IPM Notes 1.0 Two-Spotted Mites (TSM) (*Tetranychus urticae*)

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As promised in the Winter edition of the Australian Berry Journal, we feature the first of our IPM Notes on Two-Spotted Mites.

There are many elements that comprise a successful Integrated Pest Management (IPM) program, with regular and well-structured crop monitoring being one element that is a necessity for early detection, identification and treatment of pests and disease. Recording the results of that monitoring provides a database of farm pest and disease issues, that when analysed can inform producers to enable the prediction of crop pest and disease for future growing periods.

Elements that make Two-Spotted Mite (TSM) difficult to manage include its fast development from egg to adult, high reproduction rate and propensity toward resistance to chemicals. Early detection of TSM through crop monitoring allows for the early introduction of biological organisms for control, and the reduction of chemical use through spot spraying. (Figure 1)

Identification of TSM[4]

To be able to implement an IPM program it is important to be familiar with the identifying features of the organism at all stages in its lifecycle. The following provides descriptions of TSM at different stages of growth. (Figure 7)

Eggs

Two-spotted mite eggs are 0.13 mm in diameter, globular and translucent. Eggs are not visible to the naked eye but can be seen with a x10 hand lens.

Larva

Larva is pale green and has six legs.

Nymphal stages

There are two nymphal instars; protonymph and deuteronymph. Nymphs are pale green with darker markings and have eight legs.

Adults

The adult female is 0.6 mm long, has eight legs, is pale green or greenish-yellow with two darker patches on the body, which is oval with quite long hairs on the dorsal side. Overwintering females are orange-red in colour. The male has a smaller, narrower, more pointed body than the female. (Figure 3)

Life Cycle[6]

From egg to adult TSM takes about 1-2 weeks, dependant on the temperature. Populations are more likely to build up to damaging levels during warm, dry conditions.

How do they spread? [6 & 3]

Two-spotted mite spread via:

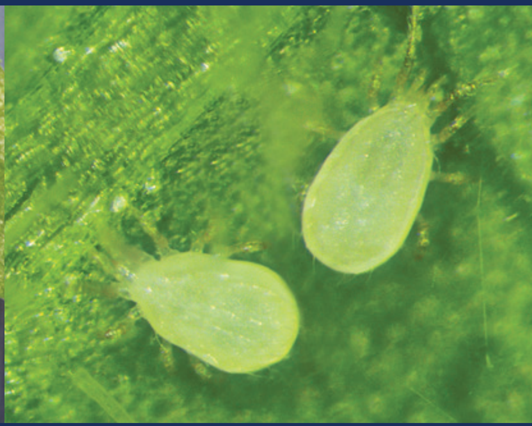
- crawling along cropping structures and along touching plants,
- wind,
- introduction of infected plants,
- tools, clothing and machinery.

1. Close-up view of two-spotted mites
Photo credit: Frank Peairs, Colorado State University, Bugwood.org

2. Californicus eating TSM adult
Photo credit: Nigel Cattlin, Alamy Stock Photo

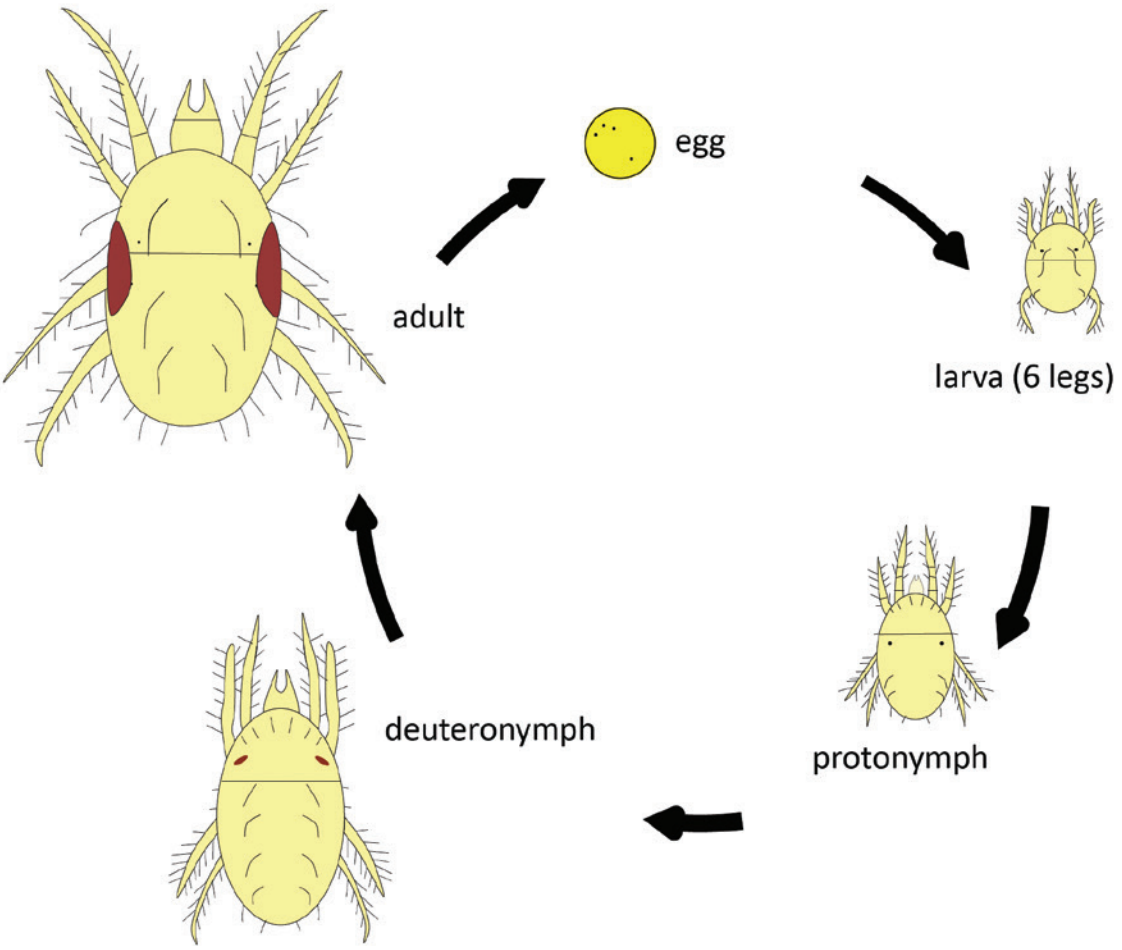
3. TSM and their eggs
Photo credit: David Cappaert, Bugwood.org

4. TSM damage on pumpkin leaves
Photo credit: Whitney Cranshaw, Colorado State University, Bugwood.org



5. *T. occidentalis* adults
Photo credit: Washington State University

6. Persimilis eating TSM egg
Photo credit: BioBest



7. The lifecycle of Mites. Photo credit: Agriculture WA

Monitoring for TSM[6 & 3]

Spider mites can be seen with the naked eye and are very easy to detect at a low population using the plant beating method. This is done by using a white bucket or container, beating the plant over the top of the container and then examining the organisms that are collected for identification.

Damage to crops[6]

Damage by TSM reduces photosynthesis through the damage caused to plant leaf cells. Yellowing or bronzing of leaves may also occur as can leaf and stem death. Severe damage can reduce photosynthetic capacity and therefore yield and fruit quality. (Figure 4)

Cultural management[6 & 3]

Cultural management options can be implemented to assist control of pest and disease, improving farm hygiene. Some of these include:

- Control of weed species which harbour pests, in the case of TSM solanaceous weeds are of particular importance
- Inspection or quarantine of new plant material to the farm
- Reduction of staff movement through known infestations
- Adjustment of growing conditions from hot and dry to more humid through overhead watering if possible
- Regular monitoring using past records to identify problem areas and times of year

Biological organisms[1]

There are a number of biological control options for the control of TSM. These are best released at the first sign of infestation. Before releasing any biological organism consult with your provider to get information on release rates, compatibility, with chemicals and recommendations for your farm.

Be aware that all chemical applications to the crop will have an impact on the efficacy of biological control organisms. This can include chemicals that have been applied in the crop's past, so it is good to be aware of the crop history when planning to use beneficial organisms. (Figure 6)

Persimilis (*Phytoseiulus persimilis*)

Predator of TSM, prefers warm and humid environments. Voracious feeder on all stages of TSM. Able to hunt out mites in dense foliage. Tolerant to some insecticides and most fungicides.

Predator of TSM and other mites Californicus prefer humidity of 60% or higher and a temperature range of 16-32°C. Californicus is able to survive well even at low prey densities due to their ability to use alternate prey and pollen as a food source. (Figure 2)

Predator of TSM Predatory mite which feeds on all stages of TSM. Does well in deciduous fruits and vegetables in drier conditions. (Figure 5)

Chemical management[4]

The best way to ensure that you choose an appropriate registered chemical for your crop and a specific pest or disease is either by consulting the Australian pesticide and veterinary medicine authority's (APVMA) Public Chemical registration information system (PUBCRIS: https://portal.apvma.gov.au/pubcris). This database provides the latest information on permits, chemicals and their registration for use.

Alternatively, you can purchase an annual subscription to Infopest – find out more on PAGE 21

TSM is well known throughout the world for becoming resistant to chemical control. According to the "Insecticide Resistance Action Committee", worldwide data, shows TSM has been found resistant to the following chemicals:

- Carbamates – Group 1A
- Avermectins, Milbemycins – Group 6
- Clofentezine, Hexythiazox, Diflovidazin – Group 10A
- Oganotin miticides – Group 12B
- Acequinocyl – Group 20B
- METI acaricides & insecticides – Group 21A
- Unknown or uncertain MoAs – Group UN

Resistance management[5]

The Insecticide Resistance Action Committee (IRAC) is prolonging the effectiveness of insecticides, acaricides and traits by implementing insecticide resistance management strategies, countering the development of resistance in traditional Crop Protection as well as Plant Biotechnology and Public Health.

Effective pesticide resistance management strategies seek to minimise the selection of resistance to any one type of pesticide. In practice, altersnations, sequences or rotations of compounds from different Mode of Action (MoA) groups provide sustainable and effective resistance management for acarine (mite) pests. This ensures that selection from compounds in the same MoA group is minimised, and resistance is less likely to evolve.

Applications are often arranged into MoA spray windows or blocks that are defined by the stage of crop development and the biology of the pest species of concern. Local expert advice should always be followed with regard to spray windows and timings. Several sprays may be possible within each spray window but it is generally essential to ensure that successive generations of the pest are not treated with compounds from the same MoA group. Metabolic resistance mechanisms may give cross-resistance between MoA groups, and where this is known to occur, the above advice must be modified accordingly. IRAC provides general recommendations for resistance management tactics regarding specific MoA groups.

SEQUENCE OF ACARICIDES (MITICIDES) THROUGH SEASON

MoA w	MoA x	MoA y	MoA z	MoA w	MoA x

Example of alternations of Modes of Action (MoA)
Credit: IRAC, www.irac-online.org

References

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