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LIFE CYCLE OF *Sycanus dichotomus* (Hemiptera: Pentatomidae) - A COMMON PREDATOR OF BAGWORM IN OIL PALM

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ABSTRACT

The life cycle of Sycanus dichotomus *(Hemiptera: Reduviidae) was studied with two types of prey,* Corcyra cephalonica *and* Plutella xylostella *in a controlled environment room. The eggs hatched after 11 to 39 days with each cluster having 15 to 119 eggs. Five nymphal stages were recorded. The mean longevity of each nymphal stage was 24.35, 16.95, 20.35, 25.32 and 43.51 days when fed with* C. cephalonica *and 16.72, 15.78, 14.88, 24.03 and 46.84 days when fed with* P. xylostella. *The period of development from eggs to adult when fed with* C. cephalonica *and* P. xylostella *were 193.44 ± 2.41 and 203.91 ± 2.77 days. The mean longevity for male and female adults fed with* P. xylostella *was 83.47± 4.37 and 87.64 ± 3.31days respectively. The longevity of male and female adults fed with* C. cephalonica *was 63.99 ± 2.92 and 61.61.86 ± 2.96 days. Lower mortality was recorded on the* S. dichotomus *fed with* P. xylostella.

Keywords: *Sycanus dichotomus*, reduviidae, life cycle, predator, bagworm.

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INTRODUCTION

Sycanus dichotomus (Hemiptera: Reduviidae) is a common predator found in oil palm. The ability to attack the larval stage of the bagworm makes it suitable for the biological control of the bagworm (Norman *et al.,* 1998). Other species of *Sycanus* which reported attacking *Mahasena corbetti* was *Sycanus macracanthus* (Tiong, 1996). *Sycanus dichotomus* was also reported attacking nettle caterpillars such as *S. asigna* and *Darna trima* (Singh, 1992) but was not a good candidate because of slow feeding. This predator spend 4 to 5 hr feeding on a single mature larvae (De Chenon *et al.,* 1989).

Bagworms are common and serious pests of oil palm in Malaysia (Basri *et al*., 1988). Biological control has been the core of successful integrated pest management programmes. Continuous use of chemicals will affect beneficial insects such as insect pollinators and natural enemies of oil palm pests.

Another family of Hemiptera commonly reported for biological control of bagworm is pentatomidae. *Cantheconidea, Platynopus* and *Eoccanthecona* spp. are the common asopine bugs found in oil palm plantations. The main difference between these species with *Sycanus* is the rostrum. *Sycanus* can feed on the bagworm larva because of their long rostrum which can penetrate the bags. It was reported that most pentatomidae predators have difficulty attacking the late instar of the bagworm (Zulkefli, 1996).

The development of laboratory rearing techniques is important for successful mass rearing. The mass rearing of a predator needs a continuous supply of prey. This will also enable studies to be done on the life cycle of the predator. The larvae of the stored product pest, *Corcyra cephalonica* and vegetable pest *Plutella xylostella* which are easily reared were used as prey to study whether the *Sycanus* life cycle is affected by the different types of prey.

MATERIALS AND METHODS

The study was conducted in a controlled environment room (entomology laboratory) at MPOB Headquarters in Bangi (day temperature 27 ± 1°C, night temperature 24 ± 1°C, light: darkness 12:12 and humidity 30.5% –50% RH).

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Rearing of Adult *Sycanus dichotomus*

The predator was reared in plastic cylindrical cages (25 cm height x 13 cm diameter). Each cage contained a pair of *Sycanus* adults. A total of 68 pairs of adults were kept in cages for mating and egg laying. Live bagworm larvae were supplied daily. The date and number of eggs laid were recorded to determine the time for eggs to hatch.

Eggs

The eggs were collected from the surface of the cylindrical cages and kept in a different plastic cylindrical container in a controlled environment room.

Upon hatching, the first instar nymphs were given moist cotton wool placed in a small petri dish. On the second day of hatching, the first instar nymphs were transferred and kept individually in small plastic cups (10 mm height x 7.5 mm diameter) with wet cotton wool and prey. The cups were checked every one or two days and the prey and water replenished as necessary.

Nymph and Adult

A total of 500 first instar nymphs were used for this study. Two hundred and fifty nymphs were supplied with the early stage of *Corcyra cephalonica* and the remaining of 250 nymphs fed with *Plutella xylostella* larvae. These nymphs were from five batches of eggs. A hundred nymphs were selected from each batch of eggs and supplied with two larvae of the early stage of *C. cephalonica* and *P. xylostella* accordingly. The larvae were supplied daily or changed when the carcass dried after been sucked by the predator. All the preys were supplied by Malaysian Agricultural Research and Development Institute (MARDI), Serdang.

P. xylostella was reared as reported by Hussan and Sivapragasam (1996). Each week, 40 to 60 cups of *P. xylostella* were used for this experiment. Two to three trays of *Corcyra cephalonica* in rice and corn mixed at a 1:1 ratio were used for two weeks. The methods of rearing as reported by Razik (1996).

Each cup was numbered 1 to 500 to determine the time of moulting and sex of the adult individually. The presence of exoskeleton was checked daily to record the date of moulting. This was recorded as the end of the previous instar and the beginning of the new instar. The duration of instars was determined by calculating the period (days) between the formations of the discarded exoskeleton. The life span of the adult was determined from the formation of the last discarded exoskeleton until it died.

The morphometrics of the predator were determined by measuring their head width, hind femur length and body weight. This was done by measuring 10 nymphs from each group, selected at random after they had moulted into new instars. The nymphs were paralyzed with CO_2 before measuring under the microscope. After measurements, the predators were released back to their container. This process was repeated in all stages until the predator moulted into an adult.

Water was supplied on a piece of cotton wool, plugged into a small hole in the plastic cup lid. Every two days, water was dripped on the cotton wool to prevent from drying. Any predator which died after moulting was excluded from this study. Sex was determined by the size of the abdomen. The female has a larger abdomen than the male.

RESULTS

Eggs

The eggs were laid in clusters and cemented to each other and the surface of the plastic cylinder. The eggs masses were brown and always in a precise *chevron* pattern in vertical but oblique rows (*Figure 1*). The female *S. dichotomus* laid three batches of eggs during its lifetime. From 68 pairs of *S. dichotomus* adults, only 50% of the eggs hatched. All the eggs (15 to 119 eggs per cluster) hatched within the same day. The incubation period was 11 to 39 days.

Nymph

The nymph moulted five times before they reached the adult stage (*Figure 2*). Newly emerged nymphs were yellowish in colour on their head, thorax and abdomen. The legs were brown, with the joints of femur and tibia darkened.

The first instar nymphs were gregarious and normally remained motionless. They however, shifted their positions at short intervals by crossing

Figure 1. Sycanus dichotomus *egg.*

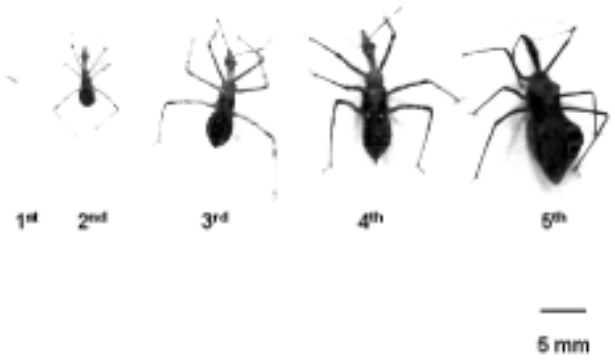

Figure 2. Nymphal stages of Sycanus dichotomus.

over each other. The mean duration of the first instar nymphs was 24.35 ± 0.57 days when fed with *C. cephalonica* and 16.72 ± 0.30 days when fed with *Plutella xylostella* (*Table 1*). At this stage, the mortality was 17.25 % and 14.4% when fed with *C. cephalonica* and *P. xylostella* respectively.

The second instar took a shorter time before it molted into the next instar. It took only 16.95 ± 0.43 days when fed with *C. cephalonica* and 15.78 ± 0.17 days when fed with *Plutella xylostella*. The colours were similar to the early instar except on the body. The body weight of the first and second instar nymphs were higher when fed with *Corcyra* (P<0.001) than *Plutella* (*Table 2*).

The third instar nymphs were darker than the second instar nymphs. The spot on the abdomen was also larger. A comparison between the different preys showed not much difference in the body measurements (*Tables 3* and *4*).

The fourth instar nymph took about three weeks before it moulted into the next instar. The durations were 25.32 ± 0.41 days when fed with *C. cephalonica* and 24.03 ± 0.31 days when fed with *P. xylostella*.

As the predator moulted into the fifth instar, the duration was increased to about one fold for both groups. The longest duration recorded was 69 days (*Tables 5* and *6*). Almost all the nymphs succeeded into adults, with only a few abnormal adults from moulting difficulties.

TABLE 1. NYMPH AND ADULT DURATIONS (days) OF *Sycanus dichotomus* REARED ON TWO TYPES OF PREY

Stage	Fed with *Corcyra cephalonica*					Fed with *Plutella xylostella*					t-Test result
(nymph/ adult)	n	Mean	±	S.E.	Range	n	Mean	±	S.E.	Range	
I	153	24.35	±	0.57	15 - 38	199	16.72	±	0.30	8 - 27	*
II	153	16.95	±	0.43	10 - 36	199	15.78	±	0.17	10 - 30	*
III	153	20.35	±	0.55	11 - 35	199	14.88	±	0.19	8 - 25	*
IV	153	25.32	±	0.41	11 - 38	199	24.03	±	0.31	14 - 23	*
V	153	43.51	±	0.89	11 - 62	199	46.84	±	0.73	18 - 64	ns
Adult	153	62.96	±	2.07	11 - 133	199	85.65	±	2.71	13 - 156	ns
Mean of nymph	153	130.48	±	1.29	97 - 156	199	118.26	±	0.88	86 - 140	*
Mean of life cycle	153	193.44	±	2.41	142 - 266	199	203.91	±	2.77	95 - 299	ns

Notes:
n = number of samples.
S.E. = standard error.
n.s. = not significant.
** = significant at 1% level.
* = significant at 5% level.

TABLE 2. BODY WEIGHT (g) OF *Sycanus dichotomus* NYMPH AND ADULT

Nymph stage	Fed with *C. cephalonica*		Fed with *P. xylostella*		t-Test
	n	Mean+S.E.	n	Mean+S.E.	
I	10	0.0013+0.0001	10	0.0007+0.0001	*
II	10	0.0020+0.0001	10	0.0014+0.0001	*
III	10	0.0066+0.0014	10	0.0045+0.0001	ns
IV	10	0.0290+0.0027	10	0.0281+0.0028	ns
V	10	0.0627+0.0042	10	0.0598+0.0023	ns
Adult	10	0.0627+0.0042	10	0.0598+0.0023	ns

TABLE 3. HEAD WIDTH (mm) OF *Sycanus dichotomus* NYMPH AND ADULT

Nymph stage	Fed with *C. cephalonica*		Fed with *P. xylostella*		t-Test
	n	Mean+S.E.	n	Mean+S.E.	
I	10	0.495+0.005	10	0.513+0.006	ns
II	10	0.715+0.008	10	0.697+0.006	ns
III	10	1.000+0.013	10	0.958+0.012	ns
IV	10	1.310+0.038	10	1.400+0.013	ns
V	10	1.785+0.030	10	1.805+0.019	ns
Adult	10	1.935+0.017	10	2.050+0.015	ns

TABLE 4. FEMUR LENGTH (mm) OF *Sycanus dichotomus* NYMPH AND ADULT

Nymph stage	Fed with *C. cephalonica*		Fed with *P. xylostella*		t-Test
	n	Mean+S.E.	n	Mean+S.E.	
I	10	0.995+0.030	10	1.170+0.037	ns
II	10	1.775+0.030	10	1.850+0.048	ns
III	10	2.855+0.068	10	2.750+0.044	ns
IV	10	4.430+0.164	10	4.495+0.031	ns
V	10	5.963+0.104	10	6.500+0.062	ns
Adult	10	7.450+0.079	10	8.875+0.070	ns

TABLE 5. NYMPH AND ADULT DURATION (days) OF THE MALE AND FEMALE *Sycanus dichotomus* FED WITH *Corcyra cephalonica*

Sex	Male nymph /adult					Female nymph/adult					t-Test result
(nymph/ adult)	n	Mean	±	S.E.	Range	n	Mean	±	S.E.	Range	
I	79	24.53	±	0.84	15 - 38	74	24.16	±	0.78	15 - 38	ns
II	79	17.25	±	0.65	10 - 36	74	16.62	±	0.56	11 - 36	ns
III	79	20.52	±	0.85	13 - 51	74	20.18	±	0.69	13 - 35	ns
IV	79	24.68	±	0.61	13 - 35	74	26.00	±	0.52	11 - 38	ns
V	79	42.46	±	1.29	24 - 68	74	44.64	±	1.23	11 - 68	ns
Adult	79	63.99	±	2.92	11 - 119	74	61.86	±	2.96	11 - 120	ns
Mean of nymph	79	129.44	±	1.88	99 - 161	74	131.59	±	1.75	95 - 178	ns
Mean of life cycle	79	193.43	±	3.43	128 - 266	74	193.46	±	3.41	135 - 275	ns

TABLE 6. NYMPH AND ADULT DURATION (days) OF THE MALE AND FEMALE *Sycanus dichotomus* FED WITH *Plutella xylostella*

Sex	Male nymph /adult					Female nymph / adult					t-Test result
(nymph/ adult)	n	Mean	±	S.E.	Range	n	Mean	±	S.E.	Range	
I	95	16.60	±	0.43	8 - 27	104	16.83	±	0.42	8 - 23	ns
II	95	15.79	±	0.27	10 - 30	104	15.78	±	0.21	13 - 22	ns
III	95	14.98	±	0.30	8 - 24	104	14.8	±	0.25	11 - 25	ns
IV	95	24.56	±	0.40	18 - 39	104	23.54	±	0.47	14 - 30	ns
V	95	44.67	±	1.25	18 - 64	104	48.83	±	0.75	24 - 69	ns
Adult	95	83.47	±	4.37	3 - 167	104	87.64	±	3.31	5 - 153	ns
Mean of nymph	95	116.60	±	1.56	76 - 138	104	119.77	±	0.89	91 - 151	ns
Mean of life cycle	95	200.07	±	4.46	95 - 299	104	207.41	±	3.38	124 - 299	ns

Adult

The male and female adults can be distinguished by their body and abdominal size. Male adults are smaller compared to the female (*Figure 3*). The newly emerged black adult remained stationary for 15-20 min. Few of the adults died during emerging. The mean life span of the adults fed with *C. cephalonica* was 62.96 ± 2.07 days and 85.65 ± 2.71 days for *P. xylostella* (*Table 1*).

There were no significant differences (p>0.01) in the mean measurements of head width, femur length and body weight of the two types of prey (*Tables 2, 3* and *4*). The head width was 2.050 ± 0.015 mm, 8.875 ± 0.070 mm on femur length and 0.1853 ± 0.0054 g on body weight on adult feds with *P. xylostella*. The same measurements on adults fed with *C. cephalonica* were 1.935 ± 0.017 mm, 7.450 ± 0.079 mm and 0.1621 ± 0.0138 g.

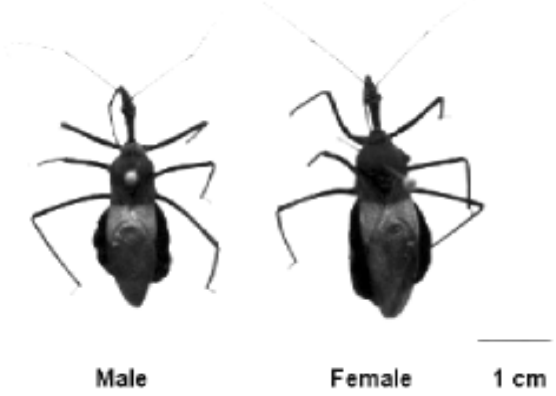

Figure 3. Adult of Sycanus dichotomus *male and female.*

The male and female adults fed with *P. xylostella* had longer life spans with 83.47 ± 4.37 and 87.64 ± 3.31 days. The range was three to 167 days for the male and five to 153 days for the female. The longevity of male and female *Sycanus* adults fed with *C. cephalonica* was 63.99 ± 2.92 and 61.86 ± 2.96 (*Tables 5* and *6*). No significant difference was observed between the male and female adults fed the same prey either with *P. xylostella* or *C. cephalonica* (p> 0.01).

DISCUSSION

This study has described the duration of the nymphal and adult stages of *Sycanus dichotomus* consuming two types of prey. The mean five nymphal stages and adult durations took more than 6.4 months and 6.7 months on the predators fed with *C. cephalonica* and *P. xylostella* respectively. Norman (1996, unpublished) found that the duration of *S. dichotomus* from egg to adult fed with unbagged bagworm larvae took about 126.4 days. This was almost the same nymphal duration on both provided the preys - 130.48 days and 118.26 days (*Table 1*).

S. dichotomus fed *Plutella xylostella* lived longer compared with *Corcyra cephalonica*. The mean duration from egg hatch to death of the adult was 200.1 ± 4.46 days and 207.41 ± 3.38 for the male and female (*Table 6*). The percentage of nymphs succeeded to adulthood was 79.60% while in the earlier group only 61.2% survived (*Figure 4*). The highest mortality was in the earlier stages especially the first instar. In the second and third instars, no mortality was recorded on the predator fed with *P. xylostella* while those fed with *C. cephalonica* had 6% and 7.2% mortalities, respectively (*Figure 5*).

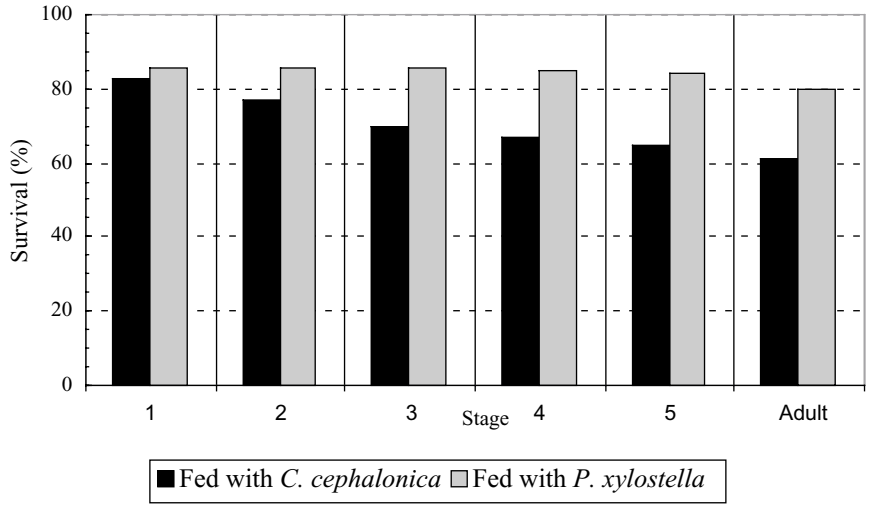

Figure 4. Survival percentage of Sycanus dichotomus *fed with* Corcyra cephalonica *and* Plutella xylostella.

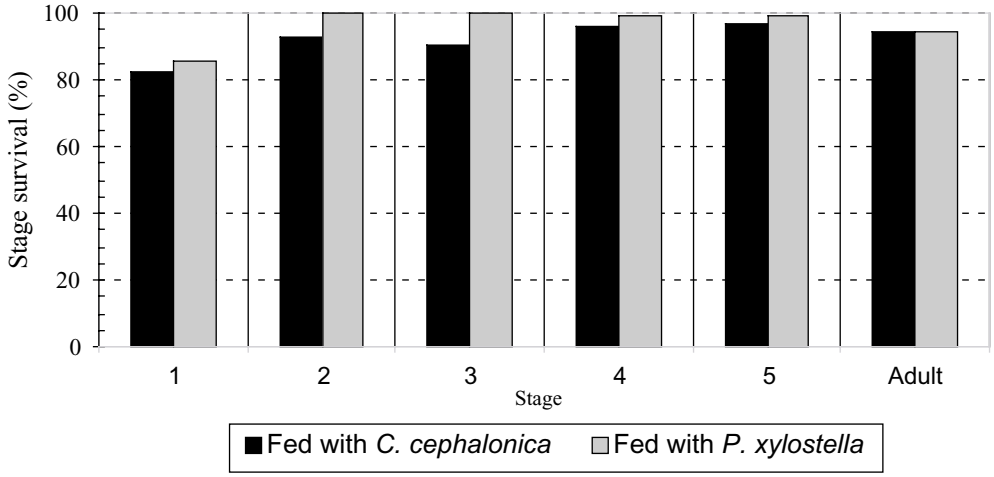

Figure 5. Stage survival percentage of Sycanus dichotomus *fed with* Corcyra cephalonica *and* Plutella xylostella.

The fecundity of *Sycanus dichotomus* reared with bagworm larvae was in the range of 15-119 eggs/female, higher compared with other species of reduviid predators except *Sycanus. affanis*. Ambrose (1999) reported that the fecundity of *S. affanis* was 372 egg/female, *S. pyrrhomelas* 86.80 egg/female (range 29-97) and *S. versicolor* 68.9 eggs/female (range 10-30.3).

Measurements on the head width, femur length and body weight to determine the effects of different type of prey showed no significant difference except in the body weight of the first two instars. Fed with *C. cephalonica*, the body weight of *S. dichotomus* was higher in the first (t = 4.88, df =18) and second (t = 4.42, df = 18) nymphal instar compared to *Plutella* (*Table 2*). No overlapping measurements were recorded in the nymphal stages (*Tables 3* and *4*). Based on their colour and sizes, the stages could be determined (*Figure 2*).

As the predator has the capability to feed on bagworms, more study should be conducted to find its limitations. With the life span of *Metisa plana* bearing 92 to 97 days for the male and female (Basri and Kevan, 1995), this predator would have enough supply of prey to build its population, especially during outbreak. Desmier de Chenon *et al.* (1989) reported that during its life time about 430 young *M. plana* larvae was consumed by an individual. This was almost same with *Corcyra* or *Plutella*. An average of two larvae were needed daily during this study.

Earlier publications reported that *Sycanus* live under cover crops, therefore, their population tend to be restricted to young palm. Observation during a bagworm outbreak showed that this predator laid their eggs on the oil palm leaflets, making it easier to find its prey on the higher fronds (De Chenon *et al.*, 1989).

It was observed that cannibalism was common among the adults and nymphs. Sometimes they prefer cannibalizing than to feed on their prey. This problem can be avoided if the predators are separated individually. However, for mass rearing,

it is impossible to rear individually because it is time consuming and less economical. Small groups of the predator can be handled effectively with sufficient food supply.

The use of systemic pesticides may suppress the *Sycanus* population in oil palm plantations if poisoned caterpillars are consumed. Pesticides that have no adverse effects on this predator should be selected in oil palm pest managements. A study on third instar nymph of *S. dichotomus* feeding on the middle instars of *Metisa plana* showed that monocrotophos, trichlorfon, cypermethrin and Xen Tri did not have any adverse effect after 14 days (Zulkefli, 1997; unpublished). More detailed study should be conducted because other factors may also affect the longevity and fecundity of this predator.

The information on longevity and fecundity of *Sycanus dichotomus* is useful for further study on biological control of leaf eating caterpillars in oil palm. We hope that the results will be useful in the study of biological control of bagworms in oil palm.

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REFERENCES

AMBROSE, D P (1999). *Assasin Bugs*. Reviewed by Schaefer. C W Science Publisher, Inc., Enfield, NH, USA. 337 pp.

BASRI, M W; A H HASSAN and M ZULKEFLI (1988). Bagworms (Lepidoptera: Psychidae) of oil palm in Malaysia. *PORIM Occasional Paper No. 23*: 37 pp.

BASRI, M W and KEVAN, P G (1995). Life history and feeding behaviour of the oil palm bagworm *Metisa plana* Walker (Lepidoptera: Psychidae). *Elaeis Vol. 7(1)*: 18-34.

DESMIER DE CHENON, R; SIPAYUNG, A and SUDHARTO, P S (1989). The importance of natural enemies on leaf eating caterpillars in oil palm in Sumatra, Indonesia - uses and possibilities. *Proc. of the PORIM International Palm Oil Development Conference*. PORIM, Bangi. 5-9 September 1989. p. 245-262.

HUSSAN, A K and SIVAPRAGASAM, A (1996). Mass rearing of some major lepidopterous insect pests of crucifers using artificial diet: potential and problems. *Proc. of the AVNET 2 Final Workshop*. Bangkok, Thailand. 1- 6 September 1996. p. 78-86.

NORMAN, K; BASRI, M W and ZULKEFLI, M (1998). *Handbook of Common Parasitoid and Predator Associated with Bagworm and Nettle Caterpillars in oil Palm Plantations*. PORIM, Bangi. 29 pp.

RAZIK, A H (1996). *Kesesuaian Sepuluh Jenis Bijirin dan Campuran Dua Bijirin Sebagai Bahan Pemeliharaan Kupu-Kupu Beras,* Corcyra cephalonica Stainton *(Lepidoptera: Pyralidae,Gallerinae).* B. Sc. thesis. Universiti Pertanian Malaysia, Serdang. 53 pp.

SINGH, G (1992). Management of oil palm pests and disease in Malaysia in 2000. *Pest Management and the Environment in 2000* (A Aziz; S A Kadar and Barlon, H S eds.). p. 195-212.

TIONG, R H C (1996). The regulatory roles of natural enemies of some oil palm insect pests. *The Planter, 72*: 653-666.

ZULKEFLI, M (1996). *The Effect of Selected Insecticides on the Oil Palm Bagworm Metisa plana Walker(Lepidoptera: Psychidae) and Predatory Bug* Cantheconidea *sp. (Hemiptera: Pentatomidae).* B. Sc. thesis. Universiti Pertanian Malaysia, Serdang. 31 pp.