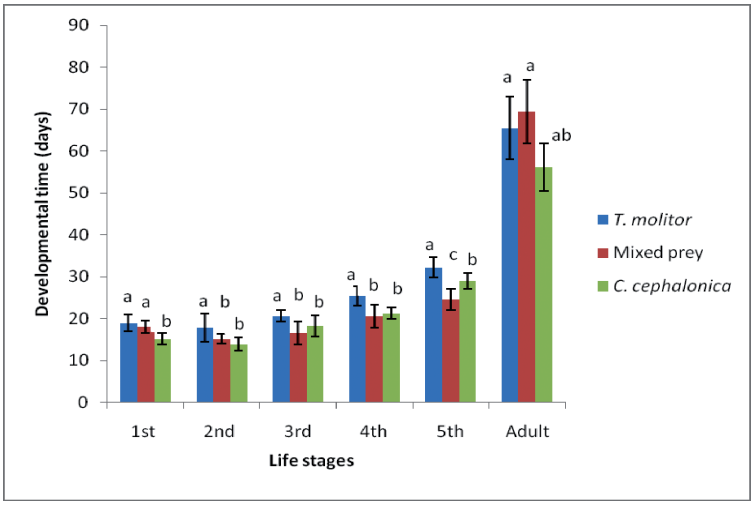


*Figure 6. Developmental time of* Sycanus dichotomus *fed on three types of food sources. Means within each life stage followed by different letters indicate significant differences between them (LSD test; $P < 0.05$).*

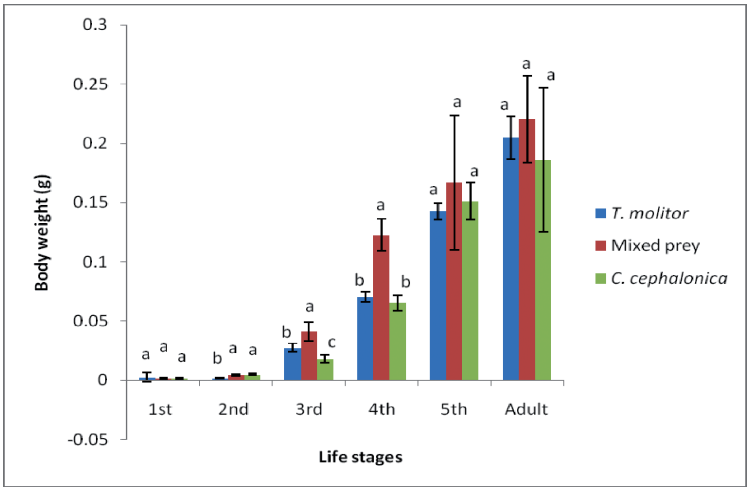


*Figure 7. Body weight of* Sycanus dichotomus *fed on three types of food sources. Means within each life stage followed by different letters indicate significant differences between them (LSD test; $P < 0.05$).*

**TABLE 1. ESTIMATED COST (RM) OF LIVE PREY**

| Prey | Cost per kg (RM) | No. of larvae (per kg) | Cost per individual (RM) |
|---|---|---|---|
| *T. molitor* (commercial) | 52.80 | 12 886 | 0.004097 |
| *T. molitor* (reared) | 4.70 | 12 886 | 0.000362 |
| *C. cephalonica* (reared) | 18.10 | 36 764 | 0.000493 |

**TABLE 2. ESTIMATED TOTAL COST (RM) TO PRODUCE ONE ADULT *S. dichotomus* BASED ON REARED PREY**

| Feeding stage | Life span (days) | No. of prey consumed (per day) | | Cost per individual (RM) |
|---|---|---|---|---|
| | | *C. cephalonica* | *T. molitor* | |
| Nymphs 1-2 | 33 | 2 | 0 | 0.033 |
| Nymphs 3-5 | 62 | 1 | 1 | 0.053 |
| Adult | 69 | 1 | 1 | 0.059 |
| **Total cost** | | | | **0.145** |

Note: The cost does not include labour cost.

## CONCLUSION

The cost of mass rearing the predator, *S. dichotomus*, was reduced by 76%, from RM 0.63 to RM 0.15 per individual by supplying reared prey to the predator. Mixed prey is the most ideal food source for enhancing the growth and development of the predator and for promoting healthy adults. Overall, the reared mixed prey is cheaper and a more suitable food source for the mass rearing of *S. dichotomus*.

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