

STUDIES ON THE BIOLOGICAL CONTROL OF PHYTOPHAGOUS MITES (ACARINA: TETRANYCHIDAE) AND APHIDS (APHIDIDAE)

M. ANWARULLAH, IRSHAD AND TASNEEM AKHTAR

Central Laboratories, Pakistan Council of Scientific and Industrial Research, Karachi

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A detailed survey of mites and aphids fauna and their predators has been carried out in and around Karachi (West Pakistan). During the survey some coccinellid beetles (*Stethorus pauperculus* Wse., *Brumus suturalis* (F), *Adonia variegata* Goeze, *Menochilus sexmaculatus* (F) and *Coccinella septempunctata* L.) and phytoseiid mites (*Typhlodromus* sp. and *Phytoseius* sp.) were found to be very effective predators of phytophagous mites (*Tetranychus telarius* (L)-*T. urticae* Koch and *Porcupinychus abutiloni* g. nov., sp. nov.¹) and aphids of bean and cotton (*Aphis fabae* Scop., *Aphis gossypii* Glov.). The rate of feeding of the predators has been studied in this paper. A brief note on the habits and life-histories of *Typhlodromus* sp., *Phytoseius* sp. and *Stethorus pauperculus* Wse. is incorporated.

Introduction

Tetranychus telarius (L.) is a serious pest of a large majority of plants viz., lady's finger (*Hibiscus esculentus*), tinda (*Citrullus vulgaris*), mung (*Phaseolus mungo*), mash (*P. radiatus*), desi sem (*Canavalia ensiformis*), ghia tori (*Luffa aegyptica*) and sweet-potato (*Ipomaea batatas*).² The authors have also found a heavy attack of these mites especially on cotton (*Gossypium herbaceum*), ground-nut (*Arachis hypogaea*), pumpkin (*Cucurbita pepo*) and bhindi (*Hibiscus esculentus*) in many regions of West Pakistan. The cause of this heavy infestation may be either the extensive use of different insecticides which have no effect on mites and kill the natural enemies of these pests or the use of fertilizers which improve the quality of crops and thus increase their nutritive value to the pests. Chemical control of phytophagous mites is not always an effective method. It involves heavy amount of expenses. The utilization of parasites and predaceous mites and insects in the control of crop pests have attracted the attention of a large number of Entomologists in recent years. At present this method is generally recognised as one of the promising lines of approach to the solution of a great many of our major insect problems. When phytophagous mites and aphids are left without any control, they cause enormous damage to crops. Present studies, therefore, were undertaken in view of the importance of the pests mentioned above.

Method of Study

The methods used in these studies had already been described in a previous paper,³ details of which will not be repeated here. In order to determine the efficiency of beetles as predators of phytophagous mites and aphids, the known number of red spider mite, *Tetranychus telarius* (L.) and cotton aphids were placed separately in the feeding space of the cavity slide with predators. The

number of prey eaten by the respective predator was noted after 24 hours. More red spider mites were placed when the original number of mites were consumed by the predator.

Observations and Results

Predators.—The most common predators that have been observed to prey on red spider mites and cotton aphids are the phytoseiid mites (*Typhlodromus* sp. and *Phytoseius* sp.) and the coccinellids (*Stethorus pauperculus* Wse., *Brumus suturalis* (F), *Adonia variegata* Goeze, *Menochilus sexmaculatus* (F) and *Coccinella septempunctata* L.)

Host Plants of Phytophagous Mites.—Table 1 shows a complete list of plants which are attacked by red spider mite, *Tetranychus telarius* (L.) (Fig. 1). The intensity of attack and the plant parts affected are also given for each plant. *Porcupinychus abutiloni* g. nov., sp. nov.¹ has also been observed on the leaves of *Abutilon indicum*¹ (Fig. 2).

Life History

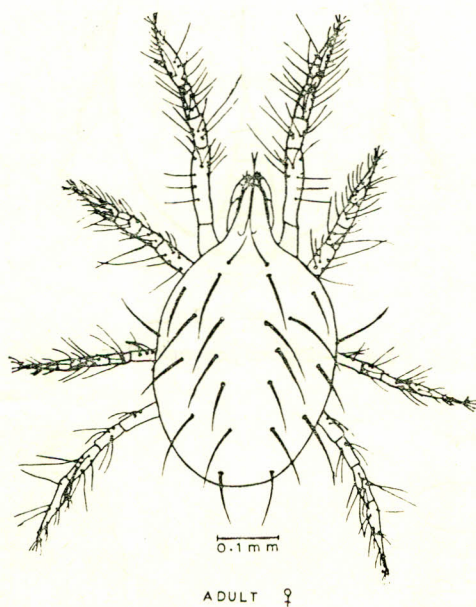
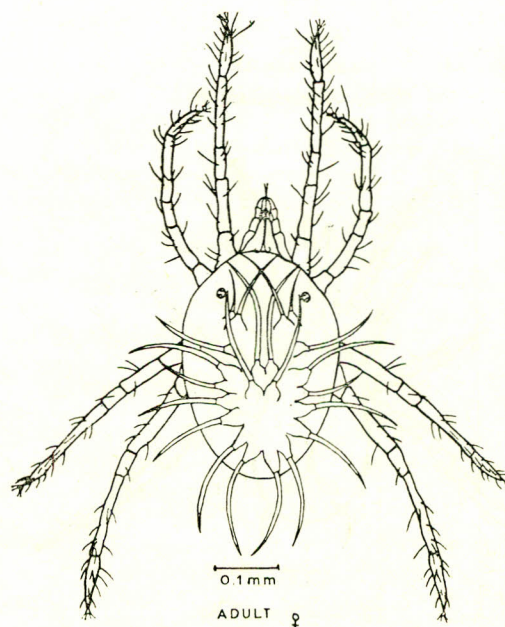
The life-history and predatory habits of beetles and mites were studied under the laboratory condition (Temperature ranges from 80° F.-90° F., relative humidity varies from 60-80%).

Typhlodromus sp. (Fig. 3).—This species is easily distinguished from *Phytoseius* sp. (Fig. 4), in the absence of large serrated setae. In addition *Typhlodromus* sp. is very active and moves quickly. Both are predaceous in habit, feeding upon all stages of red spider mite.

The eggs of *Typhlodromus* sp. are colourless, translucent and ovoid in shape (Fig. 5a). They are generally deposited on the ventral surface of the leaves, often near the midrib and lateral veins. They hatch out within 1 or 2 days into a six-legged

TABLE I.—HOST PLANTS OF TETRANYCHUS TELARIUSL.

S. No.	Host plant (Scientific name)	Family	Common name	Plant parts effected	Intensity of population	Date of collection
1.	<i>Gossypium herbaceum</i>	Malvaceae	Cotton	Generally the lower sides of leaves and flowers	Mild to heavy	Nov. 1964
2.	<i>Hibiscus esculentus</i>	do	Bhindi	Both sides of leaves and stem	Heavy	Oct. 1964
3.	<i>Abutilon indicum</i>	do	Pili Booti	do	Heavy	Nov. 1964
4.	<i>Althaea rosea</i>	do	Hollyhock	Lower sides of leaves and stem and flowers	Moderate	Dec. 1964
5.	<i>Luffa aegyptiaca</i>	Cucurbitaceae	Ghia Tori	Lower surface of leaves	Mild to moderate	Dec. 1964
6.	<i>Cucurbita pepo</i>	do	Pumpkin	do	do	Nov. Dec. 1964
7.	<i>Dolichos lablab</i>	Papilionaceae	Bean	Both sides of leaves	Moderate to heavy	Oct. 1964
8.	<i>Arachis hypogaea</i>	do	Ground-nut	Both sides of leaves stem and buds	Heavy	Dec. 1964
9.	<i>Solanum melogena</i>	Solanaceae	Bringal	Lower surface of leaves	Moderate	Jan. 1964
10.	<i>Zizyphus rotundifolia</i>	Rhamnaceae	Ber	do	Mild	Sept. 1964
11.	<i>Canna indica</i>	Cannaceae	Canna	do	do	Nov. 1964

Fig. 1.—Red spider mite, *Tetranychus telarius* (L.).Fig. 2.—Greenish spider mite, *Porcupinychus abutiloni* g. nov. sp. nov.

larvae (Fig. 5b). The newly emerged larvae are pale white. They do not appear to feed and moult within 1 or 2 days into the first of the two nymphal stages. The nymph undergoes a resting condition which lasts for a day only. The duration of the whole life cycle takes an average period of 8-11 days. The life cycle of *Phytoseius* sp. is similar to that of *Typhlodromus* sp.

Stethorus pauperculus Wse. (Fig. 6).—It is a small round-shaped beetle of shining black colour. The head is small and nearly hidden by the prothorax. The antennae are moderately long. Legs are short, hidden under the body. Males and females

are not distinguishable by superficial characters. Male can only be recognised from the female by its small size. Both adults and their young ones feed upon all stages of red spider mite. First-instar larva of beetle feeds largely on the eggs and smaller nymphs of red spider mite. When the adult beetles are placed on cotton leaves bearing the red spider mites and the predatory mite, *Typhlodromus* sp., they consume the eggs of the latter as freely as those of red spider mite. The larvae of the beetle feed by sucking the contents of the red spider mites and their eggs. The adult masticate their prey and ingest them. The exoskeleton of the prey is usually discarded.

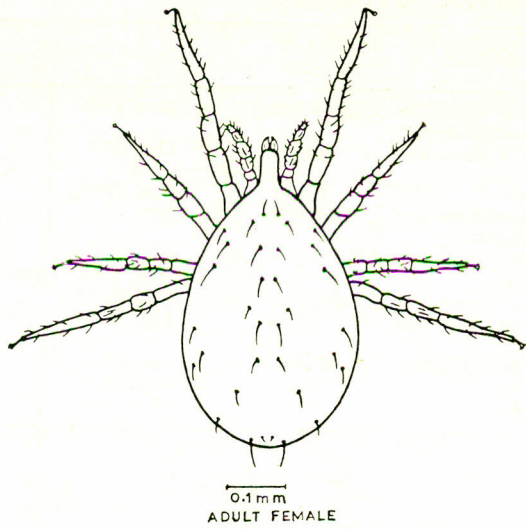


Fig. 3.—*Typhlodromus* sp.

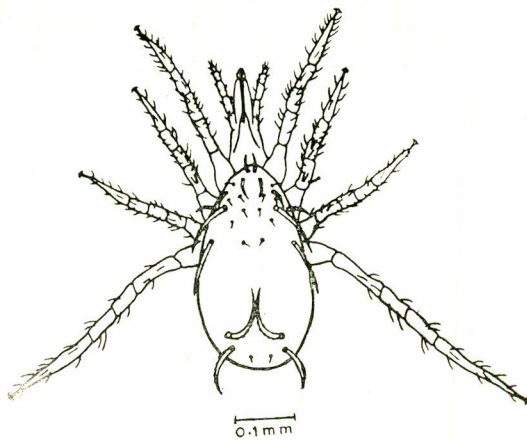


Fig. 4.—*Phytoseius* sp.

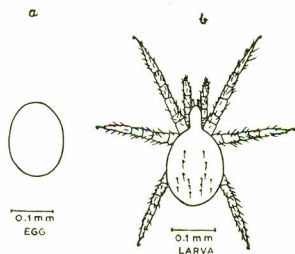


Fig. 5.—*Typhlodromus* sp. (a) Egg. (b) Larva.

The eggs of *Stethorus pauperculus* Wse., are small, smooth and ovoid in shape (Fig. 7). They are laid in clusters openly on the surface of the leaves. The larvae has a small head and broad thoracic

segments. Each thoracic segment bears hairs on tubercles (Fig. 8). They feed voraciously on eggs and larvae of red spider mite. Pupation takes place on the leaves. The complete life-cycle passes through four larval instars and one pupal stage (Fig. 9). Newly emerged adult is light brown in colour, changing into black after few hours. The whole life cycle takes an average of 3 weeks.

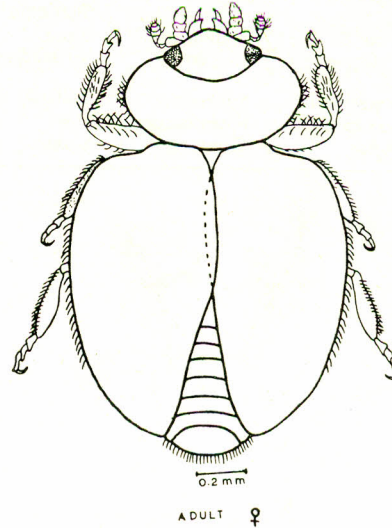


Fig. 6.—*Stethorus pauperculus* Wse..

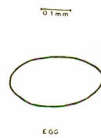


Fig. 7.—Egg of *Stethorus pauperculus* Wse

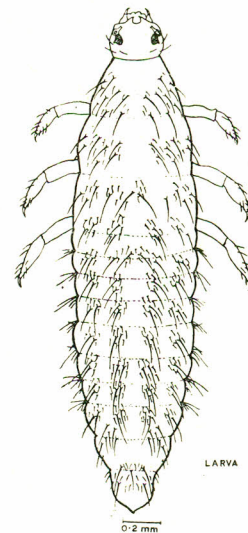
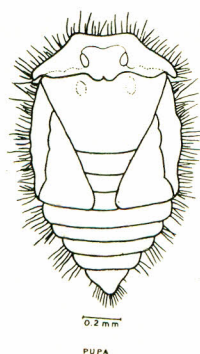


Fig. 8.—Larva of *Stethorus pauperculus* Wse..

Results of the experiments are summarised as follows:

Fig. 9.—Pupa of *Stethorus pauperculus* Wse.

Among the predatory beetles, *Brumus sutularius* (F), is more efficient and effective in controlling the population of red spider mites and greenish spider mite, *Porcupinychus abutiloni* g. nov., sp. nov. The mature female consumes an average of 53 adults of red spider mite and 33 of greenish spider mites in 24 hours (Table 2).

TABLE 2.—MEAN NUMBERS OF EGGS, LARVAE AND ADULTS OF PHYTOPHAGOUS MITES AND APHIDS CONSUMED BY DIFFERENT COCCINELLID BEETLES.

S. No.	Coccinellid beetles	Stage	Duration of feeding (in hours)	No. of <i>Tetranychus telarius</i> (L)			No. of <i>Porcupinychus abutiloni</i> g. nov. sp. nov.			No. of cotton aphids (<i>Aphis gossypii</i> Glov.)
				Eggs	Larvae	Adults	Eggs	Larvae	Adults	Adults
1.	<i>Stethorus pauperculus</i> Wse.	Larvae	24	38	39	22	35	31	21	4
		Adult	do	22	21	29	22	30	19	3
2.	<i>Menochilus sexmaculatus</i> (F)	Adult	do	3	23	29	11	26	29	137
3.	<i>Brumus sutularis</i> (F)	Adult	do	34	29	53	47	46	33	37
4.	<i>Adonia variegata</i> Goeze	Adult	do	3	23	32	11	23	30	107
5.	<i>Coccinella septempunctata</i> L.	Adult	do	17	21	9	21	19	23	101

Stethorus pauperculus Wse., is also the most important natural enemy of red spider and greenish spider mites. Both the larvae and adults of this beetle attack all the stages of these mites (Table 2). The overall population of the above-mentioned mites is greatly reduced by this beetle.

Menochilus sexmaculatus (F), *Adonia variegata* Goeze, and *Coccinella septempunctata* L., consume 29, 32 and 9 red spider mites respectively (Table 2). These beetles are also found to be a good predators of cotton aphids. They prefer more aphids than red spider mites. *Menochilus sexmaculatus* (F) has an average capacity of consuming 137 cotton aphids in 24 hours. (Table 2).

Typhlodromus sp. and *Phytoseius* sp. also prey on red spider mites. The adult of *Typhlodromus* sp.

consumes an average of 9 eggs, 15 larvae and one adult of red spider mite respectively (Table 3). Although these predatory mites can not bring the

TABLE 3.—MEAN NUMBERS OF ADULTS, LARVAE AND EGGS OF *TETRANYCHUS TELARIUS* (L) CONSUMED BY ADULTS AND IMMATURE STAGES OF *TYPHLODROMUS* SP.

Predator	Stage	<i>Tetranychus telarius</i> (L)			Duration of feeding (in hours)
		Eggs	Larvae	Adults	
<i>Typhlodromus</i> sp.	Larvae	17	12	0	24
	Protonymph	10	13	0	24
	Adult	9	15	1	24

heavy infestations of red spider mites under economic control, yet they can partly check the increase of this pest and delay the appearance of injury to the host plants.

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