BIOLOGY, HOST RANGE AND NATURAL ENEMIES OF THE COCONUT SPIDER MITE, *Oligonychus velascoi* RIMANDO

Tita L. Cayme and Dely P. Gapasin

Instructor, College of Agriculture, Xavier University, Cagayan de Oro City, Philippines; and former Professor, Department of Plant Protection, Visayas State College of Agriculture, Baybay, Leyte, Philippines.

Portion of B.S. thesis conducted by the senior author at ViSCA, Baybay, Leyte.

ABSTRACT

The total developmental period of the coconut spider mite, *Oligonychus velascoi* Rimando was 6.3 and 6.9 days for those reared on detached and undetached leaflets, respectively. The slight difference observed in the life cycle of mites using the two rearing methods indicates that both techniques are satisfactory for rearing spider mites.

Of the 30 plant species tested, only three proved to be alternate hosts of the coconut spider mite, namely: bunga de China, *Adonidia merrilli* Becc.; pugahan, *Caryota cumingii* Lodd.; and buri palm, *Corypha elata* Roxb. However, longer life cycle and higher mortality were observed in spider mites reared on these alternate host plants than in those reared on coconut. Natural enemies included two coccinellid beetles and a phytoseeid mite.

Ann. Trop. Res. 9:59-67.

KEY WORDS: Coconut spider mite *(Oligonychus velascoi* Rimando). Biology. Host range. Natural enemies.

INTRODUCTION

Coconut production in the Philippines is beset with many problems. One of these problems is damage caused by pests which result in the reduction of coconut yield. The national average production is only 31 nuts per tree per year (UCAP, 1975). Gabriel (1975) reported various arthropod pests attacking coconut, among which are two tetranychid mites — *Oligonychus velascoi* Rimando and *Pritchardina fijiensis* Hirst. Both species attack seedlings as well as mature palms. Feeding of these mites results in discoloration of leaves (Mordeno, 1975), and dieback of leaf tissues which causes abnormal nut development and yield reduction up to 25% (Mariau, 1976).

There is very limited available information on the life cycle, host

range and natural enemies of these mites. This study was therefore conducted to obtain data on the life history and behavior of *Oligonychus velascoi* Rimando, to compare two rearing techniques using detached and undetached leaflets, and to determine its alternate hosts and natural enemies in the field.

MATERIALS AND METHODS

Maintenance of Stock Culture

Spider mites collected from infested coconut seedlings in the nursery were reared continuously on Malayan Yellow Dwarf, a susceptible coconut variety. Mites from infested seedlings were allowed to transfer by attaching infested leaflets to the nether surface of uninfested leaflets using cellotape. The plants were then covered with fine-meshed nylon cloth to prevent predators from feeding on the mites. This stock culture was used as source of spider mites for testing.

Testing of Rearing Techniques

Two techniques were used for rearing spider mites in the laboratory and screenhouse. In the first technique, a freshly detached leaflet was inserted between three plastic blocks with the middle block having a hole to facilitate observation. Moist cotton was wrapped around the cut portion of the detached leaflet to keep it fresh. The plastic blocks were tied with rubber band on each end to prevent escape of mites. One adult was introduced per culture block. Eggs deposited daily were transferred to other rearing blocks using a fine-tipped camel hair brush. Upon hatching, the larvae were transferred to individual rearing blocks. Observations were done under a stereoscopic microscope.

The other rearing technique involved the use of undetached leaflets from polybagged seedlings. These undetached leaflets were used for rearing mites using similar procedure as in the preceding technique. Individual cultures were examined using a high-magnification lens.

Identification of Alternate Hosts

Thirty plant species (Cayme, 1980) including those belonging to Family Palmae such as *Adonidia merrilli* Becc. (bunga de China), *Caryota cumingii* Lodd. (pugahan) and *Corypha elata* Roxb. (buri palm) were tested as possible alternate hosts of the coconut spider mite. Other plants found in and around coconut plantations like *Manihot esculenta* Crantz (cassava), *Ipomoea batatas* (L.) Lam (sweet potato) and *Carica papaya* L. (papaya) were also tested. In all cultures, detached leaves were provided using rearing blocks as previously described. Plant species that sustained spider mites until adult emergence were used as hosts for rearing mites for one generation. The mites reared in coconut and in alternate hosts were compared as to their duration of developmental stages, mortality rate, fecundity and hatchability of eggs, and longevity of adults.

Determination of Natural Enemies

Arthropod species observed preying on spider mites on coconuts in the field were brought to the laboratory for identification and further observation. Preserved specimens were sent to a taxonomist at UPLB, College, Laguna for verification.

RESULTS AND DISCUSSION

Biological Data as Affected by Rearing Technique

Life Cycle. The total developmental period of the coconut spider mite was 6.3 days for those reared on detached leaflets and 6.9 days for those reared on undetached ones (Table 1). The slight difference observed in the life cycle of the mites using the two rearing methods indicates that both techniques are suitable for rearing said species of spider mites. Although detached leaflets were easier to use than undetached ones, the use of the former was found to be time-consuming because of the frequent transfer of cultures to fresh leaflets. The average incubation period of eggs was 3.9 and 4.3 days for detached leaf pieces and undetached leaflets, respectively.

Fecundity and Percent Hatchability of Eggs. Females laid an average of 26 and 18 eggs on detached and undetached leaflets,

Table 1. Average duration of different developmental stages and adult longevity of coconut spider mites, *Oligonychus velascoi* Rimando reared on detached and undetached leaflets of Malayan Yellow Dwarf coconut.

Developmental Stage	Average Duration (days)	
	Detached Leaf Pieces [1]	Undetached Leaflets [2]
Incubation Period	3.9	4.3
Developmental Period		
Larva	2.2	2.4
Protonymph	2.1	2.2
Deutonymph	2.0	2.3
Total Developmental Period	6.3	6.9
Adult Longevity	22.3	21.3

[1] Average of both sexes (156 females and 70 males).
[2] Average of both sexes (98 females and 74 males).

respectively (Table 2). Percent hatchability of eggs laid on detached leaf pieces was 92% as compared to 87% hatchability on undetached leaflets.

Longevity, Mortality and Sex Ratio. Spider mites reared on detached leaflets lived longer than those reared on undetached leaflets (Table 1). However, mortality (Table 3) was higher on detached leaf pieces probably because leaflets dried up easily, thus necessitating frequent transfer of mites to fresh leaflets. Younger mites had higher mortality as a result of mechanical injuries incurred during transfer to fresh leaflets. Male to female ratios were 1:2.2 and 1:1.3 for mites reared on detached and undetached leaflets, respectively, indicating that more females are produced in the former than in the latter technique.

Other Observations Without Reference to Rearing Technique

Oviposition and Eclosion. There is a preoviposition period of 1 to 2 days. Usually, females lay eggs for 20 days but some continue laying until death. Eggs are laid singly on the underside of leaflets. In rearing blocks, eggs were scattered on the leaflets with some being laid on the sides of the circular observation area. A sticky substance cements the eggs to the leaf surface.

During hatching, the interior portion of the chorion ruptures first, apparently due to larval movement. Eclosion is completed in 4 to 10 minutes.

Larval and Nymphal Behavior. The larvae feed immediately after hatching. After 1 to 2 days of active

Table 2. Fecundity and percent hatchability of eggs laid by female coconut spider mites, *Oligonychus velascoi* Rimando reared on detached and undetached leaflets of Malayan Yellow Dwarf coconut.

Parameter	Detached Leaf Pieces	Undetached Leaflets
Total Number of Females Reared	156	98
Average Number of Eggs Laid Per Female [1]	26	18
Total Number of Eggs That Hatched [1]	24	16
Percent Hatchability	92	87

[1] Highly significant at 1% level using z-test.

Table 3. Mean percent mortality at different developmental stages of coconut spider mites, *Oligonychus velascoi* Rimando reared on detached and undetached leaflets of Malayan Yellow Dwarf coconut.

Developmental Stage	Mortality (%)[1]	
	Detached Leaf Pieces	Undetached Leaflets
Larva	10.0	6.0
Protonymph	9.7	6.5
Deutonymph	4.3	1.5
Average	8.0	4.7

[1] Data based on 300 and 200 mites reared on detached leaf pieces and undetached leaflets, respectively. Means within a row are not significantly different from each other based on z-test.

feeding, the larvae become quiescent. The only sign of life during this period is a very slight pulsation of the body which was also described by Klitsaneephaiboon (1973) in *Tetranychus kanzawai* on soybeans.

Protonymphs are more active than larvae. They feed for 1 to 2 days before settling to another quiescent period. The second molt occurs 1 to 2 days after the protonymphs cease feeding. Deutonymphs are larger but more sluggish than the protonymphs. They feed frequently before undergoing another quiescent period lasting for 1 to 2 days.

Emergence of Adults and Mating Behavior. The active adults emerge from the quiescent deutonymphs. Males are more active but smaller than the females which have slender and tapered idiosoma. They actively search for female deutonymphs which are about to emerge.

Immediately after emergence, the adults are ready to mate. Copulation occurs any time of the day. The male crawls under the female and clasps its abdomen with the first pair of legs. Mating lasts from several seconds to 10 minutes. Females normally mate only once but repeated mating also occurs.

Host Range of Coconut Spider Mite

Thirty plant species were tested as possible hosts of the coconut spider mite but only six species sustained the mites until they had completed development. Three species belonging to Family Palmae, namely: *Adonidia merrilli* Becc. (bunga de China); *Caryota cumingii* Lodd (pugahan); and *Corypha elata*

Roxb. (buri palm) were considered as alternate hosts because mites reproduced on these plants. However, coconut was a more suitable host compared to these plants. Mites reared on *Carica papaya* L. (papaya), *Ipomoea batatas* (L.) Lam. (sweet potato), and *Manihot esculenta* Crantz (cassava) emerged to adults but failed to reproduce.

Life Cycle. The total developmental period of spider mites was longer on the six plants previously mentioned than on coconut (Table 4). Mites reared on *M. esculenta, I. batatas,* and *C. papaya* had approximately twice as long life cycle as those reared on coconut. This may be due to lack of certain nutrients which are necessary for the development of the mite in these plants. It may also be probable that these plants lacked the necessary feeding stimuli so that the mites fed less.

Mortality and Longevity. Mortality was very high in mites reared on the three non-palm species. Death was due to non-feeding or to presence of toxic substances detrimental to their development.

Adults reared on coconut showed the longest life span of 23.0 days followed by those reared on *A. merrilli,* 21.0 days; *C. cumingii,* 19.2 days; and *C. elata,* 15.5 days (Table 4). Those reared on the other three plants lived an average of 3 to 4 days only, thus preventing adults from laying eggs.

Fecundity and Hatchability of Eggs. Adult female mites reared on

Table 4. Total developmental period, percent mortality and longevity of coconut spider mite, *Oligonychus velascoi* Rimando on seven different host plants.[1]

Host Plant	Total Developmental Period (days)	Percent Mortality	Longevity (days)
Cocos nucifera L.	6.3	30.0	23.0
Adonidia merrilli Becc.	7.6	35.0	21.0
Caryota cumingii Lodd.	8.5	41.7	19.2
Corypha elata Roxb.	10.3	46.7	15.5
Manihot esculenta Crantz	11.6	91.7	3.6
Ipomoea batatas (L.) Lam	12.0	95.0	3.7
Carica papaya L.	13.2	93.3	3.0

[1] Based on 60 individual cultures per host plant.

Table 5. Fecundity and percent hatchability of eggs laid by female mites reared on seven different host plants.[1]

Host Plant	Total Number of Females Reared	Average Number of Eggs Laid Per Female	Total Number of Eggs Hatched (mean)	Percent Hatchability
Cocos nucifera L.	18	24	23	96
Adonidia merrilli Becc.	23	20	17	86
Caryota cumingii Lodd.	34	16	14	87
Corypha elata Roxb.	13	5	5	89
Manihot esculenta Crantz	5	0	0	0
Ipomoea batatas (L.) Lam.	3	0	0	0
Carica papaya L.	4	0	0	0

[1] Based on 60 individual cultures per host plant.

C. nucifera had higher fecundity with an average of 24 eggs laid per female while mites reared on *A. merrilli*, *C. cumingii* and *C. elata* laid only 20, 16 and 5 eggs per female, respectively. No significant difference in hatchability of eggs laid by mites reared on the three alternate hosts and on coconut was observed (Table 5).

Natural Enemies

Two coccinellid beetles and a phytoseeid mite were observed preying on coconut spider mites in the field. One species of coccinellid beetle is black and measures 1.5 mm long and 1.2 mm wide while the other species is brownish black and measures 1 mm long and 0.5 mm wide. The body of both species is oval and convex. The predatory mite passes through three nymphal instars, namely the larva, protonymph and deutonymph. The larvae are whitish, fragile, soft, rather sluggish in movement and have three pairs of legs. The newly-emerged protonymphs are more elongate and oval than the larvae and have four pairs of legs. The deutonymphs are similar to the protonymphs except for their bigger size. The adult males are smaller in size and have more slender idiosoma than the females. However, the identity and efficiency of these predators have not been ascertained yet.

RECOMMENDATIONS

The use of detached leaf pieces as rearing media is recommended in further studies of coconut spider mites. Temperature and relative humidity should also be studied since there is a wide fluctuation of these conditions between day and night. Moreover, sizes of mites should be included in the gathering of data.

LITERATURE CITED

CAYME, T.L. 1980. Biology, host range and natural enemies of the coconut spider mite, *Oligonychus velascoi* Rimando. B.S. Thesis. Visayas State College of Agriculture, Baybay, Leyte. 47 p.

GABRIEL, B.P. 1975. Insects and Mites Injurious to Philippine Crop Plants. Dept. of Entomol., UPLB, College, Laguna. 250 p.

KLITSANEEPHAIBOON, S. 1973. Biological and toxicological studies of the spider mite, *Tetranychus kanzawai* Kishida. M.S. Thesis, Dept. of Entomol., UPLB, College, Laguna. p. 79.

MARIAU, D. 1976. *Aceria* (Eriophyes) *guerreronis*: An important pest of American and African coconut groves. *In* Abstract of Papers, Int. Symp. on Coconut Research and Development, Kerala, India. pp. 40-41.

MORDENO, J.C. 1975. Common pests and diseases in coconut nurseries. *In* Proc. Nat. Coconut Research Symposium, Tacloban City. pp. 245-255.

UNITED COCONUT ASSOCIATION OF THE PHILIPPINES (UCAP). 1975. Coconut Statistics 6(6):37.

VAN DE VRIE, M., McMURTY, J.A. and HUFFAKER, C.B. 1972. Ecology of tetranychid mites and their natural enemies; A review. III. Biology, ecology and pest status, and host plant reactions of tetranychids. Hilgardia 41(13):343-432.