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Significance of Two Spotted Red Spider Mite, *Tetranychus urticae* on Crop Plants and Its Management

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Abstract

The two spotted red spider mite, *Tetranychus urticae* (Koch) is a severe pest in tropical regions of the world. The pest cause economic damage in most of the crops across the world. The pest shows resurgence to pyrethroid pesticides and it creates resistance quickly when pesticides are frequently used. Integrated pest management is necessary to manage the severity of the pest in different crop ecosystems. Frequent monitoring, removing alternate hosts, utilizing indigenous technical knowledge, biological control and rotating pesticides is essential to effectively manage the pest.

Introduction

The crops in the present world can be categorized as food crops (Rice, Wheat, Maize, etc.), cash crops (Sugarcane, Tobacco, Cotton, etc.), plantation crops (Coffee, Tea, Rubber, etc.), horticultural crops (Fruits, Vegetables, Ornamentals, etc.), etc. Each crop is infested by one or more pest. But crops in all categories are infested by this single pest, namely two spotted red spider mite. Besides the monophagous and oligophagous pests of crop this pest is highly polyphagous in nature which also feeds on weeds. Since the pest is favored by high temperature the recent trend of global warming makes this pest more comfortable. The high fecundity and less time for development makes this pest more vulnerable to the crop ecosystems. Less weight and smaller size is advantageous to the pest in both short and long distance transport by wind. Managing pest through chemical insecticides develops resistance within 2–3 years. Hence rotating management tactics is essential for effective IPM of this pest.

The most important and widespread of the mite is red spider mite (*Tetranychus urticae* Koch.) belongs to family Tetranychidae. Red spider mites are phytophagous (plant feeding) in nature, a heavy infestation can cause complete defoliation of the host plant. The mite measures about 0.5 mm in length. As like usual spiders they spin webs, but mostly under the surface of leaves. The pest is cosmopolitan in distribution and gains economic importance in the recent years. In a single crop, in brinjal alone the pest cause 13 to 31 percent yield reduction in Bangalore. The pest is noticed both in open cultivation and polyhouse conditions but the population buildup of pest is high in polyhouse condition because of increased temperature. The global warming has direct impact on the pest population.

Distribution and Host Range

Red spider mite is a severe non-insect pest recorded from 109 countries of different continents across the world which includes India (CABI, 2019). This pest is

extremely polyphagous that feeds more than 100 species of cultivated plants and also many species of weeds which acts as

an alternative host (Table 1). Among the different host plants the mite cause major infestation to Ashwagandha in India.

Table 1: Host range of two spotted red spider mite, *Tetranychus urticae*

Grain crops	Fruit crops	Vegetable crops	Ornamental crops	Plantation crops	Fibre crops
Rice, Wheat, Maize, Sorghum, Cow Pea, Mung Bean, Legumes, Beans, Groundnut, Castor, Sweet Corn	Okra, Strawberry, Soya Bean, Sweet Potato, Apple, Cassava, Papaya, Citrus, Watermelon, Orange, Grape Vine, Pear	Tomato, Brinjal, Onion, Garlic, Beet root, Bell Pepper, Cucum-ber, Pumpkin, Cucur-bits, Lettuce	Chrysanthemum, Jasmine, Rose, Carnation, Or-chids	Tea, Coffee, Pepper, Common Fig, Clover	Cotton

Life Cycle

Unlike other arthropods the red spider mite has different stage in its growth period such as egg, larva, nymphochrysalis, protonymph, protochrysalis, deutonymph, teliochrysalis and adult. The eggs are spherical, translucent and look like a tiny drop of water under the leaf surface. While the newly hatched larva almost spherical to slightly oval in shape and creamy white in color and turned green upon initiation or feeding. Whereas protonymph has oval shaped body and amber color and deutonymph was carmine red in color. The newly emerged female was bright red in colour and later turned to deep red to brick red in color. The adult male body was usually light greenish, which turned pinkish with age. The egg to adult life span varies among different regions because of the prevailing temperature. Under room temperature it took around 20–23 days for males and 29–32 days for females. The life span decreases to a week at higher temperature.

Dispersal

The mite is not carried by any insects. They are actively transported long distance by wind and some extant through tools and humans. From plant to plant, a mite is dispersed passively by walking.

Symptom of Damage

The mite pierces the leaf tissue and sucks the individual plant cell content. This results in reduced chlorophyll content and photosynthesis. The stomatal apparatus after mite infestation remains closed, which adversely affects the plant growth and yield. In most of the plants the mite tend to feed on leaf tissue, whereas in some plants the mite directly feeds on the economic parts and reduces the yield viz. maize, strawberry, pear, cotton, soya bean and grapevine. In tomato crop the mite feed tomato undergoes discoloration (gold fleck) which reduces the marketability.

IPM Package

Cultural Control

- Regular monitoring of crop for pest incidence is essential.
- Dusty condition favors mite outbreak. Spraying plants with

water to remove dust particles that settles in leaves, especially under the leaf surface will reduce the pest population.

- Since most of the incidences are carried by wind, raising wind barrier crops (tall crops) such as border cropping of sorghum, maize etc. will act as indicator of incidence and control measures can be taken at early infestation.

Indigenous Technical Knowledge (ITK)

- Soak shredded rhizome of turmeric (20g) in 200 ml cow urine. Dilute the mixture with 2-3 liters of water and add soap (8-12 ml) and spray. The extract controls red spider mites as well as aphids, caterpillars and powdery mildew (Joshi, 2019).

Biological Control

- According to the pest locality the species of predators vary, but the common predator of red spider mite, *Tetranychus urticae* (Figure 1) was noticed in wide range of host plants is predatory mites from the family Phytoseiidae. These mites, belongs to a number of genera, such as *Amblyseius*, *Euseius*, *Neoseiulus* and *Phytoseius* have been shown to regulate populations of *T. urticae* on a range of crops. *Phytoseiulus persimilis* successfully controls the mite in greenhouses. Augmentation of *Phytoseiulus persimilis* is effective under field conditions (Oliveira et al., 2007). The *Phytoseiulus* mite is ineffective at lower temperature below 16 °C. Under low temperature *Amblyseius andersoni* can be used for effective management.

- Other predators of the mites includes ladybird beetles, *Stethorus* (Coccinellidae), anthocorids (mainly *Orius* spp.), larvae of chrysopids, thrips (e.g. *Scolothrips* spp.), staphylinids (e.g. *Oligota* spp.), and larvae of cecidomyiid midges, *Feltiella acarisuga* (= *Therodiplosis persicae*). The above discussed predators can be encouraged by growing flowering plants in and around the field (or) leaving the flowering weeds undisturbed.

- The entomopathogenic fungus, *Neozygites* spp. can be utilized under high humid climatic conditions.

Some Important Predators Common in Field

- *Phytoseiulus persimilis* (Acarina; Phytoseiidae) – The *Phytoseiulus* mite can be distinguished from red spider mite by the two black spots in the dorsum of the red spider mite

which is absent in *Phytoseiulus* mite (Figure 2). The eggs of this predatory mite are considerably bigger than eggs of red spider mite.

- *Scolothrips* spp. (Thysanoptera; Thripidae) – The thrips is pale yellow in color with series of three black markings in the each wings (Figure 4).
- *Stethorus* sp. (Coleoptera; Coccinellidae) – Measures less than 1mm in length. The adult is black in color (Figure 3).
- *Orius* spp. (Hemiptera; Anthocoridae) – Black bug with white markings (Figure 5).



Figure 1: Two Spotted Red Spider Mite



Figure 2: *Phytoseiulus persimilis* predating on red spider mite



Figure 3: Predatory coccinellid - *Stethorus* sp.



Figure 4: Predatory thrips - *Scolothrips* sp.



Figure 5: Predatory bug - *Orius* sp.



Figure 6. Predator - Chrysopid

- Chrysopid Larva (Neuroptera; Chrysopidae) – Small larva with protruded mandibles (Figure 6).

Chemical Control

- The chemical insecticides, acaricide sprayed to manage mites will last in the plant parts for certain periods (Waiting Period). So spraying the pesticide to vegetables and fruits should be taken care off. Spray wettable sulphur 50 WP 2 g/lit [7–14 days waiting period (WP)], Dicofol 18.5 EC 2.5 ml/lit [15–20 days waiting period (WP)], Profenofos 50% EC (7 WP), Fenazaquin 10% EC (7 WP), Propargite 57 EC (7 WP), Flufenzine 20% SC (7 WP), Hexithiazox 5.45% EC (5 WP), Fenpyroximate 5% EC

(7 WP), Spiromesifon 22.9% SC (5 WP).

- The mite develops resistance within 2–3 years, so repeated use of acaricides should be avoided to reduce resistance.
- Carbaryl and pyrethroids should not be used as they increase the pest incidence.
- Sulphur based insecticides must not be used in cucurbits as they cause phytotoxic effects.

Conclusion

The red spider mite can be effectively managed using above control practices. The insecticides can be applied by considering the waiting period since most of the host are fruits and vegetable that we will consume directly within few days after harvest. For safe and ecofriendly management practices encourage the natural enemies by reducing the acaricide spray when the predator's population is high.

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