Research Article

BIOLOGY OF TWO SPOTTED SPIDER MITE, TETRANYCHUS URTICAE KOCH. (ACARI: TETRANYCHIDAE) ON MULBERRY, MORUS SP.

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ABSTRACT

Mulberry, *Morus* sp. is a tropical evergreen plant and their leaves are the only sole food for the mulberry silkworm, *Bombyx mori* due to the presence of some secondary plant metabolites like morin, β sitosterol and other alkaloids. The quality of the mulberry leaves is an important factor for the success rate of sericulture industry. As mulberry plant has excellent greenish foliage which acts as a susceptible host for many pests. Among various pests, the two-spotted spider mite, *Tetranychus urticae* Koch. acts as a major pest in the mulberry ecosystem as it affects the leaves quality by sucking the sap content in it. The two-spotted spider mite is a polyphagous sucking pest and dominant mite species reported in green house and field condition, which can survive even in high temperature. The biology of two-spotted spider mite was studied on mulberry leaves (var. MR 2) under laboratory condition (27±5°C and 70±5% R.H.) during March, 2019 at Department of Entomology, Faculty of Agriculture, Annamalai University. The present paper adumbrates the duration of different developmental stages such as egg, larvae, protonymph, deutonymph, developmental period, oviposition period and adult longevity (male and female) of two spotted spider mites on mulberry. The higher temperature increases the developmental rate and reduces the duration of developmental stages. The present finding from this research paves way for the selection of appropriate IPM module for the effective management of two spotted spider mite on mulberry.

INTRODUCTION

Mulberry is a tropical evergreen, perennial tree belongs to the family Moraceae. Leaves of mulberry is a vital economic component in sericulture, since the quality and quantity of leaf produced per unit area have a direct influence on the success percentage of silkworm rearing and cocoon production. Mulberry leaf is the only food for mulberry silkworm, *Bombyx mori* due to the presence of morin, β sitosterol and other phagostimulants. Young age silkworms prefer succulent, moist rich and nutritive leaves, preferably the top leaves. In tropical regions, during summer season, the incidence of sucking pest population increased rapidly at a peak. Among the sucking pest, a non-insect pest, two spotted spider mite, *Tetranychus urticae* (Koch) reported to cause drastic economic loss by sucking the sap content in leaves and diminishes the nutritive factors present in it.

The two spotted spider mite is phytophagous species of spider mites, which is more common in greenhouses and field crops throughout the world. This mite is a generalist species that can feed on wide range of host plants and causes considerable damage to field, greenhouse and horticultural crops James *et al*. (2001). Feeding activity of spider mite leads to the appearance of typical yellow chlorotic spots on leaves with profuse webbing on the underside of leaves. In severe infestations, leaves may fall off and flowering may be considerably reduced. The management practice for this mite has relied on conventional chemical means with frequent pesticide applications to achieve effective control.

Profuse feeding of *T. urticae* can damage the protective leaf surfaces, stomata, the palisade layer and the lowest parenchymal layer. It results in typical "balloning" symptom on upper surface of the leaves which aids for their dispersal mechanism. From this view, it much important to oversee the mite population build up, so that appropriate management practices can be adopted. Studying the biology of mite is imperative, for the identification of susceptible stage in order to adopt the effective and selective non chemical management tactics against two spotted spider mites.

In this current research, it was adumbrated the duration of different developmental stagessuch as egg, larva, protonymph, deutonymph, oviposition period and adult longevity (male and female) of *T. urticae* on mulberry leaves.

MATERIALS AND METHODS

The population of two spotted spider mites were collected from the field nearby Sivapuri, Annamalai Nagar. The experiment was conducted under *in vitro* condition with 27± 5°C and relative humidity of 70±5%, Department of Entomology, Faculty of Agriculture, Annamalai Univeristy (11°24' N Latitude and 79°44' E Longitude). Each pair of two spotted spider mite were released on the mulberry leaves, placed on the wet cotton pad in a Petri dish (10 cm dia) for allowing the mites to lay eggs. After oviposition, the eggs were encircled with ink and the females were separated. As such the experiment was conducted for the study on the different developmental stages, observation was recorded from the egg stage onwards by examining each of the excised leaves with eggs under stereo binocular microscope, Leica M205C.The morphological characters of different developmental stages of mites were specifically documented for each replication.

When the eggs were hatched, the emerged larva was transferred on mulberry leaves in a Petri dish (5 cm in diameter), each having one freshly emerged larva Veerendra *et al.* (2014). Observations were recorded after every two hours with four replicationsfor further development and necessary records were made regarding duration of different stages like egg, larva, protonymph, deutonymph, egg to adult period, oviposition period and adult longevity.

The time taken between laying of first egg and the last egg was considered as oviposition period. A newly emerged female deutonymph along with an adult male was placed together in Petri dishes (5 cm dia) with mulberry leaf on wet cotton pad at the bottom, allowing them to mate after the female attained adulthood Mondal and Gupta (2017). Observations were recorded after every two hours with four replications under a stereo-binocular microscope. While taking the observations, the number of newly laid eggs were counted in each Petri dishes. The longevity of the adult mites were determined by a separate experiment for which deutonymph was kept under the above setupunder *in vitro* and its life cycle was observed until its death.

RESULTS AND DISCUSSION

The results revealed that the biology of two spotted spider mite under *in vitro* condition in mulberry (var. MR 2) at Department of Entomology, Faculty of Agriculture, Annamalai University. Table 1.

Egg

The egg laying by mite was confined to the area nearer to mid rib and lateral veins on the under surface of leaf. Freshly laid eggs were spherical, smooth and translucent white and appeared like tiny water droplets measuring about 0.01 mm diameter. The creamy white egg turned brownish progressively towards hatching. The egg period ranged from 3.50 - 3.10 days in laboratory on the mulberry host. The mean duration of egg stage was being 3.30 ± 0.27 days, the present findings was in accordance with that of Kumar *et al.* (2013) in biology of two spotted spider mite, *T. urticae* where it was mentioned as 3.2 days as incubation period.

Larva

The newly emerged larva was creamy white in colour with two bright and prominent red spots on the dorsal sides with three pairs of legs. The larval period ranged from 2.10–2.90 days with average of 2.53± 0.28days when reared on mulberry host. Similar results was reported by Paramjit Kaur and Zalom(2018) in the biology of *T. urticae* at during hot summer with mean larval stage of 2.33 days.

Nymph

The newly emerged protonymph was pale white in colour and the later stage protonymph was straw yellow colour in the beginning. Later it turned to pale green and it was slightly larger than larva and easily distinguishable by the presence of four pairs of legs and this period of two spotted spider mite ranged from 0.60–0.90 and average of 0.80 ± 0.14 days in mulberry leaves. The present observations exhibit similar trend with that of Najafabadi (2012) where the average protonymphal stage period was 0.9 days during hot summer season.

After protonymphal stage the mite passed to deutonymphal stage, which resembled protonymph in all characters except bigger in size and period ranged from 1.50–2.20 days with an average of 1.78±0.12days on mulberry. The present findings exhibit a similar trend with that of Najafabadi (2012) where it was stated as, after the protonymphal stage, the mites entered to deutonymphal stage which lasted for 2.1days.

Adult

Adult mites were broad, bright red in colour with a pair of distinct spots on either side of the dorsum. The first pair of legs were longer than the remaining pairs of legs in adult. The abdomen of the adult male was narrow. Females are appeared to be comparatively larger than the opposite sex. The adult males were usually spotted near the deutonymph which nearing maturity as preparedness for mating.

Egg to Adult period

The mean oviposition period for the adult female is 4.76± 0.29 days within a range of 4.30 - 5.60. The longevity of the adult male was 4.70± 0.55days in the range of 4.50–5.30 days whereas the longevity of the adult female was 6.06± 0.58days with the range of 5.70–6.40 days which is in line with Karabhantalal *et al.* (2013) where it was stated as the longevity of *T. urticae* was 4.7 days in his research findings on grapes. Here, the total life cycle for the male of *T. urticae* was found to be 17.87 days whereas the female was 19.23 days which shows similar fashion with Forghani *et al.*

(2006) findings as the total life cycle of *T. urticae* was 19.23 days.

The total mean developmental period from egg to adult stage differs depending upon the prevailing temperature, the life cycle of mite will be prolonged during winter season and shortened during extreme summer season which is in accordance with Imani *et al.* (2009).

Table 1. Biology of two spotted spider mite, *T. urticae* on Mulberry, *Morus* sp. (var: MR 2) under *in vitro* condition.

Developmental stages	Range (in days)	Mean ± SD (in days)
Egg	3.10 – 3.50	3.30 ± 0.27
Larva	2.10 – 2.90	2.53± 0.28
Protonymph	0.60 – 0.90	0.80 ± 0.14
Deutonymph	1.50 – 2.20	1.78± 0.12
Total development period	7.70 – 9.30	8.41 ± 0.21
Oviposition period	4.30 – 5.60	4.76± 0.29
Adult period		
i. Male	4.50 – 5.30	4.70± 0.55
ii. Female	5.70 – 6.40	6.06± 0.58

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