Septoria sonchi causes *Sonchus oleraceus* leaf spot in Iran

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Abstract A survey was done on leaf samples of *Sonchus oleraceus* with symptoms of leaf spot from different areas of Hamadan province, Iran during the summer to autumn period in 2009. The causal agent of this disease was studied in terms of morphological characteristics. The causal agent of symptoms was identified as *Septoria sonchi*. This is the first report of *Septoria sonchi* on *Sonchus oleraceus* in Iran.

Keywords First record · Iran · *Septoria* · *Sonchus*

Sonchus oleraceus (sow thistle) is an annual to winter annual herbaceous plant native to Europe (Hutchinson et al. 1984). The plant has been introduced to North America, South America, Asia, Africa, Australia, and New Zealand (Hyatt 2006). *S. oleraceus* is a common weed prevalent in lowland areas, waste ground and vacant lots, uncultivated ground, roadsides, gardens and cultivated fields and ditch banks (Hutchinson et al. 1984; Parker 1972). *Septoria sonchi* was first described on *Sonchus oleraceus* by Saccardo in 1878. Different species of *Septoria* have previously been recorded on *Sonchus oleraceus*, including: *S. sonchina*, *S. sonchifolia*, *S. sonchicola* and *S. modonia* var. *brevispora*. In addition to sow thistle, the fungus *Septoria sonchi* has been reported on *Scorzonera parviflora* in Romania (Radulescu et al. 1973); on *Sonchus arvensis*, *S. asper*, *S. oleraceus* in Bulgaria (Vanev et al. 1997); on *S. asper* & *S. oleraceus* in Korea (Shin et al. 2001; Shin and Sameva 2004; Cho and Shin 2004) and on *Sonchus*

oleraceus in India (Mathur 1979) and in Central Asia (Koshkelova and Frolov 1973).

During a survey from summer to autumn 2009, symptoms of leaf spot were observed on *Sonchus oleraceus* collected in Kabudarahang, Nahavand and Ganjname areas, Hamadan Province, Iran. Observation identified leaf spots using the following characteristics; circular or irregular in shape usually with a diameter of 1–5 mm, scattered to confluent, more evident on the upper leaves, pale brown to olivaceous in color surrounded with a purplish brown margin (Fig. 1a and b). Small brown pycnidia were concentrated in the center of lesions (Fig. 1c). In order to isolate the causal agent of this leaf spot five ca. 5×5 mm pieces of tissue were taken from the margins of infected tissue, surface sterilized by dipping into 1 % sodium hypochlorite for 1 min, immersed in 70 % ethanol for 1 min and then rinsed three times with sterilized water and finally dried in sterilized tissue paper. Samples were placed on potato carrot agar (PCA). Plates were incubated in conditions of alternating 12 h' near UV/12 h' dark and observed periodically. The growing edges of any fungal hyphae developing from leaf disks were then transferred aseptically to potato dextrose agar slants and then stored at 4 °C.

In total 22 putative *Septoria* colonies were obtained and identification was achieved following pure culture and sporulation. Mycelia growth rates were measured at 25 mm in diameter after 10 days. Aerial mycelia were white to grayish and cottony in texture with diameters of 2–5 µm on PCA (Fig. 2a), later mycelia coiled to make pycnidium (Fig. 2b). Pycnidia on leaf tissue were scattered to confluent, brown, globose, more or less immersed, relatively large, unilocular, 60–100 µm in diameter with circular ostioles and rather small at 5–10 µm wide (Fig. 3a, b). Conidiogenous cells were discrete, holoblastic, hyaline, lageniform or ampulliform were irregular in width and not branched, 2–10×3–4.5 µm, formed from the inner cells of the pycnidium wall (Fig. 4c). Conidia were filiform, straight to substraight, subobtuse to obtuse at the base, subacute to subobtuse at the apex, eguttulate, subhyaline to hyaline, 15–22(–30)×1.5–2.0 µm, (0–) 1–2-septate, septa distinct (Figs. 4a, b).

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Fig. 1 **a** Symptoms of *Septoria sonchi* leaf spot on *Sonchus oleraceus*; **b** pale brown to olivaceous spots surrounded with purplish brown margin; **c** with small pycnidia forming in the centre of the lesion

Fig. 2 **a** Mycelia of *Septoria sonchi* in culture; **b** mycelia coiled to make pycnidium on PCA (Bar=20 μ m)

Fig. 3 **a** Globose pycnidium of *Septoria sonchi* on leaf tissue; **b** sector of pycnidium (Bar=20 μ m)

Fig. 4 **a**, **b** conidia, **c** conidiogenous cells (Bar= 20 μ m)

On the basis of these observations the fungus was determined as *Septoria sonchi* according to the description by Shin et al. (2001).

S. sonchi was distinguished from other species of *Septoria* such as: *S. sonchifolia*, *S. sonchina*, *S. sonchicola* and *S. modonia* var. *brevispora* on *Sonchus oleraceus* by shorter conidia and fewer numbers of septa. This species was very similar to *S. sonchifolia* but distinguishable by its somewhat large pycnidia and shorter conidia detailed in Table 1 (Jørstad 1965; Rădulescu et al. 1973; Vanev et al. 1997).

To fulfill Koch's Postulates, 15 healthy annual sow thistle plants (*Sonchus oleraceus*) were grown under greenhouse conditions. Leaves were inoculated by spraying with a conidial suspension (1×10^5 conidia/mL) of the three of the *S. sonchi* isolates and kept at 23 °C, at >75 % relative humidity. Control plants were sprayed only with distilled water and incubated in the same conditions. One week after inoculation, leaf spot symptoms had appeared on the inoculated leaves, which were similar to those in the collected survey samples environment. Pycnidia were also produced on leaf spots after 10 days and were similar to those produced on naturally diseased plants. Koch's Postulates were fulfilled by re-isolation of *Septoria sonchi* from plants showing symptoms and morphological identification as described above. A

Table 1 Comparison of morphological characters of *Septoria* species recorded on *Sonchus oleraceus*

Fungus	Conidial size (μ m)	Pycnidial diameter (μ m)	Number of septa	References
<i>S. sonchi</i>	15–22(30) × 1.5–2	60–100	(0)1–2	Samples in this survey
<i>S. sonchi</i>	15–35 × 1.5–2	70–130	(0)1–2	(Shin et al. 2001)
<i>S. sonchi</i>	15–30(35) × 1.5–2(2.5)	60–140	(0)1–2	(Saccardo 1878)
<i>S. sonchina</i>	28–34 × 1.5–2	Not recorded	3–4	(Saccardo 1884)
<i>S. sonchifolia</i>	20–30 × 1–1.5	100–120 × 150–200	3	(Saccardo 1884)
<i>S. sonchicola</i>	40–54 × 2	80–100	Not recorded	(Saccardo 1913)
<i>S. modonia</i> var. <i>brevispora</i>	33–45 × 1.5–2	90–125	1–4	(Saccardo 1909)

culture of *Septoria sonchi* was deposited in the Iranian Research Institute of Plant Protection (IRAN 2146 C).

This is the first record of *Septoria sonchi* causing leaf spot on *Sonchus oleraceus* in Iran.

References

- Cho WD, Shin HD (2004) List of plant diseases in Korea. Korean Soc. Plant Pathol, Suwon, p 779
- Hutchinson I, Colosi J, Lewin RA (1984) The biology of Canadian weeds. 63. *Sonchus asper* (L.) Hill and *S. oleraceus* L. Can. J. Plant Sci 64(3):731–744
- Hyatt P (2006) *Sonchus oleraceus* L. In: Flora of North America Editorial Committee, eds. 1993+. Flora of North America North of Mexico. 12+ vols. New York and Oxford, 19: 275
- Jørstad I (1965) *Septoria* and septorioid fungi on dicotylendons in Norway. Oslo University Press, Oslo, p 100
- Koshkelova EN, Frolov IP (1973) Microflora of kopet-dag lowland and central karakum (micromycetes). Ylym, Ashkhabad, p 194
- Mathur RS (1979) The coelomycetes of India. Bishen Singh Mahendra Pal Singh, Delhi, p 460
- Parker KF (1972) An illustrated guide to Arizona weeds. The University of Arizona Press, Tucson, p 338
- Radulescu E, Negru A, Docea E (1973) Septoriozele din Romania. Educated Academic Republiction Society Romania, Bucarest, p 325
- Saccardo PA (1878) *Michelia* 1(2):133–221
- Saccardo PA (1884) *Sylloge Fungorum* III: 552
- Saccardo PA (1909) *Annual Mycology* VII: 434
- Saccardo PA (1913) *Syylloge Fungorum* XXII: 1107
- Shin HD, Sameva EF (2004) *Septoria* in Korea. National Institute of Agricultural Science and Technology, Suwon, p 183
- Shin HD, Sameva EF, Kim JD (2001) Morphometric studies on the genus *Septoria* in Korea (I). *Mycobiology* 29:145–153
- Vanev SG, Sameva EF, Bakalova GG (1997) Order *Sphaeropsidale*. *Fungi Bulgaricae* 3:1–335