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www.publish.csiro.au/journals/apdn *Australasian Plant Disease Notes*, 2009, **4**, 29–31

First report of Septoria leaf spot of pistachio in Iran

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Abstract. During the summer of 2008, a severe foliar disease was observed on pistachio trees in Golestan Province, in northern Iran. Signs and symptoms of the disease were abundant pycnidia followed by brown spots on leaves. *Septoria pistacina* was consistently isolated from all the diseased leaves. This is the first report of Septoria leaf spot on pistachio in Iran.

Pistachio (*Pistacia vera*) has a recorded history of more than 800 years in Golestan Province, northern Iran. Wild populations of this species are distributed over a 40 000 ha area in the northern and eastern regions of this Province. Despite this, only ~30 ha of improved varieties have been established in this region (Karimidoost 2001).

During the early summer (July) of 2008, symptoms of a leaf spot disease were observed in several pistachio orchards. At first dark pycnidia appeared on both sides of the leaf. The pycnidia were scattered over a circular area ~0.5 cm or less in diameter (Fig. 1*a*). Later, more pycnidia were formed and this area enlarged to more than 1 cm in diameter. As the pycnidia matured, cirrhi of pycnidiospores could be seen extruding from the ostioles, which made the leaf tissue areas bearing pycnidia very prominent (Fig. 2*a*). These areas with pycnidia often coalesced to form larger lesions, sometimes occupying almost the entire leaf. Spermagonia of the fungus were produced on both sides of the leaf, among the pycnidia (Fig. 2*b*). They were immersed, tiny and dark. Only late in the season, the leaf tissue bearing pycnidia and spermagonia became chlorotic and eventually necrotic (Fig. 1*b*). Similar symptoms were observed on the petioles (Fig. 1*c*).

The pycnidia, immersed in the leaf tissue, were tan-brown, globose-depressed to lens-shaped and ranged from 80–175 μm (height) to 125–325 μm (width) (Fig. 3*b*). The pycnidiospores were hyaline, filiform, curved, and almost falcate, with obtuse ends, and usually one septum at their middle where they were constricted (Fig. 3*c*). Pycnidiospores with 2 or 3 septa were rarely observed (Table 1) and measured 25–47 × 2.5–5 μm.

To determine the causal agent of the disease, samples of diseased plants were collected from several locations. Infected tissues were placed in moist chambers until cirrhi of

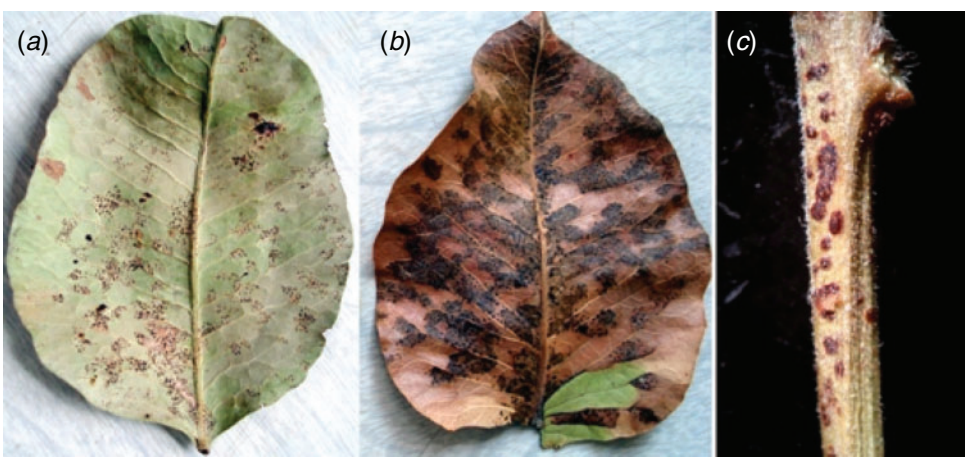

Fig. 1. Symptoms of Septoria leaf spot of pistachio: (*a*) initial symptoms on a leaflet; (*b*) advanced symptoms on a leaflet later in the season; (*c*) lesions with pycnidia on a petiole.

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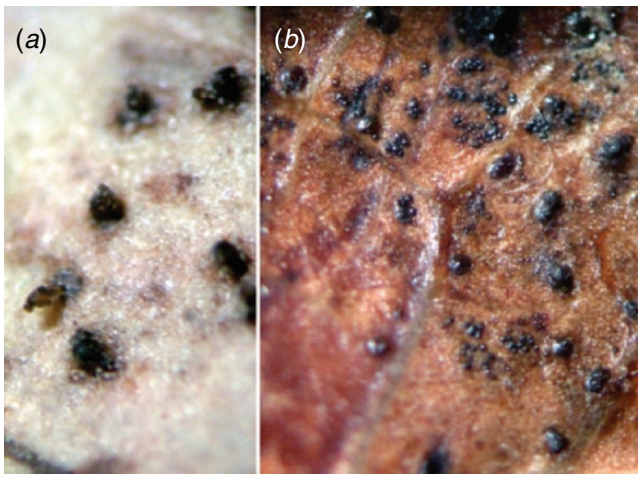

Fig. 2. Signs of Septoria leaf spot on a leaf of pistachio: (*a*) Pycnidia and extruded pycnidiospores (cirrhi); (*b*) pycnidia and spermagonia.

pycnidiospores extruded from the ostioles of pycnidia. Small pieces of cirrhi were placed on 2% water agar, and after 2 days, germinated single pycnidiospores were transferred to potato dextrose agar and incubated at 25°C in darkness. Mycelial growth of the fungus under these conditions was very slow. The fungal colony was initially white, but after 7–10 days incubation became dark grey (Fig. 4). After this time, globose to sub-globose spermagonia (52.5–107.5 (height) × 40–92.5 µm (width)) started forming on the culture plate (Fig. 3*a*). No pycnidia were formed in these cultures after incubation of the Petri plates for a month.

The causal fungus was identified as *Septoria pistacina* Allesch., based on morphological characteristics of the fungus and type of signs and symptoms on pistachio leaves (Chitzanidis 1956). It is easily separated from the two other *Septoria* species reported on pistachio in the laboratory, based on morphological characteristics and number of septa of pycnidiospores (Table 1).

Three species of the genus *Septoria* have been reported on pistachio worldwide, *S. pistaciarum*, *S. pistaciae* and *S. pistacina* (Teviotdale *et al*. 2001). Septoria leaf spot (caused by *S. pistaciarum*) was detected in the United States for the first time in 1964 within an experimental pistachio planting at Brownwood, Texas (Young and Michailides 1989; Call and Matheron 2000). The first observation of the disease in Arizona pistachio trees did not occur until 1986 (Young and Michailides 1989). Eskalen *et al*. (2001) reported it as the causal agent of Septoria leaf spot from pistachio trees in East-Mediterranean and South-east Anatolian regions. *Septoria pistaciae* was reported from the United States (California), Asia (Armenia, Republic of Georgia, India, Israel, Kazakhstan, Kirgizstan, Syria, Turkey, Turkmenistan and Uzbekistan), Europe (Albania, France, Greece, Italy, Portugal and Ukraine), and Africa (Egypt) (Pantidou 1973; Dudka *et al*. 2004; Haggag *et al*. 2006).

Septoria pistacina is reported from Greece (Chitzanidis 1956; Spaulding 1961), Syria (Spaulding 1961) and Turkey (T. J. Michailides, unpubl. data). It appears to have a limited distribution, compared with the other two species of *Septoria* on pistachio. *Septoria pistacina* is apparently limited to the Mediterranean countries, and our report for its occurrence in Iran, further documents its origin in this region. To our knowledge, this is the first report of Septoria leaf spot of pistachio caused by *S. pistacina* in Iran.

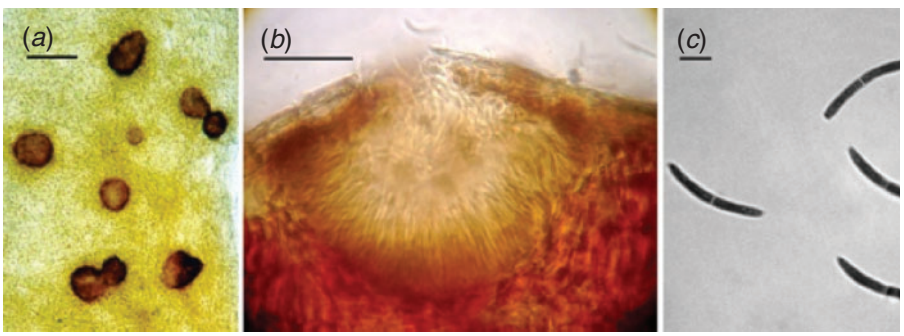

Fig. 3. Microscopic view of the *Septoria pistacina*, causal agent of Septoria leaf spot of pistachio: (*a*) spermagonia produced in culture (Bar = 100 µm); (*b*) pycnidia in a leaf cross-section (Bar = 50 µm); (*c*) pycnidiospores with one septum (Bar = 10 µm).

Table 1. Measurements of pycnidia and pycnidiospores of three *Septoria* species from pistachio reported on pistachio

Species	Pycnidial diameter (µm)	Pycnidiospore		Reference
		No. of septa	Size (µm)	
S. pistaciarum	138–218 × 128–192	2–5	47.7–84.3 × 3.2–4.3	Chitzanidis (1956)
	60–108	3–9	44–85.5 × 3–3.9	Young and Michailides (1989)
S. pistaciae	?	3–7	46–75 × 3–4	Haggag *et al*. (2006)
S. pistacina	96–160 × 160–240	1	31.8–47.7 × 3.6–4.8	Chitzanidis (1956)
	80–175 × 125–325	1 (–3)	25–47 × 2.5–5	Current study

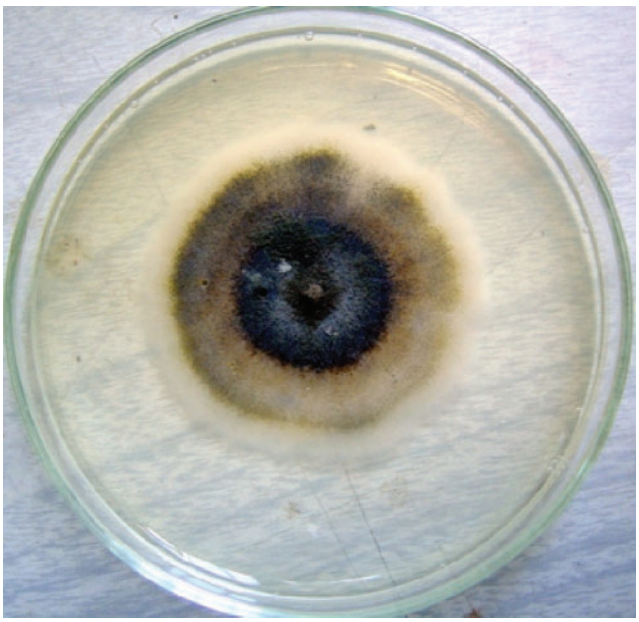

Fig. 4. Colony of *Septoria pistacina*, causal agent of Septoria leaf spot of pistachio in Iran, after 20 days growth on potato dextrose agar.

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Manuscript received 5 November 2008, accepted 12 March 2009