Biology of *Tetranychus neocaledonicus* Andre (Acarina: Tetranychidae), A Pest of *Gossypium hirsutum* L.*

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ABSTRACT

***Tetranychus neocaledonicus* Andre has been recorded for the first time in Gujarat as a pest of cotton, *Gossypium hirsutum* L. It was active during October to February on cotton, after which the activity retarded. The life history and various stages of development have been described. The number of eggs laid by mated and unmated female ranged from 35 to 85 and 2 to 31 respectively. The preoviposition, oviposition and post-ovipostion periods varied from 18 to 30 hours, 8 to 19 days and 0 to 30 hours respectively in case of mated females, while 18 to 216 hours, 2 to 38 days and 0 to 240 hours in case of unmated females. The incubation period ranged from 48 to 168 hours. The duration of larval, protonymphal and deutonymphal stages varied from 18 to 192 hours, 24 to 210 hours and 18 to 216 hours respectively. During mating male crawled underneath the female from behind. The longevity of male and female that had paired varied from 2 to 9 days and 9 to 21 days respectively while the longevity of unmated female ranged from 6 to 46 days. The life cycle from egg to emergence of adult was completed from 198 to 528 hours. The sex-ratio (Male: Female) in field as well as laboratory condition was found to be almost equal being 1:15.** *(Received on 25, May. 1975).*

INTRODUCTION

AVAILABLE records indicate that the phytophagous mite, *Tetranychus neocaledonicus* Andre was first collected in November 1934 from desi-sem (*Canavalia ensiformis*) at Lyallpur and was identified as a new species of the genus *Tetranychus* by R. J. Whitick of the British Museum. This mite was subsequently described by Rahman and Sapra (1940) as *Tetranychus cucurbitae*. Pritchard and Baker (1955) had sunk *Tetranychus equatorius* McGR as a synonym of *Tetranychus cucurbitae*. Andre (1959) reported that *Tetranychus neocaledonicus* preoccupied *Tetranychus cucurbitae*.

Tetranychus neocaledonicus Andre is an important pest of cotton. Earlier records on the biology of this species are apparently lacking from the literature except for some general notes by Rahman and Sapra (1946) and Khot and Patel (1956). Detailed studies on the life and seasonal history of this pest were, therefore, undertaken at Junagadh.

MATERIALS AND METHODS

The mite culture was maintained in the laboratory on young potted cotton plants at room temperature. When mite infested leaves exhibited typical symptoms, they were collected from such seedlings and transferred to the newly potted seedlings with the help of a fine camel hair brush. Identification of mite

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species as *Tetranychus neocaledonicus* Andre was confirmed by Dr. V. Prasad, Associate Professor of Entomology (Taxonomy), Punjab Agricultural University, Ludhiana.

For biological investigations, the petri dishes 8 cm in diameter and 2 cm in depth with a layer of moist sand at their bottom were used. The adult stages from the stock-culture of the mites were confined on the whole leaves of cotton kept in petri dishes for feeding and oviposition. The wetted cotton wool on petioles kept the leaves fresh and turgid for longer periods. The leaves were confined within the petri dishes avoiding contact with petri dish edges. The moist sand helped to confine the mites on the leaf and prevented their escape. Rearing of larvae, protonymphs, deutonymphs and adults was done separately on individual cotton leaf pieces to facilitate easy location of this small sized mite.

For life cycle studies, adult mites were transferred to separate petri dishes provided with cotton leaves at 2 p.m. daily. Then the observations were recorded twice daily at 8 a.m. and 2 p.m.

Measurements of eggs, larvae, protonymphs, deutonymphs and adults were recorded with the help of stage and occular micrometer.

The sex ratio of male to female was worked out for laboratory reared as well as field collected mites by observing body colouration and the abdominal tip.

Intensity of attack on cotton was studied by counting adult mites from one square inch area of the leaf surface of ten randomly selected plants. Mite counts were taken from 9 leaves, 3 each at top, middle and bottom portions of the randomly selected plants. The survey covered period from July 1973 to March 1974.

RESULTS AND DISCUSSION

Oviposition:

In the field observations eggs were found laid at random on the mite webbings generally on the lower surface of the leaf. But in laboratory rearing on cotton plants kept in shaddy place, at times, a few eggs were observed laid on upper leaf surface. The number of eggs laid by mated and unmated female varied from 35 to 85 and 2 to 31 respectively. The eggs laid by unmated female gave rise to only male progeny while those laid by mated one gave most of the female progeny. The oviposition commenced 18 to 30 hours and 18 to 216 hours after emergence of the mated and unmated females respectively and continued for 8 to 19 days and 2 to 38 days differing with individuals and their life-span. The mated and unmated females lived for another 0 to 30 hours and 0 to 240 hours respectively after cessation of egg laying in captivity. These findings broadly confirm the observations recorded by Rahman and Sapra (1946).

Egg Stage:

First few eggs laid at the start of oviposition were smooth, round, transparent and faintly reddish in colour. However, subsequent eggs laid were

TABLE 1.

Duration of various stages in the life history of *Tetranychus neocaledonicus* Andre on cotton *(Gossypium hirsutum* L.*)* in laboratory at Junagadh, Gujarat State.

Sr. No.	*Period of study*	*Duration in hours*					*Temperature range (°C) during rearing*
		Egg stage	*Larval stage*	*Protonymphal stage*	*Deuto-nymphal stage*	*Life cycle*	
1.	3rd Dec. '72 to 25th Jan. '73	48—168 (113·49)*	48—192 (81·22)	42—210 (105·49)	48—216 (106·91)	264—528 (407·11)	18·89—30 (23·83)
2.	9th Feb. '73 to 27th Feb. '73	96—102 (97·95)	48—120 (64·95)	42—120 (65·70)	48—138 (75·75)	240—360 (304·35)	21·11—30·56 (25·79)
3.	24th Jul. '73 to 22nd Aug. '73	78—120 (93·52)	18·96 (59·48)	24—78 (50·35)	18—114 (49·30)	216—294 (252·65)	27·22—30 (28·83)
4.	4th Sep. '73 to 19th Sep. '73	78—144 (101·33)	30—96 (55·56)	24—90 (59·11)	24—90 (52·89)	240—318 (268·89)	25·56—30 (27·41)
5.	3rd Oct. '73 to 14th Oct. '73	72—96 (80·17)	30—72 (43·50)	24—48 (42·33)	30—78 (47·68)	198—240 (213·68)	27·78—32·22 (29·77)

* Figures in the parenthesis represent average values

dirty white in colour. Prior to hatching, the eggs turned opaque and became yellowish white and two pink coloured dots could be seen very easily through the chorion. On an average, the egg measured 0·12 mm in diameter. The incubation period varied from 48 to 168 hours (Table 1).

Larval Stage:

The emerging larva was brown in colour with two red eye spots. It had only three pairs of legs, the two anterior and a posterior. The body was roundish but became elongated on development and acquired blackish dots on the dorsum. The larva measured on an average 0·15 mm in length and 0·12 mm in breadth. Length was measured in all cases excluding the gnathosoma. The duration of larval stage varied from 18 to 192 hours (Table 1).

Protonymphal Stage:

The protonymph emerged from the quiescent larva had four pairs of legs. The body colour was yellow with dark blotches on the dorsum. The protonymph measured on an average 0·22 mm in length and 0·14 mm in breadth. The duration of this stage ranged from 24 to 210 hours (Table 1).

Deutonymphal Stage:

The male deutonymph was pale yellow in colour with black spots on the dorsum. The posterior abdominal part was conically rounded. In a few cases male moulted to adult stage from proto-

nymphal stage skipping the deutonymphal stage. The male deutonymph measured on an average 0·25 mm in length and 0·15 mm in breadth.

The female deutonymph, when freshly emerged, was yellow in colour with black dots on the dorsum. The posterior part of abdomen was rounded, but it was reddish pink prior to quiescent stage. It measured on an average 0·30 mm in length and 0·17 mm in breadth. The duration of deutonymphal stage ranged from 18 to 216 hours (Table 1).

Adult Stage:

(a) *Emergence:* During the quiescent period the legs stretched out and the mite got attached either to the leaf surface with the webbing or to the leaf hairs. While moulting, the skin split dorsally between the second and third pair of legs and emerging mite freed the anterior portion of its body first and later pulled out the posterior body portion. These observations differ from those recorded by Khot and Patel (1956), where they have described that while moulting the emerging mite freed its posterior portion first and pulled out from the anterior side. This type of process was also observed in case of larval and protonymphal stages.

The male was yellowish white in colour with a few scattered black dots on dorsum and pointed abdomen. It measured on an average 0·27 mm in length and 0·15 mm in breadth. While the female was widely oval and red in colour with rounded abdomen. It measured on an average 0·36 mm in length and 0·22 mm in breadth.

(b) *Mating:* Mating between male and female usually took place soon after shedding of last nymphal skin. Male usually emerged a little earlier than the female and wandered on and around the quiescent female deutonymph. When the nymph started moulting the male became active and rubbed its anterior legs and mouth parts on the posterior abdominal part of the moulting female deutonymph. This process helped in lifting its abdomen and hastening the process of moulting. For copulation, the male crawled underneath the female from behind. It caught her abdomen on either side of the tip with its anterior pairs of legs and raised the female abdomen slightly and then crawled underneath the female. The male bent its abdomen up over the back till its tip met that of the female abdomen when copulation began. In the laboratory repeated copulations had been observed between a male and a female on the same day. Besides, a female frequently copulated during its life period.

(c) *Longevity:* The longevity of male and female that had paired, varied from 2 to 9 days and 9 to 21 days respectively. While the longevity of unmated female ranged from 6 to 46 days.

(d) *Total life span:* The life cycle from egg to emergence of adult varied from 198 to 528 hours (Table 1).

(e) *Sex ratio:* During observations recorded from October '73 to December '73 the sex ratio averaged 1 male for every

14·46 female mites in field collected samples. The laboratory proportion was also curiously found to be almost identical to the one of the field samples being 15 females for each male mite of *T. neocaledonicus* Andre. Thus it may be concluded that the female proportion was consistently predominant over the male.

Nature of Damage:

All active stages were found to feed on the tender leaves of cotton plants. They injured the leaves not only by sucking the cell sap but also by covering them with a thick web which became filled with soil particles in windy weather. The characteristic damage by feeding of these mites was exhibited as white patches on lower surface of damaged leaves. These patches were normally located near the stalk in between the veins. These patches with the passage of time turned yellow and the infested leaves dried and finally dropped off.

Seasonal History:

Seasonal field population of the mites was estimated and described earlier. The consolidated data are given in Table 2, which shows that the mite population was maximum in November month. It may also be concluded that mites preferred the top tender leaves for feeding and breeding. Survey indicated this mite feeding on different host plants like *Phaseolus mungo*, *Solanum melongena*, *Ipomaea palmata*, *Hibiscus mutabilis*, *Abutilan indicum*, *Phaseolus trilobus* and *Ipomaea purpurea* besides, *Gossypium hirsutum* L.

The record of this new mite species, *Tetranychus neocaledonicus* Andre on cotton in Gujarat adds one more phytophagous mite in the recorded list of the State. In view of the unprecedented mite attack on different varieties of cotton indigenous and long staple length in Gujarat during 1972-73 season, this new record is indeed a cause of concern to the growers as well as the plant protection workers. The biology and nature of damage studies presented here will be useful to understand this pest more clearly in devising suitable control measures.

TABLE 2

Seasonal incidence of *Tetranychus neocaledonicus* Andre on cotton.

Month	*Average number of mites per 30 leaves**			*Total number of mites per 10 plants*
	Upper leaves	*Middle leaves*	*Lower leaves*	
July '73	0·0	0·0	0·0	0·0
August '73	0·0	0·0	0·0	0·0
September '73	0·0	0·0	0·0	0·0
October '73	25·0	2·0	0·0	27·0
November '73	108·75	32·25	2·0	143·0
December '73	53·75	5·50	0·25	59·50
January '74	52·50	8·50	0·50	61·50
February '74	19·50	0·0	0·0	19·50
March '74	0·0	0·0	0·0	0·0

* Based on mite counts in one square inch per leaf.

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