

PHOMOPSIS ELAEAGNI ON RUSSIAN OLIVE (ELAEAGNUS ANGUSTIFOLIA) IN CANADA¹

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Abstract

The occurrence and distribution of *Phomopsis elaeagni*, the causal fungus of a canker and dieback of Russian olive (*Elaeagnus angustifolia*), is reported for the first time in Canada. In Canada it has been found only in nurseries on seedlings imported from Europe, and not in ornamental plantings as in the United States where it causes a serious disease. A description of the fungus and symptoms of the disease are given.

This fungus species was described by Carter and Sacamano (1967) as *Fusicoccum elaeagni*, the causal agent of a severe canker and dieback of Russian olive (*Elaeagnus angustifolia* L.) in Missouri. In a subsequent note, Carter and Dodd (1969) reported the discovery and distribution of this disease in Illinois. In Canada, a canker and dieback of Russian olive seedlings imported from Europe in 1968 was detected by inspectors of the Plant Protection Division, Agriculture Canada, and was found to be associated consistently with *F. elaeagni*. This disease was found again in 1969, 1970, and 1973 during surveys of commercial nurseries carried out by the Plant Protection Division. Dr. Carter confirmed the identification of the fungus and sent us part of the type collection of *F. elaeagni* (ILLS 34453) for study, along with cultures made from it. Single conidial cultures made from conidia that formed in this type culture were grown on 2% potato dextrose agar (PDA). Typical *Phomopsis* pycnidial stromata that contained both the alpha-conidia previously described by Carter and Sacamano, and beta-conidia, along with conidia intermediate in shape and size between these two types were formed in these cultures within 17 days at room temperatures that fluctuated between 24 and 30 C, or within 3 weeks when room temperatures fluctuated between 20 and 24 C. Accordingly, this species was redescribed as *Phomopsis elaeagni* (Carter and Sacamano) R. H. Arnold and Carter (Mycologia 1974, in press). A report of a *Phomopsis* dieback of Russian olive in Ohio by White and Ellett (1972) proved to involve the same fungus when cultures obtained from these authors were grown and examined.

In Canada the disease has not been reported from ornamental plantings of Russian olive. All confirmed reports of the

occurrence of *P. elaeagni* (Table 1) have been on imported seedlings in nurseries, where the disease was often associated with mechanical injury. These specimens have been deposited in the National Mycological Herbarium. In the nurseries the disease occurred only on seedlings imported from Europe and not on nursery stock grown from seed or on stock propagated within the nursery from trees originally grown from seed. In one case the fungus was found on seedlings at the time of their inspection on import from Europe; in some shipments seedlings that appeared disease-free at the time of importation were found to be infected the following year (Table 1). This is quite a different situation from that in the United States where *P. elaeagni* was found to cause a severe disease of Russian olive, both in nurseries and in ornamental plantings (Carter and Sacamano 1967; Carter and Dodd 1969).

Symptoms

P. elaeagni causes cankers that are elongated and red-brown in color. Pycnidial stromata form quickly in diseased bark and are usually abundant by the time the disease is detected (Figs. 1, 2, U). Cankers usually girdle affected branches or main stems of seedlings, causing rapid wilting and death of the affected parts. In the U.S. similar symptoms have been reported on mature trees as well as on seedlings by Carter & Sacamano (1967), Carter & Dodd (1969), and White & Ellett (1972). In Illinois Carter and Dodd (1969) reported the wilting and death of current season's twigs and branches having basal cankers, and the formation of large cankers on structural branches and trunks of trees up to 4 inches diam at ground level. Inoculation experiments in June in Illinois (Carter and Sacamano 1967) resulted in the development of visible cankers within 14 days and formation of pycnidial stromata within 30 days on branches up to 1 inch diam of large trees: cankers and stromata appeared within 7 days on small trees inoculated in July: girdling, wilting, and death of branches up to 0.5 inch diam occurred during the growing season in which they were inoculated, and cankers extended up to 5 inches beyond the inoculated area, with brown staining of sapwood beneath the diseased bark. White and Ellett (1972) also reported rapid development

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Table 1. Collections of *Phomopsis elaeagni* on imported seedlings of Russian olive (*Elaeagnus angustifolia*) in Canadian nurseries*, 1968-73

DAOM no.	Date collected	Location	No. of seedlings affected/examined	Comments
124924	30 Oct. '68	Aylmer, Que.	10/35	NA [†]
130290	13 Feb. '69	Richmond, B.C.	250/250	Intercepted on arrival from Holland
130666	26 June '70	Richmond, B.C.	2/10	Remainder of shipment examined 13-2-69
130289	25 June '69	Ottawa, Ont.	2/20	NA; 150 seedlings in shipment
130667	25 June '70	Ottawa, Ont.	50/50	Remainder of shipment examined 25-6-69; considerable mechanical injury
130852	17 July '70	Aldergrove, B.C.	20/20	Remainder of a shipment of 200 seedlings imported in 1969 from Europe
130895	19 Aug. '70	Ottawa, Ont.	2/4	NA
144555	14 June '73	Arnprior, Ont.	4/25	NA; only older trees affected by cankers and dieback of branches, 100 trees in planting
144556	20 June '73	Schomberg, Ont.	1/200	NA; seedlings imported in 1969 or 1970

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Note: during June and July 1970, an intensive inspection for this disease was carried out by inspectors of the Plant Protection Division in both commercial nurseries and ornamental plantings. In addition to the above positive cases, places inspected and found negative were Trenton, Ont., Pt. Burwell, Ont., St. Thomas, Ont., Petrolia, Ont., Kentville, N.S., Regina, Sask., and London, Ont.; the majority of these plantings had been propagated in Canada from seed or were not recent imports. DAOM numbers refer to collections deposited in the National Mycological Herbarium, Ottawa.

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NA: information not available on country of origin or date of entry.

of symptoms (cankers, wilt, and dieback), and formation of pycnidia in the diseased bark of inoculated potted seedlings and twigs up to 1.2 m diam of established trees.

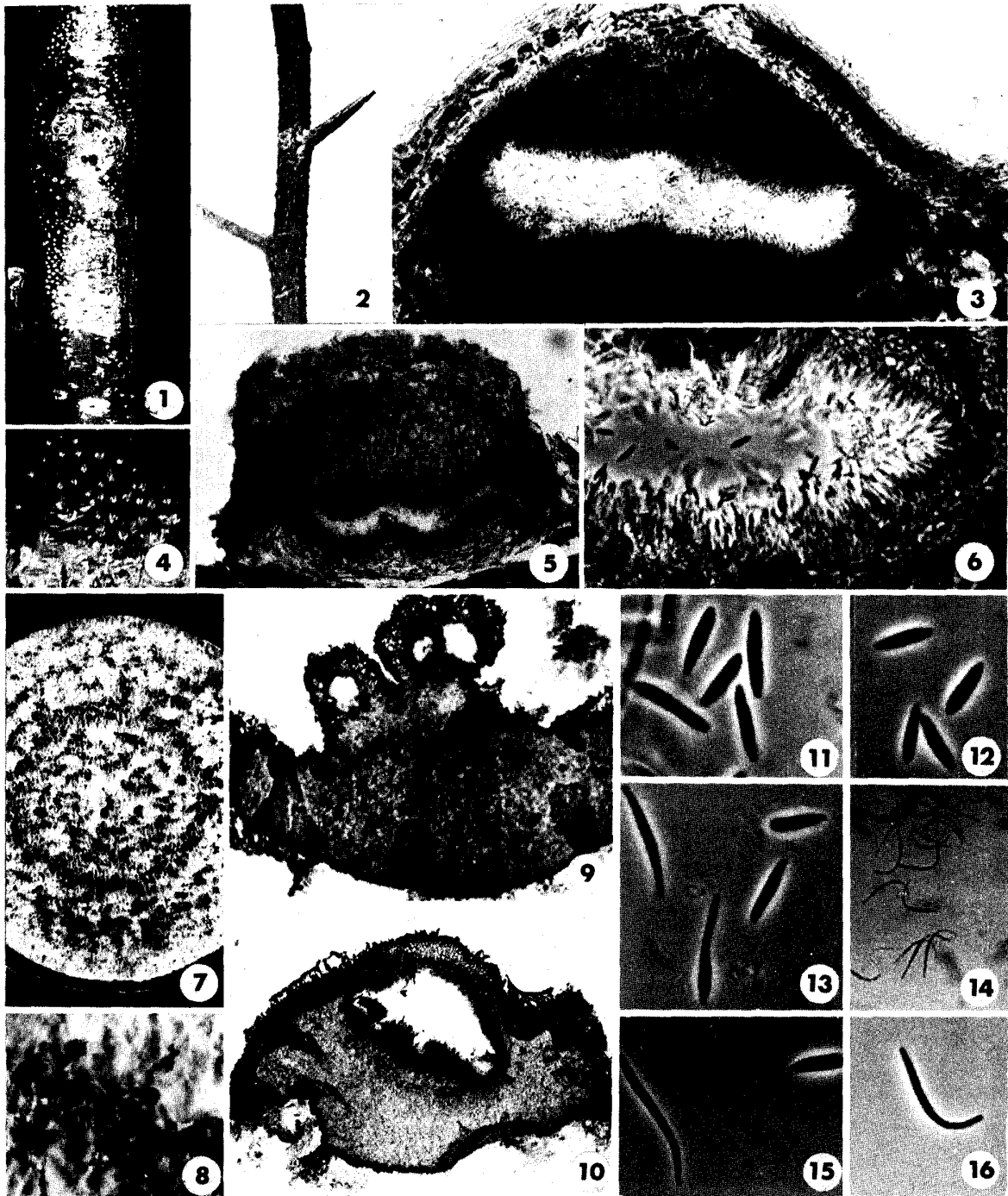
contained abundant beta conidia, and on HDA both alpha- and beta conidia with many intermediate forms were usually found in stromata formed in culture.

The causal fungus (Figs. 3-16)

Pycnidial stromata formed in the dead bark of infected stems and branches and became erumpent, subspherical, with closely adhering bark, less than 1 mm diam, usually 800-900 µm diam, 500 µm high, very numerous, one to several pycnidial locules within a stroma, usually one or two, locules lined with a layer of small, angular, dark cells from which the conidiophores arise. Conidiophores (phialides) 6-16 x 1-2 µm, cylindrical, tapered toward tip, simple or occasionally branched once near the base, sometimes with a single septum. Alpha conidia (5.0-)5.5-11.0 x (1-)1.5-2.0(-2.5) µm, narrow ellipsoid to fusiform, sometimes tapered more at one end, straight or slightly curved, hyaline, unicellular, sometimes biguttulate especially when young. Beta conidia 15-20 x 0.75-1.0 (-1.5) µm, filiform, blunt at one end, tapered toward the other, curved, or hamate at the tapered end, hyaline.

usually we found only alpha conidia in pycnidial stromata on the host. However, stromata found on the roots of one sample

The fungus grew rapidly on 2% PDA; the rate of mycelial growth and the rate of development and the number of pycnidial stromata increased with increase in temperature at the three temperatures tested (15 C, room temperature fluctuating between 20 and 24 C, room temperature fluctuating between 24 and 30 C). At 24-30 C, colonies resulting from single germinated conidia averaged 45 mm radial growth in 4-7 days, and mature pycnidia extruding conidial tendrils were abundant when cultures were 17 days old. The aerial mat of cultures was predominantly white at 1 week, felty, appressed, with the surface rather furfuraceous in appearance, indistinctly zonate, with some gray-brown or olive-brown color appearing on the central part of the mat and in splotches beyond that area, the mat gradually becoming more felty-matted and predominantly dark gray or tan-gray. Pycnidial stromata developed in culture were black on the surface, similar to those on the host but larger, with pycnidial locules lined by hymenium as on the host, or with black columnar stromatal projections on a basal stroma with one locule in each projection. Conidiophores (phialides) and alpha- and beta conidia were similar to those on the host but alpha conidia (5.5-7.5 x 1.5-



Figures 1-16. *Phomopsis seloeagni*. Figs. 1-6, 11, 12. Fungus on the host: 1) Portion of canker on 4-year-old branch, with pycnidial stromata in diseased bark, X 15; 2) Portion of canker on 1-year-old branch, with pycnidial stromata, X 1.5; 3,5) Sections through pycnidial stromata, X 150; 4) Surface view of pycnidial stromata, X 4; 6) Portion of section through pycnidial stroma to show hymenium lining locule, X 600; 11,12) Alpha conidia, phase, X 1200. Figs. 7-10. Fungus in culture: 7) Culture on 2% PDA, 4 weeks, room temperature (20-24 C), X 2/3; 8) Portion of surface of culture to show pycnidial stromata with canidial tendrils, X 4; 9,10) Vertical sections through pycnidial stromato, 8 weeks, 2% PDA, room temperature (20-24 C), X 50. Figs. 13-16. Conidia formed in culture: 13) Alpha canidia and conidia intermediate between alpha- and beta conidia, phase X 1200; 14) Beta conidio, bright field, X 600; 15) One alpha conidium and one beta conidium, phase X 1200; 16) Beta conidio, phase X 1200.

2.0 μm) usually were consistently smaller than on those on the host.

White and Ellett (1972) found that pycnidia containing both alpha- and beta conidia were produced in 1 week in cultures grown at 28 C under continuous light. The size range of alpha conidia reported by White and Ellett agreed with that of our isolates, but their measurements of beta conidia (17-26 \times 1-2 μm , majority 20-21 μm long) were larger than ours. However we have had an opportunity to study White and Ellett's cultures and there is no doubt that we are dealing with the same species.

Discussion

The ascigerous state of *P. elaeagni* should be a *Diaporthe*. To date no *Diaporthe* has been found on *Elaeagnus* in North America by contemporary investigators. The fact that Russian olive seedlings recently imported from Europe were found to have the disease caused by *P. elaeagni* with the fungus fruiting on them, and that seedlings propagated in nurseries from trees grown from seed were disease free in Canada, suggests that this species may be the conidial state of the European *Diaporthe elaeagni* Rehm. However, no data on the conidial state of that species has been found, and no recent collection of *D. elaeagni* has been made in Europe from which we might obtain information about the conidial state by cultural methods.

Diaporthe elaeagni Rehm was listed in the USDA Index of Plant Diseases (1960) on dead branches of *Elaeagnus commutata* in New York State, but we have not been able to find the source of that report. However, in the USDA files (M.L. Farr, personal communication), there is a report of *D. elaeagni* on dead branches of *Elaeagnus longipes*, published by Fairman (1910) as *D. elaeagni* Rehm var. *Americana* n. var. No information about the conidial state was included with this description. However, the Fairman specimen (*Mycotheca* Fairmani 2520) has been borrowed from Cornell University (CUP) and found to match the type specimen of *Diaporthe elaeagni* Rehm from the Wehmeyer herbarium (in DAOM 120601). In the Fairman specimen, there is an associated conidial state that appears to be the same as *Phomopsis elaeagni*. It is still necessary to obtain viable material of the ascigerous state to prove the genetic connection by cultural methods.

The severity of the symptoms described and the high percentage of infection in artificial inoculations of seedlings and trees in the United States (Carter and Sacamano 1967; Carter and Dodd 1969; White and Ellett 1972 in Missouri, Illinois, and Ohio) indicate that *P. elaeagni* is a serious threat to young nursery-grown Russian olive trees as well as to older trees in ornamental plantings, even though in Canada it has yet

been found only on imported seedlings in nurseries. It is possible that temperature may be a limiting factor, but, as recommended by Carter and Dodd (1969), nurserymen and arborists should use extreme care to reduce mechanical injury and to avoid leaving wounds unprotected when pruning and taking cuttings, to eliminate this avenue of infection for the fungus. Seedlings used in ornamental plantings should be screened carefully, since the use of diseased nursery grown stock in such plantings will greatly increase the potential spread of the fungus.

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