

## ROLE OF PREDACIOUS MITES AND INSECTS IN THE BIOLOGICAL SUPPRESSION OF SPIDER MITES ON COCONUT FOLIAGE

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### ABSTRACT

Mite, insect and spider predators exerted biological suppression of the spider mites *Oligonychus iselemae* and *Tetranychus ludeni* infesting the coconut foliage. Six species of mites, four species of insects and one species of spider were observed as natural predators. *A. (A.) paraaerialis*, *A. (T.) eucalypticus*, *Cunaxa setirostris* and *Agistemus* were the mite predators recorded in association with colonies of *O. iselemae*. The immature and adult stages of the predators consumed different stages of the prey. The predator potential and seasonal occurrence were also studied. The role of the predacious insects and seasonal occurrence were also studied. The role of the predacious insects and spiders in the natural suppression of the spider mites is also discussed.

### INTRODUCTION

The spider mite *Oligonychus iselemae* (Hirst) infests the coconut forliage and sucks plant sap. Though it occurs as an occasional pest, under congenial conditions sporadic outbreak can cause substantial loss to the crop. A number of predators occur in association with this phytophagous mites on coconut. Among these, the predacious mites play an important role in the natural biological suppression of the phytophagous mites. Sathiamma (1991, 1993) observed that weather parameters and associated natural enemies govern the seasonal abundance of *O. iselemae* under field conditions. The present paper reports on the role of these predacious mites in the biological suppression of the spider mite.

### MATERIALS AND METHODS

Ten 3-5 years old coconut palms were selected for the study and two leaves each were examined at fortnightly interval. A count of the mites, insects and spiders actually feeding on *O. iselemae* was made. Data on the seasonal incidence of the predators and the predator-prey ratio of the dominant species of predators were also recorded. Observations on prey consumption and biology of the important species of mite predators were also carried out, using petriplate cages, under laboratory conditions.

### RESULTS AND DISCUSSION

Six species of mites, two species of insects and one species of spider were observed as natural predators of *O. iselemae* under field conditions. The predators co-existed with the colonies of *O. iselemae* on the adaxial surface of the coconut foliage.

Two species of Phytoseiidae *Amblyseius (Amblyseius) paraaerialis* Muma and *A. (Typhlodromalus) eucalypticus* Gupta; one species of Cunaxidae *Cunaxa setirostris* Hermann and one species of Stigmaeidae *Agistemus* sp. were observed as predators on *O. iselemae*. In addition, species of Ascidae (*Lasioseius*) and Cheyletidae also prey upon the phytophagous mite.

Adults and immature stages of *A. (A.) paraaerialis* feed on the eggs and motile stages of the prey.

*A. (A.) paraaerialis* and *A. (T.) eucalypticus* fed on all stages of *O. iselemae* while *C. setirostris* was an active predator on motile stages. It has been observed that the prey consumption by cunaxid mites was much higher than phytoseiid mites (Table I).

The females of *A. (A.) paraaerialis*, *A. (T.) eucalypticus* and *C. setirostris* laid 22.3 ± 1.2, 5-8 and 2-12 eggs, respectively.

**Table I. Prey consumption (mean  $\pm$  SE) by phytoseiid and cunaxid predators on *O. iselemae* (Hirst) in the laboratory.**

Predator stage	Predator		
	<i>A. (A.) paraaerialis</i>	<i>A. (T.) eucalypticus</i>	<i>C. setirostris</i>
Larva	2.8 $\pm$ 0.2	2.8 $\pm$ 0.3	8.8 $\pm$ 1.1
Protonymph	3.1 $\pm$ 0.4	3.7 $\pm$ 0.7	11.8 $\pm$ 1.4 *
Deutonymph	3.4 $\pm$ 0.3	5.8 $\pm$ 0.6	
Adult female	5.4 $\pm$ 0.9	9.0 $\pm$ 0.5	14.9 $\pm$ 1.7
Adult male	2.7 $\pm$ 0.3	2.5 $\pm$ 0.2	

\* Protonymph and deutonymph stages combined.

The life cycle of females of *A. (A.) paraaerialis*, *A. (T.) eucalypticus* and *C. setirostris* was completed in 4.5  $\pm$  0.1, 4.3  $\pm$  0.2 and 6.3  $\pm$  0.2 days respectively.

Species of *Agistemus* occurred at a low level in the field and it fed on all developmental stages of *O. iselemae*. The prey consumption varied from 2.0 to 20.5 by larva 3.7 to 30.0 by nymph and 3.3 to 31.0 by the adult predator.

Taking into consideration, the predator-prey ratio in the field, *A. (A.) paraaerialis* occurred at the ratio of 1:7.4, *A. (T.) eucalypticus* 1:10.6 and *C. setirostris* 1:10.7.

These predators occurred in the field during

all months of the year except July and the maximum population occurred from March to May when the prey population was abundant. High population of the predators occurred during March, with a predator-prey ratio of 1:2.6. The seasonal incidence of these predators coincided with that of the prey population (Table II). The observations revealed that the predators were capable of multiplying in large numbers and maintaining the prey mite population at low levels during most months of the year. Taking into account the occurrence of the predators in the field, the phytoseiid and cunaxid predators occurred in abundance during the months of January to May, when the prey also occurred in abundance. Together with the phytoseiid and cunaxid predators, the stigmatid, cheyletid and ascid predators occurred

**Table II. Seasonal occurrence and mean population of *O. iselemae* (Hirst) and its predators during the years 1985 and 1986 (total palms observed - 10)**

Month	<i>O. iselemae</i>	Predators						
		Mites			Insects			Spiders
		Phyto-seiidae	Cunaxidae	Stigma-eidae	Cheyle-tidae	Coccinel-lidae	Cecido-myiidae	Clubion-idae
January	187	70	11	0	1	2	2	40
February	682	64	23	14	1	3	6	17
March	706	208	66	92	1	4	0	20
April	766	136	11	0	0	5	0	6
May	1605	218	63	0	1	4	2	13
June	1169	86	18	14	1	0	5	5
July	8	0	0	0	0	0	0	0
August	43	32	0	0	0	1	0	23
September	116	55	6	4	1	4	0	21
October	185	40	9	2	0	2	0	12
November	10	19	1	0	0	0	1	18
December	145	36	15	2	0	0	2	25

in abundance during the period from January to May and effected natural suppression of the prey in the field (Table II).

In addition to these mite predators, insect predators such as Coccinellidae, Cecidomyiidae, Chrysopidae and Thysanoptera and predacious spiders belonging to the family Clubionidae, consumed the different stages of *O. iselemae* under field conditions. These mites, insects and spider predators together effected natural suppression of the spider mite fauna on coconut foliage.

Increase in the population of the spider mites infesting coconut foliage is governed by meteorological factors and the natural enemies (Sathiamma, 1993). high population of the predators was recorded from January to May and zero to very low level from June to December. With increase in population of *O. iselemae* from January onwards, the predators reach their peak level during March. But with the decrease in prey population, the number of predators also became less abundant and reached either a very low level or were totally absent. Predators caused a decrease in phytophagous mite population and their beneficial role was observed when the prey population reached severe proportions.

The predacious mites, insects and spiders were successfully utilized in the past against a number of crop pests. Among these, phytoseiid mites are the dominant predators which play a significant role in the biological suppression of mite pests, Huffaker et al., 1970; Jeppson et al., 1975; Helle and Sabelis, 1985; and Pickett and Gilstrap, 1986. *A. (Euseius) alstoniae* (Gupta and Gupta, 1978), *A. (A.) nuciferae* (Gupta, 1986) and *A. largoensis* (Schicha and Gutierrez, 1985) were the other known species of phytoseiid mites recorded on coconut. Among these, *A. (E.) alstoniae* is a predator on *Raoiella indica*, the red palm mite on coconut palm. Cayme and Capasin (1987) recorded a phytoseiid predator on *O. velascoi* infesting coconut palm.

*C. setirostris* were known predators of tetranychid mite pests (Gupta et al., 1971, Gupta, 1985). Several species of *Agistemus* were recorded as effective predators on spider mites infesting cotton, grapevine, maize, nut grass, orange, sweet potato etc. (Gupta, et al., 1971; Sadana and Kanta,

1971. Sadana and Chabra, 1974; Hafez et al. 1983; Rizk et al., 1983 and Gupta, 1985).

Coccinellid predators, particularly, *Stethorus fijiensis*, *S. exspectatus* and *S. exsultabilis* were recorded as predators on the spider mites infesting coconut foliage (Chazeau, 1983. Cayme and Gapasin 1987). The coccinellid predator *S. keralicus*, thrips, chrysopid larvae, cecidomyiid larvae and staphylinid beetles were recorded as predators on *R. indica* infesting arecanut palm foliage (Daniel, 1979).

According to the observations made, biological suppression of the spider mite population on coconut foliage could be achieved mainly by predacious mites, insects and spiders.

#### REFERENCES

- CAYME, T.L. and CAPASIN, D.P. 1987. Biology, host range and natural enemies of the coconut spider mite *Oligonychus velascoi* Rimando. *Ann. Trop. Res.* 9 : 59-67.
- CHAZEAU, J. 1983. Two predators of Tetranychidae in New Guinea : *Stethorus exspectatus* sp. n. and *Stethorus exsultabilis* sp. n. (Col. Coccinellidae). *Entomophaga* 28 : 373-378.
- DANIEL, M. 1979. Survey of the indigenous predators of arecanut phytophagous mites. *Proc. PLACROSYM II* : 227-236.
- GUPTA, S.K. 1985. *Handbook of plant Mites of India* zoological Survey of India, Calcutta, 519 pp.
- GUPTA, S.K. 1986. *Fauna of India (Acari : Mesostigmata) Family Phytoseiidae*. Zoological survey of India, Calcutta 350 pp.
- GUPTA, S.K., SINDHU, A.S., DHOORIA, M.S. and SINGH, G. 1971. Preliminary note on the phytophagous and mite fauna of the Punjab and Himachal Pradesh. *Sci & Cult.* 37 : 296-299.
- GUPTA, Y.N. and GUPTA, S.K. 1978. On a collection of tetranychoid mites from Madhya Pradesh, India, with a description of a new *Eotetranychus* (Acari : Trombidiformis). *Indian J. Acar.* 3 : 87-91.
- HAFEZ, S.M., RASMY, A.H. and ELWAWY, S.A. 1983. Effect of prey species and stages on predatory efficiency and development of the stigmacid mite *Agistemus exsetus*. *Acarologia* 24 : 281-283.

- HELLE, W. and SABELIS, M.W. (eds.) 1985. *Spider mites. Their biology, natural enemies and control. World Crop pests (Vol. IA & B)*. Elsevier, Amsterdam, pp. 405-408.
- HUFFAKER, C.B., VANDEVRIE, M. and MCMURTHY, J.A. 1970. Ecology of tetranychid mites and their natural enemies. A review, II. Tetranychid populations and their possible control by predators: An evaluation. *Hilgardia* 40 : 391-458.
- JEPPSON, L.R., KEIFER, H.H. and BAKER, E.W. 1975. *Mites injurious to economic plants*. University of California Press, California, 614 pp.
- PICKETT, C.H. and GILSTRAP, F.E. 1986. Predation of *Oligonychus pratensis* (Aca : Tetranychidae) by *Phytoseiulus persimilis* and *Amblyseius californicus* (Aca : Phytoseiidae) under controlled laboratory conditions. *Entomophaga* 31 : 205-221.
- RIZK, G.A., KARAMAN, G.A. and ALI, M.A. 1983. Population densities of phytophagous and predacious mites on citrus trees in Middle Egypt. *Bulletin de la societe Entomologigud' Egypte* (1978/79) 62 : 97-103.
- SADANA, G.L. and CHABRA, S.C. 1974. New records of the hosts and predators of the phytophagous mite *Oligonychus mangigerus* (Rahman & Sapra). *Sci. Cult.* 40 : 362-363.
- SADANA, G.L. and KANTA, V. 1971. Predators of the citrus mite *Eutetranychus orientalis* (Klein) in India. *Sci. Cult.* 37 : 530.
- SATHIAMMA, B. 1991. *Investifations on Oligonychus iseilemae* (Hirst) (Acarina) and other tetranychid mites on coconut foliage. Ph. D. Thesis, University of Kerala, Thiruvananthpuram, 206. pp.
- SATHIAMMA, B. 1993. Seasonal abundance of coconut white mite *Oligonychus iseilemae* (Hirst) and its predators. In : *Advances in coconut Research and development*. Eds. M.K. Nair et. al., Oxford & IBH Publ. Co., New Delhi-pp 517-522.
- SCHICHA, E. and GUTIERREZ, J. 1985. Phytoseiidae of Papua New Guinea, with three new species and new recorded of Tetranychidae (Acari). *Int. J. Acarol.* 11 : 173-181.

## DISCUSSION

A.G.S. REDDY : What is the strategy for more multiplication of predacious mites? What do their recoverability in the field?

B. SATHI AMMA : Techniques were devised by Entomologists Scientists (Biocontrol group) of ILHR to mass multiply the phytoseiid mites. Hence, it is possible to mass multiply them. Released predators were recovered from the field.