

SURVEY OF THE INDIGENOUS PREDATORS OF ARECANUT PHYTOPHAGOUS MITES

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ABSTRACT

The results of the survey and ecological studies of the predator fauna of arecanut phytophagous mites are presented. Three species of mites viz: *Oligonychus indicus* Hirst, *Raoiella indica* Hirst and *Tetranychus fijiensis* Hirst infest the leaves of areca palm. Species belonging to Coleoptera, Acarina, Diptera, Thysanoptera, Hemiptera, Neuroptera and Araneida are represented in the predator fauna of these mites. Two species of *Stethorus* and a staphylinid beetle are the major predators of *O. indicus*. Other predators of this spider mite include a phytoseiid mite of the genus *Typhlodromus*, a chrysopid, a cecidomyiid, and a species of thrips. The coccinellid *Stethorus keralicus* Kapur and the phytoseiid *Amblyseius channabasavanni* Gupta and Daniel are the key predators of the palm mite *R. indica*. Other members of the predator complex of *R. indica* include two genera of cecidomyiids, a chrysopid, an anthocorid and a species of spider. The predator fauna of *T. fijiensis* include two species of *Stethorus*, a cecidomyiid, a chrysopid and the phytoseiid *A. channabasavanni*. Information on the ecology of the major predators are given.

INTRODUCTION

The areca plam (*Areca catechu* L.) is infested mainly by three species of mites on leaves. Palms of all ages are infested and these mites even coexist on the same leaflet. They are the sorghum mite *Oligonychus indicus* Hirst (Acari: Tetranychidae) (Puttarudriah and ChannaBasavanna, 1956a), the palm mite *Raoiella indica* Hirst (Acari: Tenuipalpidae) (Puttarudriah and ChannaBasavanna, 1956a) and *Tetranychus fijiensis* Hirst (Acari: Tetranychidae) (Mariamma Daniel, 1977). Control of these mites is obtained by spraying the lower surface of leaves with acaricides, which is laborious for large scale operation. Alternate strategies for the control

of these perennial pests are essential. An assessment of the potential of biotic agents associated with these mites is important to the development of alternate strategies of control. Puttarudriah and ChannaBasavanua (1956_b) had observed some coccinellid predators on both *O. indicus* and *R. indica*. Kapur (1963) had described a new species of *Stethorus* from Kerala, feeding on *R. indica*. Work on using the exotic predaceous mite *Phytoseiulus persimilis* Athias-Henriot (Acari: Phytoseiidae) was started in early 1970s, but this species could not acclimatise to the tropical conditions here (Mariamma Daniel and Seshadri, 1976). A survey was taken up to study the indigenous predators of these mites at CPCRI, Regional Station farm at Vittal, Karnataka.

This paper gives an account of the predators of the mites with observations on their feeding behaviour and other ecological aspects.

MATERIALS AND METHODS

Predators feeding or associated with various life stages of the mites were collected from the field. In the laboratory the predators were supplied with the prey and the predaceous habits were recorded. The field population build up of the predators of *R. indica* in an unsprayed orchard was studied from 1975-78. Predators of this mite were sampled monthly.

RESULTS AND DISCUSSION

Table 1 gives a list of the predators which have been observed on the three species of mites attacking areca leaves and Table 2 shows the incidence of predators.

Natural enemy complex of *Oligonychus indicus* H.

O. indicus is seen in the field mainly from January to June. During monsoon period they are washed off from the leaves. Species belonging to Coleoptera, Thysanoptera, Neuroptera, Diptera and Acari are recorded as predators of this mite.

Table 1. Natural enemy complex of arecanut phytophagous mites at Vittal

Coleoptera	: Coccinellidae - <i>Stethorus keralicus</i> Kapur on <i>Raoiella indica</i> H. <i>Stethorus</i> spp. on <i>Oligonychus indicus</i> H. and <i>Tetranychus fijiensis</i> H. Staphylinidae - A single species on <i>O. indicus</i> and <i>T. fijiensis</i> .
Thysanoptera	: Thripidae - A single species on <i>O. indicus</i> .
Neuroptera	: Chrysopidae - <i>Chrysopa</i> sp. on <i>R. indica</i> and <i>O. indicus</i> .
Hemiptera	: Anthocoridae - A single species on <i>R. indica</i> .
Diptera	: Cecidomyiidae - A species related to the genus <i>Arthrocnodax</i> on <i>R. indica</i> A species related to the genus <i>Felitia</i> on <i>R. indica</i> A species on <i>O. indicus</i> and <i>T. fijiensis</i> .
Acari	: Phytoseiidae - <i>Amblyseius channabasavaani</i> on <i>R. indica</i> & <i>T. fijiensis</i> <i>Typhlodromus</i> sp. on <i>O. indicus</i> .
Araneida	- A single species on <i>R. indica</i> .

Table 2. Incidence of the main predators of *R. indica* for the month of March - June*

Month	<i>Stethorus keraliticus</i>										<i>Amblyseius channabasavanni</i>				Cecidomyiids		Mite population per 1 cm ² area					
	Eggs		Larvae		Pupae		Adults		Eggs		Nymphs		Male		Female			Pupation in soil		Pupation in leaf		
May '75	26.3	15.1	11.0	5.3	4.4	2.4	0.9	2.2	0.0	0.6	0.0	1.2	1.5	—	—	—	—	—	—	—	—	—
June '75	26.4	7.1	1.8	7.1	10.8	6.1	1.8	4.2	0.0	0.1	0.0	0.1	0.7	—	—	—	—	—	—	—	—	—
March '76	0.1	0.0	0.1	0.0	0.5	0.4	0.2	0.5	0.1	0.3	0.0	0.0	0.0	13.9	—	—	—	—	—	—	—	—
April '76	6.3	0.9	0.4	0.7	0.2	0.1	0.0	0.5	0.0	0.7	0.0	0.0	0.5	36.6	—	—	—	—	—	—	—	—
May '76	20.6	5.2	1.1	1.5	0.7	0.3	0.2	0.7	0.0	0.5	0.0	0.7	0.3	37.5	—	—	—	—	—	—	—	—
June '76	20.3	12.2	6.0	13.3	7.0	6.9	1.9	5.1	0.0	0.0	0.0	0.5	0.2	95.0	—	—	—	—	—	—	—	—
March '77	2.4	1.1	0.0	0.7	0.4	0.1	0.1	0.3	0.1	1.5	0.0	0.1	0.2	11.9	—	—	—	—	—	—	—	—
April '77	2.2	2.3	0.3	0.3	0.9	0.6	0.1	0.5	0.0	0.3	0.0	0.0	0.0	7.5	—	—	—	—	—	—	—	—
May '77	9.3	9.9	0.6	2.3	8.3	3.6	1.9	3.5	0.0	0.3	0.0	0.9	0.9	44.1	—	—	—	—	—	—	—	—
June '77	8.6	2.9	0.3	2.7	4.1	5.1	1.0	1.9	0.0	0.3	0.0	0.1	0.0	19.1	—	—	—	—	—	—	—	—
March '78	0.0	0.1	0.3	0.3	0.0	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	—	—	—	—	—	—	—	—	—
April '78	6.0	1.1	0.5	1.0	0.5	0.6	0.1	0.7	0.6	0.1	0.0	0.7	1.0	28.5	—	—	—	—	—	—	—	—
May '78	3.1	2.5	1.5	0.6	1.0	0.6	0.4	0.8	0.0	0.0	0.2	1.1	2.5	17.5	—	—	—	—	—	—	—	—
June '78	0.0	0.0	0.0	0.0	0.0	0.7	0.1	0.3	0.0	0.0	0.0	0.0	0.7	0.3	—	—	—	—	—	—	—	—

* Average of 15 observations per month.

Stethorus sp. nr. *pauperculus* Weise had been recorded as feeding on sorghum mite *O. indicus* (Puttarudriah and Channa Basavanna, 1956b). Puttarudriah (1947) recorded *Scymnus gracilis* Motsch. and another coccinellid as predators of this mite infesting jowar plants. *Stethorus pauperculus* Weise and *Scolothrips sexmaculatus* (Pergande) were reported as feeding on *O. indicus* from Mysore (Channa Basavanna and Puttarudriah, 1957).

Thysanoptera - Thripidae: One species of thrips preys on eggs, larvae, nymphs, and adults of *O. indicus*. Population is very low here and is seen during March-May.

Neuroptera - Chrysopidae: The larvae of a chrysopid feed on this spider mite and this appears to be an important member of the predator complex of *O. indicus*.

Coleoptera - Beetles of the families Coccinellidae and Staphylinidae are observed as predators of this mite. The staphylinid beetle feeds and reproduces on *O. indicus*. Both adults and grubs feed on all stages of the prey. The yellowish eggs are covered by the cast skins of the mites. Pupation is in soil. Two species of *Stethorus* are seen as predators. The eggs are laid attached to the web of the mite. The grubs are voracious feeders. The pupae are attached to the leaf surface. More than 40 pupae are counted from a single infested leaflet.

Diptera - Cecidomyiidae: A species of cecidomyiid is seen feeding on this spider mite. The maggots feed on eggs and other stages of the prey.

Acari - Phytoseiidae: A species of *Typhlodromus* feeds on this mite. But the population is very low in the field.

Natural enemy complex of *R. indica*.

R. indica is seen in the field from March-June. Puttarudriah and Channa Basavanna (1956b) had reported adults of *Stethorus tetranychii* Kapur as feeding on red mites *R. indica* infesting areca palms at Tharikare. They collected also *S. parcepunctatus* Kapur and *Juaravia soror* Weise from *R. indica*

infested areca palms. *Spilocaria bisettata* Muls. (Coccinellidae) *Cybocephalus semiflavus* Champ. (Nitidulidae), *Aspectes indicus* Arrow. (Dermestidae) are other predatory beetles collected from *R. indica* infested areca leaves (Channabasavanna and Puttarudriah, 1957). Mariamma Daniel (1976) studied the biology and predatory habits of the lady-bird beetle *S. keralicus* on *R. indica*.

Coleoptera - Coccinellidae: The ladybird beetle *S. keralicus* is the most numerous and frequently encountered predator of *R. indica* on areca palms here. It completes its life cycle on *R. indica* in 12-14 days. An adult beetle consumes 2.41-6.46 host mites/hour during a period of 24 h (Mariamma Daniel, 1976). The eggs are laid among the host colony, one end of the egg being attached to the leaf surface. The larvae feed on all stages of the prey by a process of alternate sucking and regurgitation. Pupae are attached to the leaf surface. The adults consume the prey as a whole and are good fliers. This species is never observed to feed on any other mite species infesting arecanut and shows a high degree of host specificity. The predator is seen in large numbers in the field during April-June when the prey population is also in its maximum. From a completely infested leaflet 51 eggs, 14 larvae, 3 pupae and 14 adults of the predator could be collected. In its peak period, the adult population in a single leaflet varied from 1-45; more than 100 adults are counted from a single leaflet when the prey population is diminishing in the field. During monsoon period also this predator is found feeding only on *R. indica*, occurring on areca palms in shaded areas of the garden (Anon, 1976). Since no alternate prey is noticed for this predator, it can be assumed that this predator thrives on the low population of *R. indica* present in shaded areas of the garden where it is protected from heavy rain,

Acari - Phytoseiidae: *Amblyseius channabasavanni* Gupta and Daniel is the second major predator of this mite. It is found throughout the year on areca leaflets; during the off-season of the main prey, it feeds and reproduces on the eggs and crawlers of the scale insect *Chionopsis* sp., the mealybug

Pseudococcus sp. and the spider mite *T. fijiensis* in the field. The presence of alternate prey sources is an added advantage for this phytoseiid to build up rapidly for suppressing the main host in its season. In the field the eggs are laid either among the host colony or in the cast skins of the larvae and pupae of *S. keralicus* or in the grooves and other hidden places on the leaf surface. In *T. fijiensis* and mealybug infested leaves the eggs are laid on the web or in the egg mass of mealybug or in the holes on the coverings of scale insects. The adults and other moving stages of the predator is seen hiding in any of these places during non-feeding time. From a completely infested leaflet 45 eggs, 16 larvae and nymphs, 3 males and 21 females of the predaceous mite are collected. It is having high searching ability since this predator is seen among the mealybug and scale insect colonies which are sparse in nature. The biology and predatory habits of this predator in the laboratory are reported by Mariamma Daniel (1979). All stages of the prey are attacked by all feeding stages of the predator. The adult female consumes 11-40 host eggs or 6-13 female host mites in a day. The biology of another phytoseiid *Typhlodromips tetranychivorus* on *R. indica* is reported by Jagadish and Nageshchandra (1979).

Diptera - Cecidomyiidae: Two species of cecidomyiids are observed as predators on *R. indica*. From India work on cecidomyiid predators of mites is not reported so far. One species of this cecidomyiid related to the genus *Arthrocnodax* Felt. is specific to *R. indica*. The eggs are laid among the host's eggs. The red maggots feed on all stages of the prey and when mature, drop to the soil where pupation takes place. It completes its life cycle within 9-10.5 days. The adults are very small. In a single infested leaflet 2 eggs and 10 maggots are seen. The second species closely related to the genus *Feltiella* completes its life cycle on the leaf within 9-10 days. Pupation is inside a white cocoon on the lower surface of leaves. Predatory action of this species can be easily detected by the numerous white cocoons and pupal skins attached to the leaf. From a single infested leaflet, 1 egg, 7 maggots and 6 pupae are collected. Once from a *R. indica* infested areca

seedling 66 maggots and 78 pupae of this fly have been collected and complete control of the prey was seen. This species is seen feeding on mealybug crawlers. Maggots of both species suck out the body fluid from the prey. The adults of both the cecidomyiids are seen frequenting areca leaflets during morning hours of the day.

Neuroptera - Chrysopidae: A species of *Chrysopa* is seen feeding on *R. indica*. The larvae are general feeders. The egg mass of this green lacewing is deposited either on areca leaflet or on cacao leaves. It consists of 18-23 eggs. The trash-carrying larvae complete their life cycle on *R. indica*. They feed also on aphids infesting cacao, scale insects, mealybugs and other mite species infesting arecanut leaves.

Hemerobiidae - Hemerobid adults are seen frequenting infested areca leaflets but feeding is not observed.

Hemiptera - Anthocoridae: Nymphs and adults of an anthocorid bug feed on all stages of *R. indica*. They are voracious feeders.

Acari - Stigmaeidae: A stigmaeid mite feeds on *R. indica*. It is collected occasionally.

Araneidae: A species of spider feeds on *R. indica*. Its web is seen on the lower surface of areca leaves.

S. keralicus, *A. channabasavanni*, and the cecidomyiid occur on the same infested leaflet. Cannibalism in any of these species is never observed during these studies.

Natural enemy complex of *T. fijiensis*

Coleoptera - Coccinellidae: Two species of *Stethorus* are predaceous on this spider mite. Since this mite is seen throughout the year in the field, these coccinellids, which are the main predators of *O. indicus*, maintain its population in the field on them.

Staphylinidae - The staphylinid beetle which feeds on *O. indicus*, is predaceous on this mite also.

Acari - Phytoseiidae: *A. channabasavanni* is predaceous on this spider mite also.

Neuroptera - Chrysopidae: A species of chrysopid feeds on this mite.

Diptera - Cecidomyiidae: A cecidomyiid maggot feeds on this mite.

The predator - complex of the phytophagous mites of arecanut can be used to prevent rapid population build ups of the pest. The short development time of the phytoseiid *A. channabasavanni* gives it a potential ability to complete a generation in a shorter time than its prey *R. indica*. Even the coccinellid *S. keralicus* completes its life cycle in the same time as that of prey. No data are available on the developmental rates of the predators of spider mites on arecanut. The egg-laying potential of these predators need further studies.

Very little information is available on the prey-consumption capacity of these predators and further investigations are required to assess the effectiveness of these predators in controlling prey populations. The searching efficiency of the predators also needs investigation.

The distribution of *Stethorus* spp; the phytoseiids and cecidomyiids is related to their preys. Since acaricides are used to control the mites, the direct and indirect effects of these chemicals on the natural enemy complex need investigation to develop an integrated pest management system. For this, detailed studies are required on the biology and predaceous habits of the biotic agents. Work on these aspects is in its infancy in India.

REFERENCES

- ANONYMOUS, 1976. Annual Report for 1975. Central Plantation Crops Research Institute, Kasar. god, 1976. pp. 111-112.
- CHANNABASAVANNA, G. P. AND PUTTARUDRIAH, M. 1957. Some predators of mites in Mysore *Mysore Agric, J.* 32: 179-185.

JAGADISH, P. S. AND NAGESHCHANDRA, B. K. 1979. Biology of *Typhlodromips tetranychivorus* (Acari: Phytoseiidae) on red palm mite *Raoiella indica* (Acari: Tenuipalpidae). Paper presented in the First All India Symposium in Acarology held at Bangalore, 23-25 April, 1979.

KAPUR, A. P. 1961. A new species of *Stethorus* Weise (Coleoptera: Coccinellidae) feeding on arecanut palm mite in Kerala, Southern India. *Entomophaga* 6: 35-38.

MARIAMMA DANIEL. 1976. Biology and predatory habits of the ladybird beetle *Stethorus keralicus* Kapur (Coleoptera: Coccinellidae) predatory on the palm mite. *J. Plant. Crops*. 4: 7-9.

MARIAMMA DANIEL. 1977. The spider mite *Tetranychus fijiensis* Hirst on the betelnut palm. *Acarologia* 19: 220-221.

MARIAMMA DANIEL. 1979. Bionomics of the predaceous mite *Amblyseius channabasavanni* Gupta and Daniel (Acari: Phytoseiidae), predaceous on palm mite. Paper presented in the First All India Symposium in Acarology held at Bangalore, 23-25 April, 1979.

MARIAMMA DANIEL AND SESHADRI, S. N. 1976. Observations on *Phytoseiulus persimilis* A. H. (Acarina: Phytoseiidae) for control of the phytophagous mites of areca palm. *Acarology News Letter* No. 3: 5-9.

PUTTARUDRIAH, M. 1947. A note on the occurrence of the mite *P. indicus* H. on jowar (*Andropogon sorghum*) and its predators in Mysore. *Curr. Sci.* 16: 60-61.

PUTTARUDRIAH, M. AND CHANNABASAVANNA, G. P. 1956a. Some new insects and mites on areca palm in Mysore. *Arecanut J.* 7: 9-10.

PUTTARUDRIAH, M. AND CHANNABASAVANNA, G. P. 1956b. Some beneficial coccinellids of Mysore. *J. Bombay Nat. Hist. Soc.* 54: 156-159.