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MASS REARING OF THE TWO-SPOTTED MITE, *Tetranychus urticae* Koch, ON WATER HYACINTH

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ABSTRACT

The two-spotted mite, *Tetranychus urticae* Koch, was reared using as host plant water hyacinth (*Eichornia crassipes* L.) held in plastic gallon jugs with tap water to keep them fresh, then placed on plastic trays with water to ward off ants and other invaders. The technique was initially developed for rearing *T. truncatus*. An average of 3,077.7 eggs, 417.7 active immatures, 117 female adults, and 19.4 male adults per leaf were produced after a week of infestation of fresh substrate, which was 2.7 times the starting population density.

Key words: phytoseiid mites, spider mites, *Eichornia crassipes* L, *Tetranychus truncatus* Ehara

INTRODUCTION

The green spotted or two-spotted spider mite, *Tetranychus urticae* Koch, is the most prevalent spider mite pest of commercially grown roses, chrysanthemums, other ornamentals, strawberry and other important crops in Benguet and wherever these crops are commercially grown in other parts of the Philippines (Corpuz-Raros et al. 2004). It was recorded in the Philippines only recently (Corpuz-Raros 2001) but was first collected from Bontoc in 1973 and from Leyte in 1988 .

T. urticae is potentially serious on several cultivated crops. Heavy infestation on sampaguita alarmed owners in Cabuyao, Laguna as it did eggplant growers in Banlic, Calamba City early this year (2005). Pigeon pea, *Cajanus cajan*, used as trap plant for tomato fruitworm, *Helicoverpa armigera*, attacking processing tomato in the Ilocos Region, in the experimental area of the National Crop Protection Center, and University of the Philippines Los Baños, College, Laguna was likewise naturally infested by *T. urticae*. Infestation by this pest may result in yellowing of leaves, premature leaf fall and dramatic reduction in yield of eggplant. In some countries like Malaysia (Ibrahim and Abdul Rahman 1997), this spider mite is being used as prey for commercial production of the predatory phytoseiid mite, *Neoseiulus longispinosus* (Evans) (=*Amblyseius longispinosus*). A similar undertaking can be pursued in the Philippines.

The water hyacinth, *Eichornia crassipes* L., a weed that clogs canals, rivers, and water reservoirs all over the country, is an excellent host plant for spider mites like *Tetranychus truncatus* Ehara, as we reported earlier (Navasero *et al.* 2004). Comparing *E. crassipes* with seven other host plants, we found significantly higher rate of spider mite development and reproduction on the former host plant. We attributed this to the bigger size of the leaves as well as to its succulence, firmness and long vase-life inside the laboratory. Subsequently, we conveniently used *E. crassipes* for mass rearing other spider mites like *T. urticae* and *Oligonychus biharensis* that serve as prey for phytoseiid predators in various biological control experiments in the laboratory.

This paper presents observations on the habits of *T. urticae* at different developmental stages on water hyacinth, data on the density of eggs, active immatures and adults and a more detailed methodology of mass rearing the spider mites on water hyacinth.

MATERIALS AND METHODS

Stock culture

The initial laboratory stock of *T. urticae* was collected from leaves of roses in a private farm in Putho, Tuntungin, Los Baños, Laguna in May 2002. Since then, the mites are being maintained on soybean in the laboratory. Part of the stock was allowed to reproduce on water hyacinth and was continously reared on the said plant for more than a year prior to detailed assessment of its suitability as host for mass rearing of the mite.

Mass Rearing of *T. urticae*

The rearing protocol for *T. truncatus* reported by us earlier (Navasero *et al.* 2004) was adopted for rearing *T. urticae* and is reported in greater detail as follows:

One-gallon plastic containers with the upper 1/3 removed, were used to contain the host plants. Each container was filled with tap water and placed on a moat of water on a rectangular tray or vat to ward off ants and predators which may invade the culture (Fig. 1).

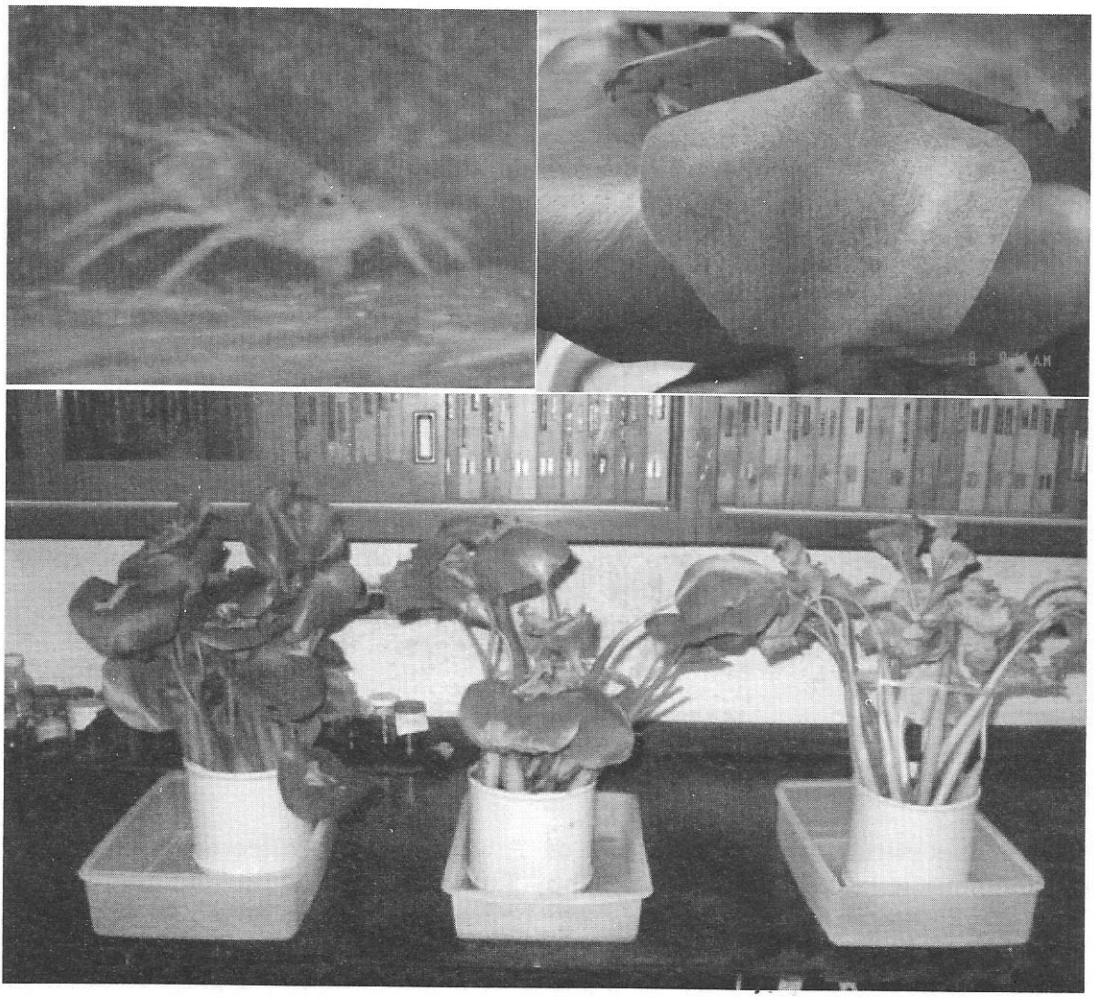

Figure 1. Adult female *T. urticae* (a), close-up of an infested leaf of *E. crassipes* (b), and laboratory set-up for mass rearing *T. urticae* (c). Note the newly infested *E. crassipes* (left), fully infested host (middle) and deteriorated host (right).

Infested leaves from the pure stock culture were collected, and cut into four pieces. A piece was pinned on an uninfested water hyacinth leaf. When the leaf pieces dried up, the active immature mites freely transferred to the new leaves. Transfer was usually completed within two to three days, after which, the dried pieces were removed and the culture was allowed to develop. After one week the host started to deteriorate and another container of fresh water hyacinth was prepared for infestation. The process was repeated continuously to maintain the cultures of spider mites.

The suitability of water hyacinth as host for the mass rearing of *T. urticae* was quantified after more than a year of continuous rearing on said host plant. Ten leaves were selected at random, detached, and placed separately in zip-lock plastic bags and frozen in an ordinary refrigerator. Freezing prevented hatching of eggs and further development of the mites. It also immobilized these active immatures, making it easier and faster to count them under a microscope. Samples were taken 7 days after introducing a quarter of infested leaf containing an average of 989 mites at all growth stages. The eggs, active immatures, adult males and females per leaf were counted and recorded.

RESULTS AND DISCUSSION

Life History of *T. urticae* on Water Hyacinth

In mass rearing *T. urticae* under laboratory conditions, thorough knowledge of its developmental stages, feeding habits, reproduction, rearing conditions needed for proper growth and development and suitable host plants, are important.

Normally, *T. urticae* undergoes five developmental stages, namely, egg, larva, protonymph, deutonymph, and adult. The eggs hatch within 3-5 days, adult female emerges in 4-5 days and each lays more than 100 eggs in a lifetime of about 30 days. The eggs are normally laid on the upper surface of the leaf of water hyacinth. They are spherical and appear clear, and colorless at first, but become opaque later, and finally turn yellow just before hatching. The newly hatched larva is minute, pale, almost colorless at first, but becomes pale yellow to greenish with a black spot on each side of the body as it feeds and settles on the upper surface of the leaves which becomes stippled as a result of the feeding punctures of the mites. The protonymph and deutonymph, which are darker green and with larger spots, also settle on the upper surface and feed more voraciously since they are bigger. Feeding damage by the nymphs is manifested by bigger stipplings and the leaves appear laden with whitish powder, which are actually molted skin or exuviae. The larva, protonymph, and deutonymph constitute the active stages of the

active stages of the mite. The greenish adult female has a more prominent dark spot on each side, is the biggest among the stages, and occupies also the upper surface of the leaves where it feeds and oviposits. The adult male, which is smaller and paler, seems not to feed much because it was observed always moving about, or settled near a prospective mate, a deutonymphal female.

The lower surface of the leaves becomes colonized only when the upper surface is totally infested. When both surfaces of the leaf become fully infested, part of the colony moves down the petiole and leaf sheath to feed and reproduce. Unlike *T. urticae,* nymphs and adults of *T. truncatus* normally congregate at the tip of the leaf and at high density produce web of silken threads over the entire leaf surface. Generally, this occurs when the substrate starts to deteriorate and the mites need to transfer to new or fresh host.

Population Growth of *T. urticae* on Water Hyacinth

Table 1 shows the density of eggs ($\bar{x}$ = 3077.7), active immatures ($\bar{x}$ = 417.7), adult females ($\bar{x}$ = 17) and males ($\bar{x}$ = 19.4) of *T. urticae* per leaf seven days after infesting *E. crassipes*. The average total density was 3,631.8 per leaf, representing an increase of 2.7 times that of the initial 989 individuals infested, indicating active population growth. Ninety-three per cent of the total population occupied the upper leaf surface. Of these, 94 % of the eggs, 90 % of active immatures, 83 % of females and 95 % of males were on the upper leaf surface. The small percentages of the mites at various stages of development found on the lower leaf surface indicate that this is less preferred for feeding and reproduction of the mite.

Table 1. Number of eggs, active immature and adult *T. urticae* per *E. crassipes* leaf under laboratory condition seven days after initial infestation with 989 individuals at various stages of development.

Leaf Sample	Egg	Active Immatures	Adult		Total
			Female	Male	
1	4338	826	156	20	5340
2	2706	242	114	16	3078
3	602	322	64	18	1006
4	1474	112	134	11	1731
5	2384	424	116	18	2942
6	4837	796	215	37	5885
7	4199	150	126	12	4487
8	4318	271	102	27	4718
9	3235	716	65	18	4034
10	2684	318	78	17	3097
Mean	**3077.7**	**417.7**	**117.0**	**19.4**	**3631.8**

CONCLUSION

The results show that water hyacinth is suitable for supporting a growing population of *T. urticae* inside the laboratory. Growth and development appeared normal, and the mites did not change in color even in crowded condition.

The use of water hyacinth as laboratory host for mass rearing of spider mite prey, like *T. urticae* for biological control agents, gives economic value to this otherwise noxious weed species. It facilitates and makes rearing work less tedious and more convenient. Likewise, *T. urticae* which is a very widespread pest, is easy to rear and maintain, making it easier and faster to produce unlimited quantity of prey for detailed laboratory experiments in biological control.

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