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Spruce spider mite, *Oligonychus ununguis* (Jacobi)

- an integrated approach to management

Acarina:Tetranychidae

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Spruce spider mite is one of the most widespread and damaging mites in Pennsylvania. By recognizing the pest and understanding its biology, growers, landscape managers, and homeowners can develop a solid, integrated approach to management.

Hosts and Distribution: Worldwide, all species of conifers are potential hosts for spruce spider mite. In Pennsylvania, it has been recorded from 43 conifer species (Lehman 1982) but infestations are most common on species of arborvitae, fir, hemlock, juniper, and spruce. In Japan this mite is also a serious pest of chestnut - a host not reported in the United States.

Identification: Spruce spider mite (Fig. 1) looks like many other spider mites: elliptical shape, 0.3 to 0.4 mm long, with moderately long dorsal body setae (hairs). There is considerable variation in the color of spruce spider mites. Newly hatched larvae are light salmon or pale red. After feeding, the mites are dark green or dark red, depending on the host and time of year. Managers and growers should be aware that these are color variations of the same mites, not different species.

Fig. 1. Female spruce spider mite

The shape of the colored area, rather than the actual color, can be helpful in separating spruce spider mite from other conifer-inhabiting species. Spruce spider mite has one solid colored area (Fig. 2) on the posterior half of the body; twospotted spider mite (Fig. 3) has two areas; and arborvitae spider mite (Fig. 4) (Lehman 1997) has numerous small, darkened areas. Another character useful in separating these three species is the presence of a thin hair, or stipe, on the top of the egg. The stipe on a spruce spider mite egg can be seen with a 15X hand lens. Twospotted and arborvitae spider mite eggs lack stipes.

Overwintering spruce spider mite eggs are red, while main season eggs are tan or salmon colored. Proper identification of spruce spider mite is vital for development of an IPM strategy to control this pest.

Fig. 2. Spruce spider mite

Fig 3. Twospotted spider mite

Fig 4. Arborvitae spider mite

Life History, Habits and Control Tips: Spruce spider mite has a typical spider mite life cycle of egg, six-legged larva, and the eight-legged stages: protonymph, deutonymph, and adult. Between each active stage, a resting stage, or chrysalis, occurs. Both male and female mites are generally present in the population but the sex ratio varies through the year. When fewer males are present, females continue to deposit eggs, but unfertilized eggs will produce only males. Fertilized eggs, on the other hand, will produce all females.

Fig. 5. Overwintering eggs of spruce spider mite.

Twospotted and arborvitae spider mites overwinter as adults in the duff and under bark scales, respectively. In contrast, spruce spider mite overwinters as an egg on the bark of small branches (Fig. 5), not on the needles or main trunk. Studies in Ohio (Richmond and Shetlar 1996) revealed that the overwintering eggs were evenly distributed on all portions (top, middle, bottom) of the tree with no preference to compass direction. Most eggs were not on the ends of branches, but located at a distance from the bud. Also, the distance from the main trunk to oviposition site increased from the top to the bottom of the tree. This has implications in control, underlining the need for thorough coverage and penetration of sprays into the foliage.

After spring hatch, the mites feed on older growth for several generations. Since they do not feed on new growth until it has hardened off, controls of spring populations must be applied in such a way as to reach older growth.

As with all "cool season" mites, populations of *Oligonychus ununguis* are highest in spring and fall. In laboratory studies, temperatures of 26°C (78.80F), coupled with relative humidity levels of 50-60%, were favorable for rapid population build-up, with a generation being completed every 15 days. At 20°C (68~F), 23 days were required to complete a generation but these adults lived nearly twice as long. In addition, these "cooler" females deposited an average of 39 eggs over their lifetime, while the "warmer" females only deposited 29 eggs (Boyne and Hain 1983). In practice, this means that populations are slower to build up in cool springs but populations produced in these years may eventually surpass those in a short warm spring. And, since all active stages feed, longer life may result in added feeding damage.

In summer, when daily temperatures consistently exceed the mid-80's, spruce spider mite populations decline. In the laboratory, eggs exposed to temperatures above 29°C (84.2°F) did not survive (Boyne and Ham 1983). However, in the field a few mites and eggs survive in protected, cooler areas on the host. These survivors reactivate the population in late summer and fall, when temperatures moderate. Therefore, monitoring for these mites should be done throughout the season, with particular emphasis on spring as well as late summer through fall.

High humidity is thought to inhibit development of some spider mites by reducing evaporation through the mite's cuticle. This restricts the amount of feeding and consequently reduces population increase. In fact, in laboratory studies, total egg production was about 50% less at relative humidities of 88-98% than at 50-60% (Boyne and Hain 1983).

Damage and Detection: Spruce spider mites can cause chlorosis, premature needle drop, and death of the host plant. Unlike mite damage on the foliage of deciduous hosts, spider mite damage to conifers (Fig. 6) is permanent, and the only relief is to wait until the host produces new growth to cover the chlorotic needles or bare branches. For some hosts this may take several seasons. Although this mite does not spin excessive silk, the accumulation of cast skins, dirt, and debris make the host look even less attractive.

Fig. 6. Spruce spider mite damage to fir.

The type and extent of spruce spider mite damage is related to the host species and age of plant. Seedlings and transplants are more likely to be killed by severe outbreaks of spruce spider mite while 6-foot trees may be defoliated, but will survive. In nurseries and Christmas tree farms, scouting for spruce spider mite should begin before symptoms appear. The amount of effort spent on detection depends on the value of the crop. In the landscape, specimen and highly susceptible plants should receive priority.

Scouting for any spider mite usually involves the use of a hand lens, with 15X the preferred magnification. Winter scouting with a hand lens can show overwintering eggs on the shoots; during the main growing season, both eggs and active forms can be seen. When mites are active, beating or tapping branches over a light-colored surface will dislodge the mites and allow you to count mites to estimate the population. Be sure to tap several branches on all sides of the plant and sample multiple trees throughout the block.

Management Strategies: Growing degree day models for spruce spider mite are being developed but need to be refined. Overwintering eggs are reported to hatch between 7 -121 GDD (base 50°F) (Clark and Kowalsick 1992). Orton (1989) suggests controlling the first generation between 100-200 GDD (base 50°F). In Ohio, Richmond and Shetlar (1996) used a lower base temperature (45°C) and found that 50% of the overwintering eggs had hatched when 171 GDDs had accumulated. This compares to their field data, also at a base of 45°F, of 137 - 208 GDD. They recommend miticide applications near 258 GDD (base 45°F) to control the first generation in spring. Orton (1989) lists saucer magnolia (pink bud to early bloom), Norway maple (blooming), and *Amelanchier* X *grandifolia* (beginning bloom) as phenological indicators to mark the control period for spring populations.

Several publications have discussed thresholds for spruce spider mite. Of note is work being done in Fraser fir growing areas of North Carolina (Sidebottom 1996), where this mite is a problem in mid-summer, not spring and fall. Scouts use a hand lens to check a minimum of 15 shoots per acre for viable eggs or mites. The presence of any viable eggs or mites on a shoot identifies that shoot as infested. The number of infested and non-infested shoots is used to calculate the percentage of infestation for the block or field. Suggested economic thresholds for treatment vary from an infestation rate of 40% (for trees less than waist high) down to 10% (for trees in year of sale).

There are, however, many variables to consider before deciding to treat for spruce spider mite. Host species, age, season, and cost of control all should be included with the population level to develop a sound control strategy. As a rule, if regular scouting indicates the population is increasing, control should be considered for high value and marketable trees. If you keep records of the spruce spider mite population levels in your trees, you will develop your own threshold for your situation.

Control of spider mites depends on thorough application of a miticide when the mites are active. A second application should be made in 7 - 10 days, unless prohibited by the label, to kill those individuals that were not susceptible to control during the first application. Dormant applications of horticultural oil controls overwintering eggs but removes the "bloom" from glaucous varieties of spruce.

In the landscape, some population reduction can be obtained by a steady stream of water applied to the

plant (Stewart and Peterson, 1960). Insecticidal soaps are effective in combating spider mites but must be re-applied faithfully since they lack residual action.

A number of predatory mites, generally in the family Phytoseiidae, feed on eggs and active stages of *Oligonychus ununguis.* The reproductive rate of beneficial mites is somewhat lower than that of spider mites, causing their populations to lag behind rapidly building spider mite populations. This difference may allow significant damage to occur before the pest population is in check. Also, phytoseiids may be killed by insecticides used on the plants to control other insects or mites. Check with your Plant Inspector or university extension agent regarding the use of predatory mites in the landscape.

References

Boyne, J.V. and EP. Ham. 1983. Effects of constant temperature, relative humidity, and simulated rainfall on development and survival of the spruce spider mite. Can. Entomol. 115:93-105.

Clark, S. and T. Kowalsick. May 1992. Using growing degree-days for insect pest management. Long Island Horticulture News. Cornell Cooperative Extension. 4pp.

Lehman, R.D. 1982. Mites (Acari) of Pennsylvania conifers. Trans. Amer. Entomol. Soc. 108:181-286.

Lehman, R.D. 1997. "Arborvitae spider mite", *Platytetranychus thujae* (McGregor). Regul. Hortic. 23(l):25-26.

Orton, Donald A. 1989. Coincide: The Orton system of plant management. Plantsmen's Publications. Flossmoor, IL. 189 pp.

Richmond, D.S. and D. J. Shetlar. 1996. Eclosion time and spatial distribution of over-wintering spruce spider mite eggs on Colorado spruce. J. Econ. Entomol. 89:447-452.

Sidebottom, J.R. 1996. The spruce spider mite in Fraser fir. Christmas Tree Notes #29. North Carolina State Cooperative Extension. 6 pp.

Stewart, K.E. and L.O.T. Peterson. 1960. Control of the spruce spider mite. Canada Dept. Agriculture Pub. 1078. 4 pp.

[1]Revised 2002, R. Lehman.