

SPRUCE SPIDER MITE BIOLOGY AND MANAGEMENT – RESEARCH FINDINGS

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In 1993, the magazine “American Nurseryman” asked ten nursery experts from across the United States to list the five worst pests of ornamental plants in their region. The pest mentioned most often: the spruce spider mite, listed by seven regional experts, ahead of household names such as aphids, black vine weevils and tree borers.

Why such a problem? One reason is the wide range of control recommendations.

- The “B.C. Nursery and Landscape Management & Production Guide” recommends to “*apply sprays in June or August as necessary*”.
- On the other hand, Pascal Pirone, in the textbook “Diseases & Pests of Ornamental Plants”, recommends treating “*in early spring just before new growth emerges, or spray in mid-May, repeat in September if necessary*”.

The biology of this pest is also the subject of different opinions.

- The Canadian Forest Service publication “Spruce spider mite in British Columbia” says: “*Succeeding generations are produced during the summer and early fall*”.
- From the book “Tree and shrub insects of the prairie provinces”: “*Hot, dry conditions appear to favor survival, and high populations may build up by late summer*”.
- However, the U.S. Forest Service tells nursery growers the spider mites “*survive hot weather during the summer by remaining dormant in the egg stage*”.
- A University of California publication on “Mites Injurious to Economic Plants” explains the “*summer eggs are laid in sheltered portions of the tree*”.

Despite the different opinions, all the publications may be correct!

- The spruce spider mite develops rapidly at temperatures between 20 and 30⁰C, but goes dormant during hot summer weather.
- Thus, publications from regions with “cooler” summers discuss this pest as a summer problem, but publications from “hot” areas describe it as a spring and fall problem.

This presentation is a short review of the surveys and field trials conducted between 1994 and 1997 by Integrated Crop Management Inc., of Okanagan Center.

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I. THE BIOLOGY OF THE SPRUCE SPIDER MITE

The spruce spider mite is found in most of the conifer areas of the world. Feeding by this pest causes yellowing of foliage and, in severe infestations, the needles turn brown and fall.

Damage

- A stippling pattern, white to bronze, is seen on the foliage where the mites have inserted their mouthparts to feed.
- Young spruces are the preferred host. On large trees, damage is mostly on lower parts.
- Webbing is seen on branches where the mite population is extremely high.

Eggs

- Eggs are usually found at the base of needles, dark orange brown colour.
- Development threshold is 6 to 7⁰C.

Nymph

- Nymphs are pinkish at first but turn green once they start feeding on the foliage.
- Young nymphs have three pairs of legs, but older nymphs and adults have four pairs.

Adults

- Adults show a variation of colours from orange to red to dark green to black.
- When dislodged from branches, they appear as minute moving dots on white paper.
- Diapause (resting period) in the fall is induced by shorter daylength.

Common spider mites of conifers

Spruce spider mites (Oligonychus ununguis)

- This is the most common spider mite on conifers.
- Hosts including spruce, *Thuja*, juniper, pine, fir, larch, yew, cypress and incense cedar.
- Damage can be severe on Alberta spruces.

Pine spider mite (Oligonychus milleri)

- This species is easily confused with the spruce spider mite, but it feeds only on pines.
- Reported in Washington State as a serious pest of nursery-grown pines.

“False” spruce spider mites

- These spider mites are less common and seen mostly on *Thuja* grown at the Coast.
- Includes *Pentamerismus* species, a small, bright red mite with a rounded posterior.
- Also includes *Brevipalpus* species, a reddish mite with a flat body.

Eriophyid mites (rust mites)

- These very small mites have a life biology that is not fully understood.
- *Triseticus* mites have been reported on Scots, lodgepole and shore pines.
- Eriophyid mites are also found on spruces, junipers and hemlock.

Two-spotted spider mites (Tetranychus urticae)

- These mites, very common on broadleaf plants, are seldom seen on conifers.

II. FIELD RESEARCH IN THE OKANAGAN

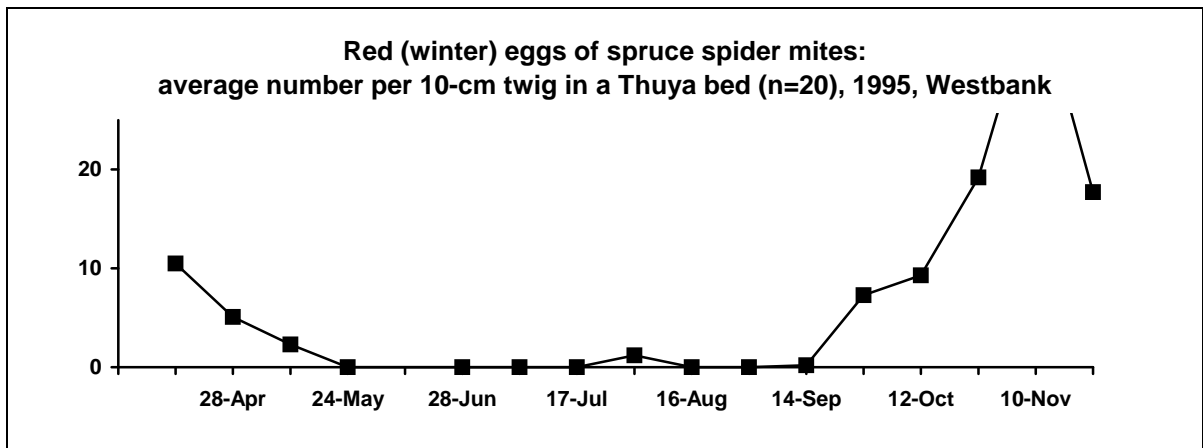
Between 1994 and 1996, we followed seven beds of container-grown *Thuja* cultivars and one bed of field-grown spruces (*Picea*) at Byland's Nurseries in Westbank.

- Every second week, a sample of 20 ten-cm long terminal twigs were collected from the inside foliage, cleaned with a mite brushing machine, and counted under a microscope.
- Although the numbers varied, the seasonal cycle was similar in all beds and years.
- Since 1996, the same seasonal cycle has been verified in other areas of the Okanagan valley on *Thuja* and junipers grown in landscape situations.

Winter eggs

On samples of *Thuja*, red eggs were found on the twigs in early spring and late fall.

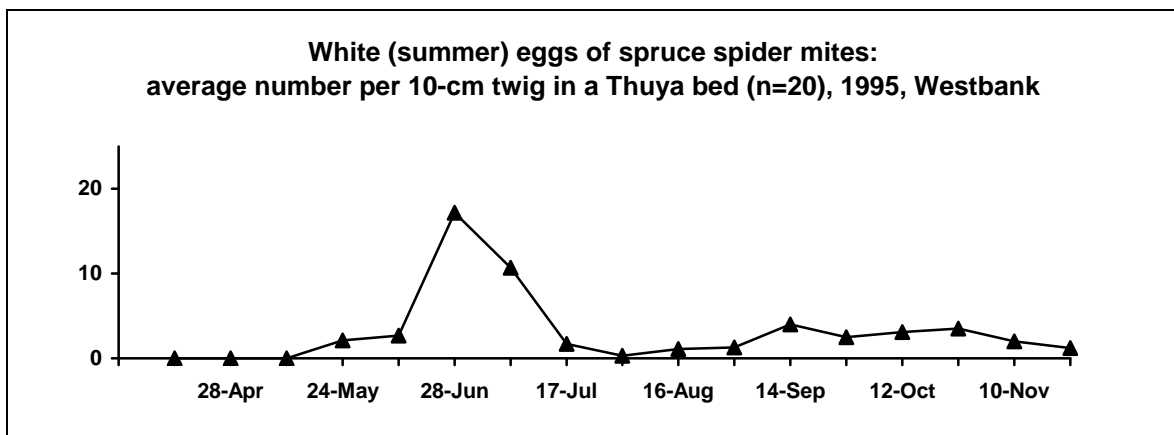
- The red eggs are the overwintering stage of spruce spider mites.
- In the fall, overwintering eggs are first seen during the month of September.
- Numbers found in late fall will predict early spring activity the following year.



Summer eggs

On the same samples, white eggs were found on the twigs between late May and late fall.

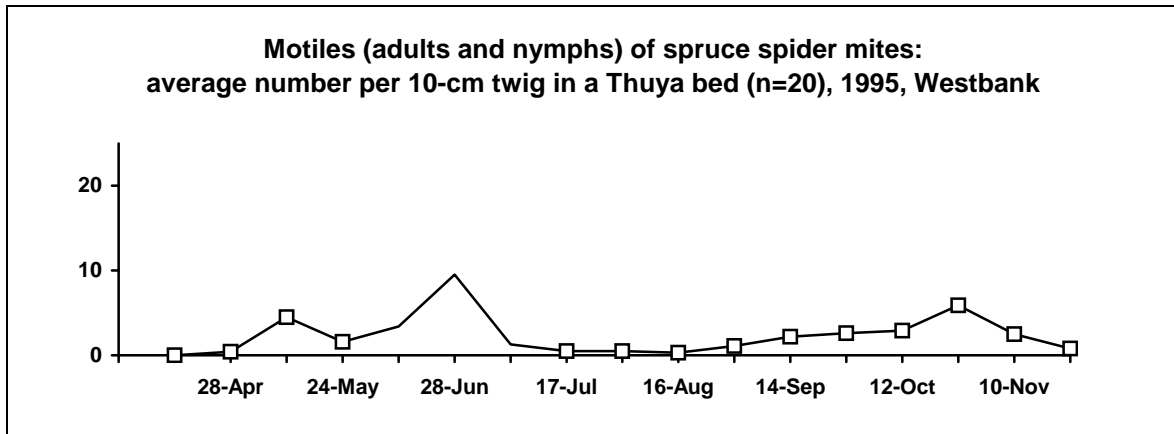
- The white eggs are the summer stage of spruce spider mites.
- During hot summer weather, they are the only visible form of this mite.



Motile stages (adults and nymphs)

Motile stages were found on the twigs during May and June, and again in September to November.

- Very few motiles were found in July and August, except on plants with a very high number of overwintering eggs in April.
- The number of nymphs in the spring goes up as the number of winter eggs goes down.
- There is a two-week delay between the appearance of motiles and the appearance of summer eggs, the time required for young nymphs to develop into egg-laying females.



Implications for management

Based on our data, there are two treatment windows for the motile stages in the Okanagan:

- 1) In early to mid May, when hatch of winter eggs is approximately 50% but no white summer egg has been laid yet;
- 2) In early September, when hatch of summer eggs is approximately 50% but no red winter egg has been laid yet.

Our field data indicates that spruce spider mites are very active during spring and fall in the Okanagan, but almost completely inactive in winter and summer.

- These results contradict the findings of Canadian researchers in the Prairie provinces, who found spruce spider mites to be very active during summer months.
- However, the results are similar to descriptions made by many American researchers and the U.S. Forest Service.
- Summer temperatures can explain the differences, with a threshold around 30°C.

John Boyne and Fred Hain, researchers at North Carolina State University, published in 1983 the results of laboratory work with spruce spider mites on Fraser fir (*Abies fraseri*).

- Adults developed more rapidly at temperatures of 29°C than at 20°C.
- However, adults had the highest reproductive rate at 20°C (23 offspring per female) and a much lower reproductive rate at 29°C (10 offspring per female).
- Winter eggs did not survive temperatures above 29°C.
- Taking into account the survival rates of adults at different temperatures, and the number of eggs laid per day, the authors concluded that “*the greatest potential for population growth occurs at moderate temperatures (circa 26°C)*”.

III. CONTROL RECOMMENDATIONS

Cultural practices

- Spraying with water only will reduce the motile population by about 50%.
- This approach works well in landscape situations, where the plants are thoroughly washed in early to mid May to help reduce the population of spruce spider mites.

*Treatments applied on June 2 to Fraser fir trees
Counts on June 12 from brushing 4 twigs per treatment*

Product	Rate	Motiles	Eggs
Vendex	Low rate	38 c	96 a
Horticultural oil	2.5 %	51 c	193 a
Kelthane	Label rate	55 c	113 a
Safer's Soap	2.5 %	78 bc	250 a
Water only	303 ml per tree	161 b	136 a
Untreated		350 a	142 a

Source: P.R. Heller and S. Kellogg, Pennsylvania State University, 1990.

Biological control

There are sporadic reports of predator mites feeding on spruce spider mites. Field experience indicates that biological control is not reliable with this pest.

- The U.S. Forest Service reports that *Typhlodromus* mites are predators of spruce mites.
- In Pennsylvania, field surveys in 1971 and 1972 found *Stethorus punctillum*, a small lady beetle, on conifer plants infested by spruce mites.

Chemical control

The following pesticides are registered in Canada for spruce spider mites:

- Superior (dormant) oil
Rate: 2% concentration (cost is \$4 per 100 L.)
Apply before bud break but do not treat blue spruce. Works by suffocating the eggs.
- Vendex WP (fenbutatin-oxide)
Rate: 50 to 100 grams / 100 L (cost is \$5 per 100 L.)
A slow acting but very effective product. Safer on predator mites and long residual.
- Kelthane (dicofol)
Rate: 75 to 100 grams / 100 L. (cost is \$5 per 100 L.)
An effective product for rapid kill but very toxic to predators.
- Avid 1.9%EC (abamectin)
Rate: 30 ml / 100 L (cost is \$11 per 100 L.)
A miticide produced by a soil micro-organism. Labeled for greenhouse use only.

These other pesticides are registered in Canada for use on conifers:

- Insecticidal soap (salts of fatty acids)
- Orthene T&O (acephate)
- Cygon EC and Lagon EC (dimethoate)
- Sevin XLR (carbaryl)

When using pesticides, always read the label for rate of application and safety instructions

Management program for spruce spider mites

These mites overwinter as eggs on the stems

- They are red and round, laid in clusters, and visible at the base of needles.
- Overwintering eggs hatch in late April to early May.

The damage is from sucking on the needles

- Damage occurs mostly during warm, dry weather.
- The pest is less severe under continuous wet conditions or with very hot temperatures.

Monitor with beating trays or hand lenses

- Cornell University suggests treating landscape conifers if there is an average of over 10 mites per beat.
- North Carolina University suggests treating Christmas trees when 20% of the shoots examined have spider mites.

Spray timing varies depending on temperatures

- In the Okanagan, the best treatment windows are early May and early September.
- Indicator trees are Magnolia in pink bud and Hydrangea blossom turning bronze.

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