AN EVALUATION OF PREDATOR BY *CHILOMENES SEXMACULATA* TO *APHIS MEDICAGINIS*

by

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ABSTRACT

A field experiment on aphid predation was conducted at Lebak Bulus, Jakarta, Indonesia, using a predator bettle, Chilomenes sexmaculata, *to obtain information of the beetles feeding performance to its prey,* Aphis medicaginia. *The experiment was done using an exclussion methode. The result indicates that the aphid population in the caged pods increased remarkably up to maximum number when the alate individuals were produced. While the aphid populations on the uncaged pods increased very slightly due to contineus predation by the beetles. The difference between the aphid number on the caged and uncaged pods indicates the number of the aphids eaten by the beetles.*

INTRODUCTION

Aphids are common insect pest of many vegetable plants. Their immense reproductive abilities make many of them serious pest, especially when foods are ubundant. Among vegetables legumes are preferred food plants to aphids. One of which, *Aphis medicaginis* are often found abundant on cowpea plants, *Vigna chinensis*, feed mainly on tender leaves and young pods.

Despite their high prolificity aphids are subject to being preyed by various predators and parasites. Under field condition aphid population rarely stabilize, but they decline rapidly after reaching high number. This is indeed due to activities of predators (SMITH, 1965; EMDEN, 1965).

Chilomenes sexmaculata (Coleoptera : Coccinellidae) is a common predator of *A. medicaginis* on cowpea plants in vegetable fields. The beetle often acculmulates on plants bearing large number of the aphids. After sometimes, due to feeding by the coccinellid larvae and adults the aphid population is gradually diminished (KALSHOVEN, 1980; CHINERY, 1977).

Although there are many information about the beetle predation to the aphid preys, little is known about the quantitative data of

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feeding performances of the beetle. This paper provide clues about possible role of *C. sexmaculata* as natural enemy of *A. medicaginis*. The importance of this paper is to evaluate the effectiveness of the beetle in the aphid population regulation and control.

MATERIALS AND METHODS

The experiment was carried out in a cowpea field *(V. chinensis)* of about 100 m^2, at Lebak Bulus, Jakarta, from February to March, 1986, using exclussion methode (DE BACH *et al.* (1974). The plants bearing pods and having no aphid infestation were used in the experiment. During the experiment no chemical pesticides were used to avoid aphid infestation.

As many as 10 cowpea plants bearing pods were selected randomly, and from all the plants were again selected for 30 young pods of about 20 cm long for each pod. On each of the selected pod 10 adults *A. medicaginis* were infested in such a way with very little disturbances to fascilitate feeding and development. A number 15 infested pods, each was the caged in a terylene screen to avoid predator infestation. The remaining 15 pods were left uncaged and subject to predation by *C. sexmaculata.*

The number of the aphids in both caged and uncaged pods were examined and calculated daily. The same was true for coccinellid larvae and adults feeding or staying near the aphid colonies in the uncovered pods. The number of the aphids devowed by the beetles day were computed using Thompson formula (VARLEY *et al.*, 1975) as follows :

$$Nha = N\ (1 - Exp.\ (Na - N),\ \text{where}$$

Nha = number of aphids eaten by the beetles per day, Na = number of the beetle on or near the aphid colonies, N = number of aphids on the uncaged pods.

RESULT AND DISCUSSION

Field observation indicates that there are two species of the aphid predator, namely *C. sexmaculata* and *Syrphus* sp. (Diptera : Syrphidae). However, *C. sexmaculata* is the most abundant and represent a dominant aphid predator. It is obvious that the coccinellid beetle is the main factor effecting the aphid population in the field.

Further calculation reveals that the number of the aphids on the caged pods was much higher than that on the uncaged ones.

This marked differences was due to predation by the beetles. The larvae and adults of the beetles were found feeding on the aphids in their colonies. Such a phenomenon was also observed by KALSHOVEN (1981) for other species of aphids in fields.

The aphids on the caged pods showed tremendous increase in population number. During the first 2 and 3 days they showed only a little increase, but their number built up rapidly and became abundant on day 4 and 7. On day 7 when the number was 107.6, alate individuals were produced from the aphid colonies. The big number of aphids in the colonies resulted in the adverse effect to the caged pods. In such situation the development of the alates among the progeny is due to overcrowding and the host plant quality (DIXON, 1973). Further observation indicates that the aphid population in the caged pods were still increasing during the succeding days, and attained maximum number on the day 9, when the number reached 325 aphid individuals. (Table 1). The pods were nearing to a state of wilted due to the feeding activity and juice material being sucked by the aphids.

Table 1. The development of *A. medicaginis* population on the caged and uncaged pods.

The day	Mean number of *A. medicaginis* on	
	caged pods	uncaged pods
1	10.00	10.00
2	38.87 ± 2.62	32.27 ± 3.09
3	78.13 ± 4.64	52.87 ± 6.97
4	111.30 ± 7.84	69.73 ± 8.78
5	153.73 ± 12.10	90.13 ± 9.17
6	197.60 ± 15.87	105.27 ± 11.06
7	252.87 ± 15.40	88.27 ± 10.38
8	316.40 ± 13.62	87.60 ± 8.83
9	325.00 ± 30.23	96.13 ± 11.10
10	The pods wilted	68.73 ± 10.88
11	The pods wilted	49.40 ± 8.92
12	The pods wilted	17.00 ± 5.44

The aphid population on the uncaged pods showed adverse condition. They increased gradually during the succeding days of observation. The maximum population number was attained on day 6 after infestation with the total number of 105.27 aphid individuals. Their number later declined during the 7 and 8. After increasing to some extent their number continued to decline on the following days.

The lowest aphid population number in the uncaged pods was observed on day 12, when the number was only 17 individuals per pod (Tabel 1). No wilted pods were observed.

The aphid population on the caged and uncaged pods showed very much difference in their development (Fig. 1). It is obvious that the beetle, especially their larvae, caused heavy mortality to the aphids.

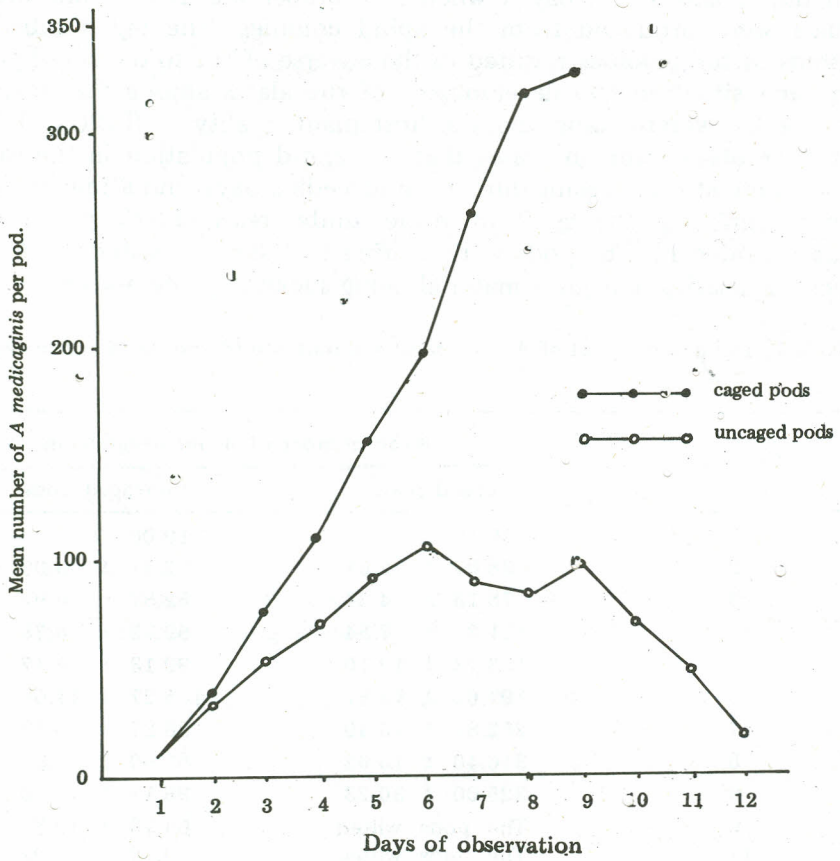

Fig. 1. Population development of *A. medicaginis* on the caged and uncaged pods.

Their larvae were even more voracious than the adult beetles, feeding on a large number of the aphids. MILLS (1982) and IMMS (1960) indicated that during its life cycle a single coccinellid predator can eats up to 216 and 475 aphid individuals. Indeed, their feeding performance is very effective in checking aphid population in the fields (EMDEN, 1960).

Further observation indicates that the number of *C. sexmaculata* underwent changes following the changes of their prey number. When the aphid population on the uncaged pods buit up, the beetle larvae increased in number, and decrased when the prey population was scarce (Table 2). Is was also observed that the beetles laid more eggs when their prey was abundant. Their eggs were deposited close to the aphid colonies, and the larvae that hactch from the eggs were able to obtain sufficient food on which to survive. The same results were reported by DIXON (1973) for Coccinellidae in Europe. But if a few aphids were present the beetles left the site and sought aphids elsewhere. It is probably due to the fact that the beetle can not find sufficient food to mature their eggs.

Table 2. The development of *A. medicaginis* on the uncaged pods and *C. sexmaculata* living in association.

The day	Number of *A. medicaginis* (15 pods)	Number of *C. sexmaculata* (15 pods)
1	150	15
2	484	17
3	793	22
4	1046	30
5	1352	34
6	1579	38
7	1324	35
8	1314	41
9	1442	33
10	1031	36
11	741	26
12	256	21

The number of the aphids eaten by the coccinellid bettles per day was computed using Thompson formula. The result showes that the consumption by the beetles increased following the increased of the aphid number which were available for food. The consumption

attained maximum on day 8 after the aphids infestation, but between day 9 to 12 the number of the aphids consumed by the beetles declined (Table 3). This is probably due to the inability of the beetle to catch more aphids when the prey is scarce. This is a kind of numerical response of the beetle to different prey densities (HASSEL, 1976).

Table 3. The number of aphid *A. medicaginis* eaten per day by the predator *C. sexmaculata*.

The day	Number of *C. sexmaculata* (15 pods)	Number of *A. medicaginis* eaten per day (Nha)
1	15	7.77
2	17	13.21
3	22	17.99
4	30	24.38
5	34	28.32
6	38	31.90
7	35	28.89
8	41	32.74
9	33	27.93
10	36	28.02
11	26	20.21
12	21	12.06

CONCLUSSIONS

The ladybird beetle, *C. sexmaculata* is an important predator of *A. medicaginis*, which is an important pest of cowpeas at Lebak Bulus, Jakarta. The beetle is very effective in checking the population density of the aphids. The beetle is capable of consuming a large number of the aphid per day. However, the number of the aphids consume by the beetles is numerically responded.

REFERENCES

CHINERY, M. 1977. Insects of Britain and Northern Europe. Collins St. Jame's Place, London : 352 pp.

DE BACH, P. and C.B. HUFFAKER. 1974. Experimental techniques for evaluation of the effectiveness of natural enemies. In : Biological Control (C.B. Huffaker, ed.). Plenum Rosetta Edition : 511 pp.

DIXON, A.F.G. 1973. Biology of aphids. Edward Arnold Ltd., London : 55 pp.

EMDEN, H.F. van. 1965. The effectiveness of aphidophagou insects on reducing aphids population. In : Ecology of aphidophagous insects (I. Hodek, ed.). Proceeding symposium held Libliece near Praque, September 27 — December 1, 1965. Acad. Publ. House, Czechoslovak Acad Sci., Praque : 227 — 235.

HASSEL, M.P. 1976. The dynamics of competition and predation. Edward Arnold Ltd., London : 68 pp.

IMMS. A.D. 1960. A general textbook of Entomology. Methuen and Co., London : 886 pp.

KALSHOVEN, L.G.E. 1981. Pest of crops in Indonesia. P.T. Ikhtiar Baru, van Hoeve, Jakarta : 701 pp.

MILLS, N.J. 1982. Voracity, cannibalism and coccinellid predation In : Proceeding natural enemies and insect pest dynamics (B.D. Wratten, ed.). Annal appl. Biol. 101 : 141 — 148.

SMITH, B.C. 1976. Effect of food on some aphidophagous Coccinellidae. In : Ecology of aphidophagous insects. (I. Hodek, ed.). Proceeding symposium held in Libliece near Praque, September 27 — December 1, 1965. Acad. Publ. House, Czechoslovak Acad. Sci., Praque : 75 — 81.

VARLEY, G.C.; G.R. GRADWELL and M.P. HASSEL. 1975. Insect Population Ecology. An analytical approach. Blackwell Scientific Publication, London : 212 pp.