Susceptibility and Response of Juniper Species to *Kabatina juniperi* Infection in New Jersey

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ABSTRACT

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Kabatina juniperi was confirmed by wound inoculation of various juniper species and cultivars under greenhouse and field conditions as an important tip blight incitant in New Jersey. Although the symptoms were similar to those reported for *Phomopsis juniperovora*, they developed under different environmental conditions, requiring low temperatures (16–21 C) and relative humidities above 95%. Sunken, ashen-gray cankers developed at the base of the blighted tip, where rounded to ellipsoidal, erumpent, black acervuli as long as 1 mm usually developed. Hyaline conidiophores with pointed tips were packed together on a stromatic surface; hyaline, unicellular, ellipsoid conidia of various sizes (2–3 × 4–8 μm) were produced at their tips. Twelve cultivars representing nine juniper species were artificially infected.

Juniper tip blight has long been a problem in New Jersey. The disease is widely distributed in nurseries, where it especially damages young plants in seedling and transplant beds. It is also common on established plantings as well as on wild red cedars. In 1976 and subsequent years, a tip blight on junipers in northern New Jersey was observed with symptoms that resembled those associated with infection by *Phomopsis juniperovora* Hahn or winter or drought injury. *P. juniperovora* was not found during this study, although the nonpathogenic *P. occulta* (Sacc.) Trav. was found occasionally and identified on the basis of cultural characteristics. The most common fungus found on juniper produced erumpent, ellipsoidal acervuli in sunken, ashen-gray areas at the bases of dead juniper tips. Many isolations from blighted tips yielded an organism that had an *Aureobasidium* (*Pullularia*) *pullulans* mycelial state when grown in culture. The organism was identified as *Kabatina juniperi* Schneider & Arx. This genus was named in 1966 to include acervulus-producing fungi found on *Juniperus* spp. that produced an *A. pullulans*-like mycelial state in culture (6). The fungus has been found in several parts of Europe and was first reported in North America in 1969 by Funk and Molnar (1) in Canada. Ostrofsky and Peterson (4) were first to report the organism in the United States after isolating it during 1976 from blighted eastern red cedars in Nebraska. In Europe, *K. juniperi* has been described as a wound parasite that causes extensive dieback of new growth by girdling young stem tissue. A recent report by Ostrofsky and Peterson (5) confirms *K. juniperi* as a wound parasite on seedlings of *Juniperus virginiana* and *J. scopulorum* in Nebraska.

This study represents the first record of *K. juniperi* in New Jersey. It was undertaken to determine the host range and conditions under which this fungus can incite infection in cultivated juniper cultivars in the northeastern United States.

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MATERIALS AND METHODS

Isolation of the pathogen. Blighted juniper tips were surface-sterilized in 2.5% NaOCl, rinsed with sterile distilled water, and allowed to dry. Acervuli were removed from the stem tissue, transferred to a sterile slide, and the conidia allowed to emerge. Conidia were transferred to water agar plates and incubated at 20 C. After 24–48 hr, single germinated conidia were isolated and transferred to petri plates containing potato-dextrose agar (PDA) and incubated in darkness at 20 C. This material served as stock cultures for subsequent studies.

Pathogenicity and host range. In greenhouse inoculation trials, 10 plants each of *J. horizontalis* 'Plumosa' and *J. scopulorum* 'Table Top Blue' were used as hosts. Inoculum consisted of either mycelial fragments taken directly from a stock culture plate containing actively growing mycelium or from an aqueous conidial suspension (5×10^5 conidia per milliliter) prepared by removing conidial masses from a stock culture. Inoculations with both types of inoculum were made on unwounded shoots and shoots that had been wounded by cutting the thin bark with a sterile scalpel. Control shoots on each plant were wounded but not inoculated with the fungus. Mycelial fragments were inserted under the bark with a sterile scalpel or applied directly to unwounded bark. Conidial suspensions were sprayed directly on the surfaces of wounded and unwounded tips with an atomizer. After inoculation, plants were immediately transferred to a lighted mist chamber for periods of 24, 48, 72, and 96 hr at temperatures of 16–18 C, 19–21 C, and 24 C, with RH maintained at 90% and above 95%. After incubation, plants were transferred to a greenhouse bench and maintained under natural light at 25–30 C.

A field planting of junipers located in Morris County was the site for the field inoculation and host range trials. The new growth of two to four plants each of 24 *J. chinensis, J. communis, J. horizontalis, J. japonica, J. procumbens, J. sabina, J. squamata,* and *J. virginiana* cultivars were inoculated. Inoculations were performed the same as for the greenhouse trials, except the wound inoculation sites and unwounded controls were covered for 48–72 hr with moistened cotton. All plants were examined for disease development over several months.

RESULTS

Disease symptoms and signs. Symptoms of Kabatina tip blight under field conditions were similar to those attributed to *P. juniperovora* (Fig. 1). Infected tips on various juniper species first appeared to be suffering from moisture deficiency. They developed a desiccated, brittle appearance and lost the glossiness that is characteristic of new healthy tips. Infected tips changed from green to yellow-green to gray-green to brown as

time passed. Sunken ashen-gray areas developed near the base of the dead tip; dark, rounded to ellipsoidal acervuli up to 1 mm in length developed in this region (Fig. 2). Acervuli developed below the epidermis but later became erumpent. Hyaline conidiophores with pointed tips were packed together on a stromatic surface and hyaline, unicellular, ellipsoid conidia of variable sizes (2–3 × 4–8 μm) were borne singly at their tips (Figs. 3 and 4). Chlorosis and necrosis did not extend below the ashen-gray areas and necrotic tips with acervuli persisted on the plants well into the following year. Under favorable growing conditions, lower lateral branches elongated and replaced the dead terminals, which gradually fell from the plant. Most plants tended to recover, although many maintained an unsightly appearance throughout the year. On *J. horizontalis* cultivars, however, the infected tips retained their green coloration during the winter infection, while the healthy foliage assumed its characteristic purple-brown coloration. The following spring, the infected tips turned brown as the healthy foliage returned to its summer coloration.

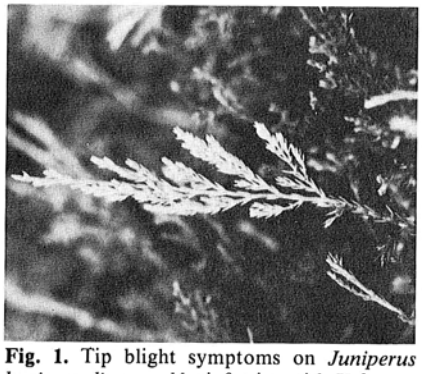

Fig. 1. Tip blight symptoms on *Juniperus horizontalis* caused by infection with *Kabatina juniperi*.

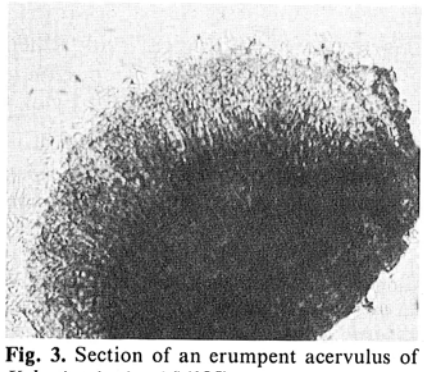

Fig. 3. Section of an erumpent acervulus of *Kabatina juniperi* (×125).

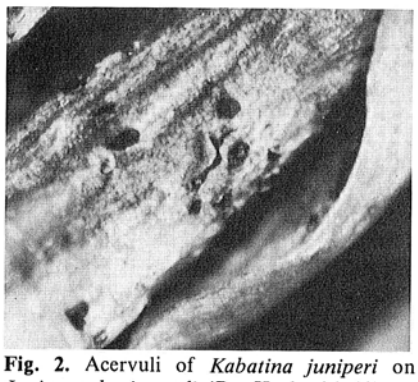

Fig. 2. Acervuli of *Kabatina juniperi* on *Juniperus horizontalis* 'Bar Harbor' (×10).

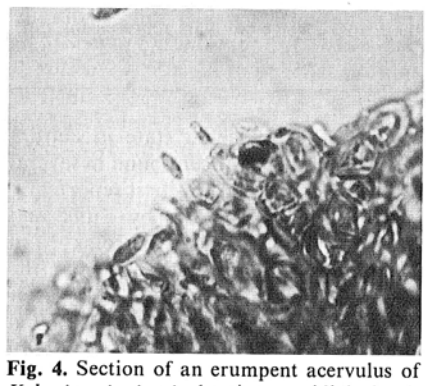

Fig. 4. Section of an erumpent acervulus of *Kabatina juniperi* showing conidial development at tip of conidiophore (×625).

Table 1. Infection of various juniper species and cultivars inoculated with conidia or mycelium of *Kabatina juniperi* in the field

Juniper cultivars		Infection using[a]	
		Conidia	Mycelium
J. chinensis	Armstrongi	0	+
	Aurea Gold Coast	0	0
	Densaerecta Spartan	+	+
	Hetzi Glauca	0	0
	Pfitzeriana	0	0
	Pfitzeriana Aurea	0	0
	Sargenti Glauca	0	0
	Sargenti Viridis	0	0
	Torulosa Hollywood	+	+
J. communis	Hornbrooki	0	0
J. horizontalis	Bar Harbor	+	+
	Blue Horizon	+	+
	Blue Rug	0	+
	Emerson Creeper	+	+
	Marcellus	0	0
	Plumosa Compacta	+	+
	Wiltoni	+	+
J. japonica	San Jose	0	0
J. procumbens	Nana	0	0
	Variegata	0	0
J. sabina	Tamariscifolia	0	0
J. squamata	Expansa Parsoni	0	0
J. virginiana	Prostrata Glauca	0	0
	Sky Rocket	+	+

[a] An index of 0 = no infection; + = infection.

Pathogenicity and host range. Greenhouse and field inoculations were positive when wounded new shoots were inoculated with mycelium or sprayed with a conidial suspension. Unwounded new shoots failed to become infected. Infection was greatest between July and late October when inoculated plants were incubated for at least 48 hr at 20 C with RH above 95%. No infection occurred in inoculated plants held at 90% RH. Infections were also unsuccessful at 24 C regardless of RH. Discoloration and desiccation of host tissue occurred 2–3 wk after inoculation, while complete tip necrosis could be observed at about 8 wk. Acervuli began forming at the base of the infected tip within 6 wk. Necrosis generally did not develop below the inoculation point but proceeded distally until the entire juniper tip became necrotic and turned brown. The dead tips, which persisted on the plants through the winter and well into the following summer, were gradually replaced by elongation of lower lateral branches. Inoculations were positive in 10 of the 24 juniper cultivars tested in the field (Table 1) and in the two cultivars tested in the greenhouse.

DISCUSSION

K. juniperi has been described as a wound parasite on various juniper species and cultivars growing in North German nurseries, causing extensive dieback of new growth during late summer and fall by girdling young stem tissue (2). The fungus is reported to infect the bark and decompose the cortical parenchyma so that young shoots die back in spring. In this study, *K. juniperi* was an important tip blight incitant on junipers in northern New Jersey, producing symptoms similar to those attributed to *P. juniperovora* but apparently under different environmental conditions.

K. juniperi infection was greatest during late summer and fall after inoculation with either conidial suspensions or mycelial fragments. In this study, infections were initiated after a minimum incubation time of 48 hr at temperatures of 16–21 C with RH above 95% and acervuli began to form within 6 wk after inoculation, many being present before winter. In their study with a Nebraska isolate of *K. juniperi*, Ostrofsky and Peterson (5) reported that infection occurred over a wider temperature range (16–28 C) but after incubation for 5 days

at 100% RH. They also reported (6) that acervuli were not found in winter but developed in the spring on yellow-brown infected branches.

Infections developed in the current year's growth that had been wound inoculated but failed to develop in unwounded tissue, as well as in the older wood. These findings are consistent with all previous reports (2,3,5). Because unwounded tissues never became infected either under greenhouse or field conditions, *K. juniperi* may be unable to penetrate intact tissue or use natural openings as points of entry. The pathogen, however, possibly gains entry either through wounds caused by insects or by the sharp needlelike foliage on adjacent shoots.

In northern New Jersey, natural infections with *K. juniperi* are most likely during later summer and fall after the new growth has developed and wounds have had a chance to occur. Infections may be especially heavy during years when there is considerable cool rainy weather during that time. Midsummer infections may generate conidial production which, in turn, is responsible for later infections. Because *A. pullulans* is commonly found in nature, *K. juniperi* may also exist on other substrates in its *A. pullulans* state and could be an important source of inoculum for juniper infections. It is not known how long *K. juniperi* has occurred on junipers in northern New Jersey. Its presence as a tip blight pathogen may have been responsible for the ineffectiveness of spray schedules based upon the assumed presence of *P. juniperovora*.

LITERATURE CITED

1. Funk, A., and Molnar, A. C. 1972. *Kabatina thuja* on yellow cedar in British Columbia nurseries. Can. For. Serv. Bi-mon. Res. Notes 28:16-17.
2. Hoffman, G. M., and Fliege, F. 1967. *Kabatina juniperi* als Ursache eines Zweigsterbens an verschiedenen Juniperusarten. Z. Pflanzenkr. Pflanzenschutz 74:587-593.
3. Meyer, E., Hoffman, G. M., and Fliege, H. F. 1964. Auftreten eines Zweigsterbens bei Juniperus. Gartenwelt 64:363-366.
4. Ostrofsky, A., and Peterson, G. W. 1977. Occurrence of *Kabatina juniperi* on *Juniperus virginiana* in eastern Nebraska. Plant Dis. Rep. 61:512-513.
5. Ostrofsky, A., and Peterson, G. W. 1981. Etiology and cultural studies of *Kabatina juniperi*. Plant Dis. 65:908-910.
6. Schneider, R., and von Arx, J. A. 1966. Zwei neue, als Erreger von Zweigsterben nachgewiesene Pilze: *Kabatina thujae* n.g., n. sp. und *K. juniperi* n. sp. Phytopathol. Z. 57:176-182.