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ENTOMOSPORIUM LEAF SPOT OF RHAPHIOLEPIS SP.

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Rhaphiolepis spp. are broad-leaved evergreen flowering shrubs in the family Rosaceae, and are grown in warmer regions (zones 8b-10, USDA Climate Zone Map) around the world (5,6). Rhaphiolepis indica (L.) Lendl. (Indian-hawthorne) along with its named cultivars, and R. umbellata (Thunb.) Mak. (Yedda-hawthorn) are available in Florida nurseries. A hybrid of these two species designated R. x Delacourii Andre., has pink flowers (12). All species of Rhaphiolepis flower in

Fig. 1. A Entomosporium mespili leaf spot on leaves of Rhaphiolepis umbellata. Left - upper leaf surface. Right - lower leaf surface. DPI Photo by J. Lotz

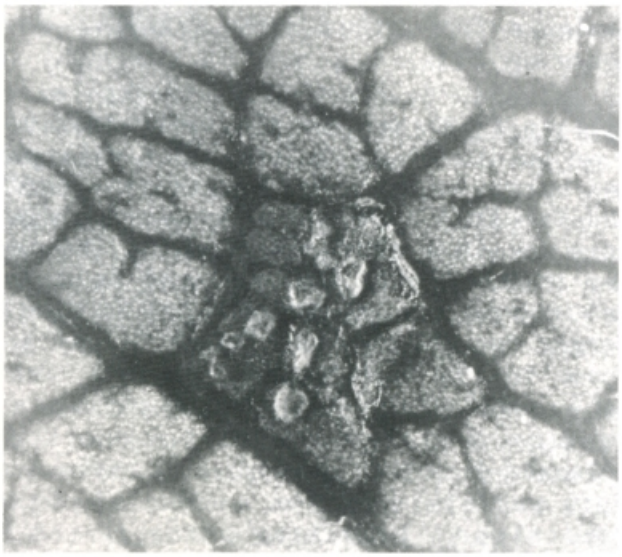
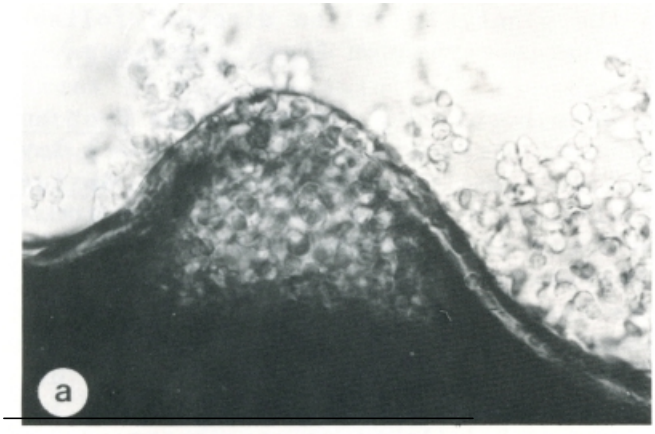


Fig. 2. Close-up view of upper surface of lesion showing fruiting bodies (acervuli) of E. mespili. Approximately X 20. DPI Photo by J. Lotz.



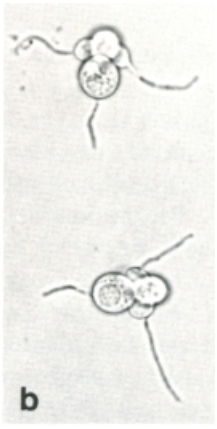


Fig. 3a. Cross section of acervulus of E. mespili containing masses of conidia. X 289.

Fig. 3b. Conidia of E. mespili.

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late winter or spring and sometimes again in the fall, and they make excellent hedges, container, or specimen plants. Purple to black berry-like pomes add to these plants' ornamental value. Rhaphiolepis sp. has a reputation for being easily cultured, having moderate salt-, drought- and shade-tolerance, though it prefers well-drained but moist soils in full sun (5,6). Despite its low maintenance requirements, leaf spots and defoliation caused by Entomosporium mespili (DC. ex Duby) Sacc. have recently become a serious problem on both R. indica and R. umbellata in Florida nurseries and in the landscape.

The Pathogen: Entomosporium leaf spot, also known as leaf blight or scald on some hosts (see Host and Pathogen Range section), is caused by Diplocarpon mespili (Sorauer) Sutton (Fabraea maculata Atk.). The anamorph is Entomosporium mespili (DC. ex Duby) Sacc. (E. maculatum Lev.) [see (17) for full synonomy]. Races of the pathogen are thought to exist, since a host may react differently to E. mespili isolates from other hosts (13,14). However, other studies present evidence to the contrary (9).

Disease Syndrome: On the upper leaf surface, spots are initially red, round, and 1-2 mm in diameter. As the spots enlarge, centers become dark reddish brown to black, and become angular to irregular in outline. The perimeter of the lesion remains red and is often surrounded by a yellow halo. The reverse side of leaf lesions show more brownish-red coloration in the center of the lesions than is obvious from the top of the leaf, and the red halo is less pronounced (Fig. 1). Spots usually enlarge to a maximum of 5 mm in the longest dimension but can coalesce to form larger necrotic areas. Black raised bumps with a lighter, membranous covering may form in the spots during moist weather (Fig. 2). These are fruiting bodies (acervuli) (Fig. 3a) of the pathogen and are most plentiful on the upper leaf surface, but acervuli can form on either side. Eventually, conidia (Fig. 3b) are released from the acervulus by rupture of the membranous covering, which is actually host cuticle. White masses of conidia ooze from the acervuli under favorable conditions. Splashing water is the most effective means of conidial dispersal within the immediate area.

Although the pathogen will occasionally form small cup-shaped, immersed sexual fruiting bodies (apothecia) in diseased tissues, the ascospores thus produced are considered to be of minor importance in the disease cycle. Infected leaves often turn yellow orange to red and abscise prematurely (16). The fungus overseasons as mycelium in diseased leaves which remain on the plant, in fallen diseased foliage, and/or in infected twigs of some hosts (9,18) (not observed on Rhaphiolepis sp.).

Extrapolation of data from photinia and pear (also hosts of E. mespili, see Host and Pathogen Range section) indicates that leaf spots begin to appear about 4-9 days after inoculation (2,3,18), though penetration into host tissues takes place in less than 12 hours at 25°C (3). Environmental conditions necessary for infection are at least 6 hours (9-12 hours are better) of continuous leaf wetness, with temperatures of 14-28°C, optimum 20°C (3). Infection increases as leaf wetness periods are extended (4). Experimental evidence indicates that conidia can withstand drying of at least 12 hours duration in shade or darkness at 25°C and remain viable. Infection is reduced at higher temperatures (> 30°C) and in full sunlight (3), even in the presence of free moisture (4). Disease management decisions should take into account this reduced disease activity when normal daily temperatures exceed 30°C (4). Young expanding leaves of photinia are most susceptible to Entomosporium infection. The fungus usually penetrates directly through the host cuticle and cell wall and less often through stomates. Penetration occurs on either side of the

young leaves. On older photinia leaves, which are more resistant to infection, penetration is through stomates and guard cells on the underside of the leaf (3). Until specific experimental data on Entomosporium infection of Rhaphiolepis sp. are available, it is deemed wise to consider this information on infection of photinia as appropriate for disease control considerations for other hosts as well.

Host and Pathogen Range: Entomosporium mespili can infect many Rosaceous plants in the subfamily Pomoideae. The following genera are hosts of Entomosporium leaf spot or blight, sometimes called Fabraea leaf scald: Amelanchier, Aronia, Cotoneaster, Crataegus, Cydonia, Eriobotrya, Heteromeles, Malus, Mespilus, Photinia, Pyracantha, Pyrus, Rhaphiolepis, and Sorbus (1,10,11,13,14,16,18). The disease has worldwide distribution through the temperate zones, and extends into the tropics in Central America and highlands of east central Africa (8,16).

Control: Cultural measures recommended to control Entomosporium leaf spot on Rhaphiolepis sp. are: 1) Start with clean plants. Do not use cuttings from diseased stock plants. 2) Keep foliage as dry as possible. If overhead watering is unavoidable, water early in the morning so as to coincide with, and not prolong, the dew period. Locate and space plants to allow adequate air movement. 3) Monitor soil fertility and pruning practices to anticipate flushes of susceptible new growth. 4) Clean up fallen, infected foliage to reduce inoculum. Though twig infections are not reported in Rhaphiolepis sp., if these should occur, aseptic pruning to reduce inoculum from infected twigs is recommended. At present, the possibility of resistance to the disease in Rhaphiolepis sp. is an unresolved question.

Despite adherance to these cultural control recommendations, fungicides may be required to get Entomosporium leaf spot under control. Only benomyl, Zyban /Duosan , and basic copper sulfate are currently registered by EPA for use on Rhaphiolepis sp. to control Entomosporium leaf spot (15). It is anticipated that the new ergosterol biosynthesis inhibiting (EBI) fungicides such as triforine will soon be registered for use on Rhaphiolepis sp. These EBI fungicides have given excellent control of Entomosporium sp. and related fungi on other hosts (7).

Fungicides should be applied starting at bud break and continuing on a 10-14 day schedule until that growth matures. Care should be taken to apply fungicides, especially protectant types, to both leaf surfaces. A spreader sticker is advised.

Survey and Detection: Look for prominent, red colored spots, 1-5 mm in diameter, on leaves of Rhaphiolepis sp. (Symptoms are similar on other hosts.) In moist weather, raised, black fruiting bodies with a lighter membranous covering or white oozing masses of conidia may appear in the lesions. Be sure to check other hosts of Entomosporium sp. when attempting to identify the inoculum source for disease control measures.

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