ԵՐԵՎԱՆԻ ՊԵՏԱԿԱՆ ՀԱՄԱԼՍԱՐԱՆԻ ԳԻՏԱԿԱՆ ՏԵՂԵԿԱԳԻՐ
УЧЕНЫЕ ЗАПИСКИ ЕРЕВАНСКОГО ГОСУДАРСТВЕННОГО УНИВЕРСИТЕТА

Քիմիա և կենսաբանություն 2, 2010 Химия и биология

Biology

УДК 582.28

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SEPTORIA ALBANIENSIS THUEM. CAUSING LEAF SPOT OF *SALIX TRIANDRA* IN IRAN

Septoria collections on *Salix* spp. from herbarium of Iranian Research Institute of Plant Protection were studied. The collections were identified on the base of morphometric criteria. This study results to identify *Septoria didyma* Fuckel, *Septoria capreae* Westend., *Septoria albaniensis* Thuem. This is the first report of *Septoria albaniensis* Thuem. for Iranian mycoflora.

The genus *Septoria* Sacc. belongs to sympodial *Blastopycnidiineae of Coelomycetes*, *Fungi Imperfecti* [1]. All species of this genous are plant pathogens causing leaf spots and blight in field crops, vegetables, ornamentals and wild plants [2]. Saccardo (1884) included 581 species in *Septoria*. This genus presently contains more than 1000 taxa [3]. Jorstad [4,5] emphasized the significance of the size, shape and septation of conidia in the taxonomy of the genus *Septoria*. Nevertheless, the shape and size of conidia are variable, the characters that mostly used in the mothern taxonomy of *Septoria* spp. are the conidiomatal type, conidiogenesis, conidiogenous cells and the conidial shape, length, width and septation [6–10].

Salix triandra is a bushy tree or robust, spreading shrub that reaches 10 *m* in height, native to Europe and western and central Asia, from southeastern England, east to Lake Baikal south to Spain and the Caucasus and Alborz mountains. It usually grows on river banks and wetlands [11, 12]. Teterevnikova-Babayan [13] described seven species of *Septoria* on *Salix* spp.: *Septoria albaniensis* Thuem. with conidia measurements (38–32×2,5) *µm*, 1 septum on *Salix pulchra*; *Septoria blennorioides* (Karst.) Berl. et Vogl., with conidia measurements (10–18×2,0–3,0) *µm*, without septum, synonym with *Phoma blennorioides* Karst. and *Septoria rhabdosporoides* Syd. on *Salix babylonica* and *Salix myrsinites*; *Septoria capreae* West. with conidia measurements (33,5–45,5×2,5–3,5) *µm*, 1–3 septum, synonym with *Depazea salicicola* Fr. and *Septoria salicicola*, on *Salix acutifolia*, *S. aurita*, *S. caprea*, *S. caspica*, *S. cinerea*, *S. daphnoides*, *S. fragilis*, *S. myrsinifolia*, *S. purpurea*, *S. pyrolifolia*, *S. repens*, *S. starkeana*, *S. triandra*, *S. vimina*, *S. wilhelmsiana* and *Salix* sp.; *Septoria didyma* Fuckel, with conidia measurements (23–36×3,8–6,0) *µm*, 1–5 septum, on *Salix acutifolia*, *S. caspica*, *S. cinerea*, *S. daphnoides*, *S.triandra*, *S. viminalis* and *Salix* sp.; *Septoria jenisseica* Thuem. with conidia

measurements (60–66×2,5–3,0) *µm*, 1 septum, on *Salix* sp.; *Septoria salicina* Peck. with conidia measurements (40–60×1,0–1,5) *µm*, 3–5 septum, on *Salix* sp.; *Septoria salicis* West. with conidia measurements (22–27×1,0–1,5) *µm*, 4–6 septum, synonym with *Depazea salicicola* Thum*.,* on *Salix fragilis, S. pyrolifolia*, *S. traindra* and *Salix* sp. [4,1]. Jorstad [4] described *Septoria salicicola* (FR.) Sacc. on *Salix caprea* L. with conidia measurements (32–55×2,5–3,5) *µm* and on *Salix lanata* L. with conidia measurements (45–65×2,5–3,0) *µm*; *Septoria pentandriana* Bulb. & Vleug. on *Salix pentandra* with conidia measurements (48–104×2,0–2,5) *µm* with up to 11 septum; *Septoria rhabdosporioides* Syd. with conidia measurements (13–18×2,0–3,0) *µm* without septum. Jorstad [4] presumed that *Septoria blennorioides* (Karst.) Berl. et Vogl. and *Septoria rhabdosporioides* Syd. are congeneric. Teterevnikova-Babayan [13] keep *Septoria salicicola* (FR.) Sacc. synonym with *S. capreae* West. Additionally Jorstad [4] point out to *Septoria Pentandriana* Bub & Vleug., (48–104×2,0–2,5) *µm* with up to 11 septa and *Septoria salicicola* (Fr.) Fuckel without any descriptions.

In Iran the species of *Septoria* are poorly known and not yet intensively studied. *Septoria didyma* Fuckel reported from Ahvaz (Khozestan Pr.), Caspian sea area, Ghuchan (North Khorasan Pr.), Tehran vicinity by Petrak and Esfandiari (1941); Esfandiari (1946); Scharif and Ershad (1966) without any descriptions [14], and *Septoria capreae* Westend. described by Fatehi from Ardebil Pr. [15].

Materials and Methods. *Septoria* collections from herbarium of Iranian Research Institute of Plant Protection were studied. These samples had been collected by Scharif, Esfandiari, Izadyar, Khodaparast from Kermanshah Pr. Babolsar of Mazandaran Pr., Lahidjan of Gillan Pr., Herow-abad of Ardebil Pr., Ahar of East Azarbayjan Pr., Tehran Pr., Heyran defile of Ardebil Pr., Meshkinshahr of Ardebil Pr. and Ghoutchan of North Khorasan Pr. from 1942 to 2004 on *Salix triandra* and *Salix* sp. These collections previously were detected as *Septoria didyma* Fuckel. and *Septoria capreae* Westend. by Ershad, Esfandiari, Fatehi and Saber without any descriptions. Two of these collections that collected by Khodaparast were detected by author.

Macroscopic features of leaf fragments bearing pycnidium described from dried materials, and microscopic features described from dried materials re-hydrated in 3% KOH for 1–2 hours [16]. For examination of the pycnidia, ostiole, conidia, their length, width and septation the re-hydrated specimens bearing pycnidia investigated under SHZ Olympus stereo-microscope, where the pycnidia picked up and took to a slide using a narrow needle. Slides were stained with Lactofuschin modified with Cotton blue, and for examination of the conidiogenous cells specimens stained with KOH 5% and NH_3OH 10% modified with Erythrosin 3%, by heating over a small flame [16]. The width of pycnidia, conidia and conidiogenous cells were measured at their widest part. Measurements of pycnidia and ostiole were made from 30–50 replicates for each collection under 400x magnifications, and for conidia and other fungal structure were made 50–100 replicates for each collection under 1000x magnifications. The mycological characteristics of conidia and pycnidia, like shape, size, color, number of septa, etc were illustrated with the aid of a CH2 Olympus microscope, provided with Olympus BH2-DA drawing tube under 500x and 1250x magnifications.

To anatomical studies sections were made by Leitz 1512 paraffin microtome from the area of lesions bearing pycnidia. Formalin-Aceto-Alcohol (FAA) [17] was used to fix the specimens. Samples left in fixing liquid for 24 hours. After an aqueous fixing fluid tissues were washed in rinsed water, dehydrated in ethyl alcohol 30%, then were transferred to dehydration solutions. Dehydration were done with normal Butyl Alcohol series containing progressively increasing concentrations of the dehydrating agent and decreasing concentrations of water for avoid of tissues distortion [17]. To infiltration, samples from Butyl alcohol series were placed on top of paraffin into Petri dishes, and put into the oven at 70^0C for one hour. This step repeats two times again for another one hour and for over night. In this step Butyl alcohol replaced with paraffin. Then samples embedded in a convenient block of solid paraffin, and trimmed into determinate block in order to produce continuous series of sections, when cut on the microtome. Sectioning or cutting was made by Leitz microtome with 10–25 *μm* thickness. Spreading or mounting of the ribbon were accomplished by floating it on water 34^0C, then transferred on the slide and fixed by Hupts Gelatin fixative. Decreasing accomplished by placing the slide in a coplin jar containing xylene, then mounted with a small drop of Canada Balsam, carefully covered with cover slip, and were dried in dust free atmosphere at room temperature [17].

The identification keys for species on *Salix* spp. used in this study are as follows:

1. Conidia width less than 1,5 *μm*……..……...……..……2
1. Conidia width more than 1,5 *μm*…….……....…...……..….3
2. Conidia length less than 30 *μm*……..... *S. salicis* Westend.
2. Conidia length more than 40 *μm*…….....*S. salicina* Peck.
3. Conidia width 1,5–3 *μm*…….…….……....…….4
3. Conidia width more than 3 *μm*…….……....……...6
4. Conidia length less than 20 *μm* .....*S. blennorioides* (Karst.) Berl. et Vogl.
4. Conidia length more than 20 *μm*……...……...……...……...5
5. Conidia length 20–40 *μm*……..……..…....*S. albaniensis* Thuem.
5. Conidia length more than 60 *μm*……...…... ..*S. jenisseica* Thuem.
6. Conidia width less than 3,5 *μm*……..….*S. capreae* Westend.
6. Conidia width more than 3,5 *μm*……..…*S. didyma* Fuckel

Results. Three species of *Septoria*: *S. didyma* Fuckel, *S. capreae* Westend., *S. albaniensis* Thuem., were detected in studied collections.

Septoria albaniensis Thuem.

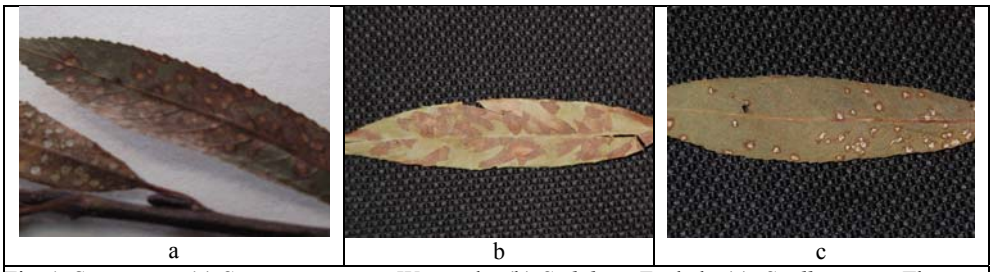
Synonyms: *Depazea salicicola* Fr., *Septoria salicicola* (Fr.) Sacc.

Matrix: *Salix triandra* sub sp. *triandra* Skvortson., *Salix acutifolia*, *S. aurita*, *S. capreae*, *S. caspica*, *S. cinerea*, *S. daphnoides*, *S. fragilis*, *S. myrsinifolia*, *S. purpurea*, *S. wilhelmsiana*, *Salix* sp.

Investigated samples: *Salix triandra* sub sp. *triandra* Skvortson., collected by Izadyar in 1970 from Herouabad of Khalkhal in Ardabil Pr. and pre-detected by Saber.

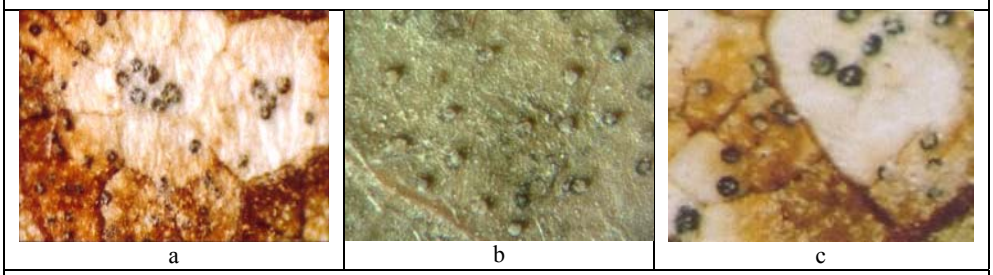
Description: spots small, 0,93 (0,62–1,25)×0,89 (0,62–1,17) *mm* in diameter, orbicular, amphigenous, white, surrounded by a dark brown distinct border zone.

Pycnidia amphigenous, scattered, separate, occasionally aggregated, submerged to erumpent, globose, dark brown to black, 152 (125–187)×138 (112–175) *μm* in diameter, not papilate, with thin pseudoparanchymatic wall. Ostiole single, apical, light brown, 40 (30–50)×35 (27–50) *μm*, with thick wall. Conidia hyaline, straight to slightly curved, 27,2 (22–33)×2,04 (2–2,5) *μm*, with truncate to obtuse base and subacute to obtuse apex (Fig. 1c–4c).



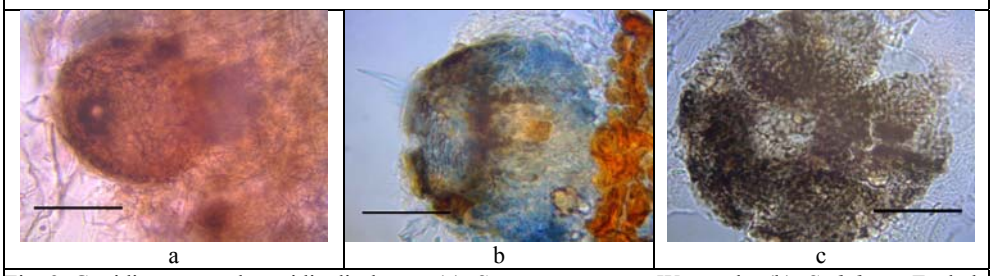
a b c

Fig. 1. Symptoms. (a) *Septoria capreae* Westend.; (b) *S. didyma* Fuckel; (c) *S. albaniensis* Thuem.



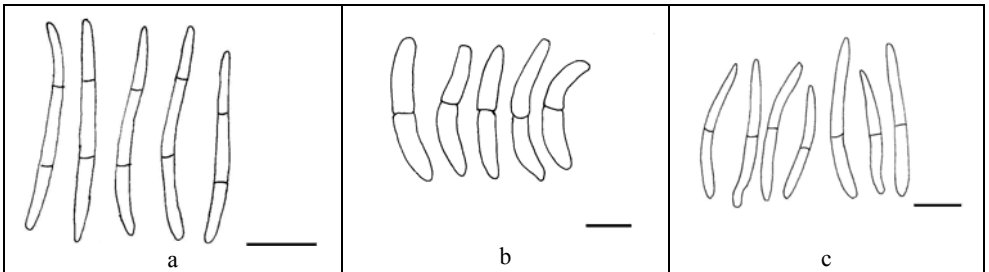
a b c

Fig. 2. Leaf spots and Conidiomata scattered on lesions. (a) *Septoria capreae* Westend.; (b) *S. didyma* Fuckel; (c) *S. albaniensis* Thuem.



a b c

Fig. 3. Conidiomata and conidia discharge. (a) *Septoria capreae* Westend.; (b) *S. didyma* Fuckel; (c) *Septoria albaniensis* Thuem. Scales 50 *μm*.



a b c

Fig. 4. Conidia drawings. (a) *Septoria capreae* Westend.; (b) *S. didyma* Fuckel; (c) *S. albaniensis* Thuem. Scales 10 *μm*.

Notes: current study showed that conidia in examined materials closer to description for *Septoria albaniensis* Thuem. by Teterevnicova–Babayan [13]. This is the first report of *Septoria albaniensis* Thuem. for Iranian mycoflora.

Septoria capreae Westend.

Synonyms: *Depazea salicicola* Fr., *Septoria salicicola* (Fr.) Sacc.

Matrix: *Salix acutifolia*, *S. Aurita*, *S. caprea*, *S. caspica*, *S. cinerea*, *S. daphnoides*, *S. fragilis*, *S. myrsinifolia*, *S. purpurea*, *S. pyrolifolia*, *S. repens*, *S. starkeana*, *S. triandra*, *S. vimina*, *S. wilhelmsiana*, *Salix* sp.

Investigated samples: *Salix triandra* sub sp. *triandra* Skvortson. collected by Izadyar in 1970 from Herouabad of Khalkhal in Ardabil Pr. and pre-detected by Fatehi (Fig. 5).

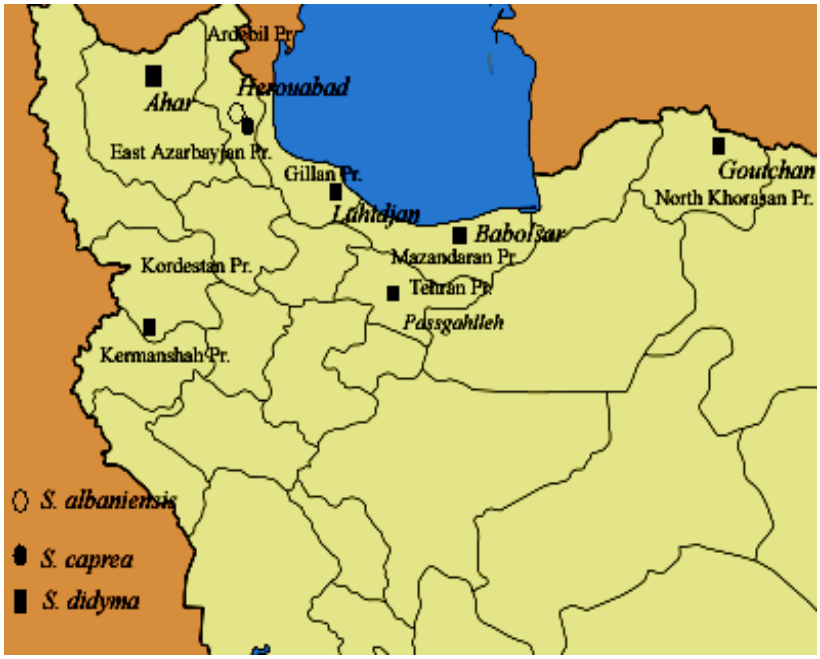


Fig. 5. Geographical distribution of *Septoria* species on *Salix* spp. in Iran.

Description: spots amphigenous, restricted by vein, orbicular, rarely angular, white, with distinct margin and brown hallow, in lower surface spots red to brown, with indistinct margin. Pycnidia amphigenous, scattered on spots, but rarely seen on lower surface, immersed, separate, occasionally aggregated, globose, not papilate, with thin pseudoparanchymatic wall, 105 (73–128)×90 (60–120) *μm*. Ostiole single, apical, with thick wall, 20–30 *μm*. Conidiogenesis cells hyaline, separate, ampuliform to lageniform, 2–8×5–14 *μm*, Conidia fusiform, straight to slightly curved (falcate), hyaline, with obtuse base and subacute to obtuse apex, 1–3 septate, 40 (30–45)×2,5 (2–3) *μm* (Fig. 1a–4a).

Notes: conidial dimensions in this examined material are closer to description for *Septoria capreae* Westend. by Teterevnicova–Babayan [13].

Septoria didyma Fuckel

Synonymes: *Septoria didyma* Fuckel var. *santonense* Pass.

Matrix: *Salix* sp., *S. acutifolia*, *S. caspica*, *S. cinerea*, *S. daphnoides*, *S. triandra*, *S. viminalis*.

Investigated samples: *Salix* sp. collected by Scharif in 1969 from Road Kermanshah–Sanandaj In Kordestan Pr. and pre-detected by Ershad; *Salix* sp. collected by Sharif in 1975 from Babolsar in Mazandaran Pr., *Salix* sp. collected by Esfandiari in 1942 from Lahidjan in Gillan Pr. and pre-detected by Esfandiari; *Salix* sp. collected by Esfandiari in 1942 from Ahar in East Azarbayjan Pr. and pre-detected by Esfandiari, *Salix* sp. collected by Esfandiari in 1942 from Passghalleh in Tehran Pr. and pre-detected by Esfandiari; *Salix* sp. collected by Sharif in 1953 from Ghoutchan in North Khorasan Pr. and pre-detected by Ershad; *Salix* sp. collected by Khodaparast in 2004 from Ardebil–Meshkinshahr road in Ardebil Pr. and detected by Azimi; *Salix* sp. collected by Khodaparast in 2004 from Heyran defile of Ardebil-Astara road in Ardebil Pr. and detected by Azimi (Fig. 5).

Description: spots angular, restricted to leaf vein, amphigenous, umber-brown, with dark brown margins. Pycnidia epipyllous, globose to subglobose, dark brown to black, submerged, scattered on lesions, separate, 115 (75–140) *μm*. Ostiole single, papilate, circle to oval, 58 (30–95) *μm* wide. Conidiogenous cells hyaline, discrete, ampuliform to lageniform, 9 (6–15) *μm* wide and 4,5 (2–7,5) *μm* tall, producing conidia holoblastically. Conidia fusiform with rounded base and obtuse apex, hyaline, 24,6 (22–27)×4,4 (4–5) *μm*, with 1 septate, septum submedian (Fig. 1b–4b).

Notes: conidial dimensions in these examined materials are closer to descriptions for *Septoria didyma* Fuckel by Teterevnicova–Babayan [13].

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ՀՈՒՍԵԻՆ ԱԶԻՄԻ

ԻՐԱՆՈՒՄ *SALIX TRIANDRA*-Ի ՏԵՐԵՎՆԵՐԻ ԲԾԱՎՈՐՈՒԹՅՈՒՆ ՀԱՐՈՒՑՈՂ *SEPTORIA ALBANIENSIS* THUEM. ՍՈՒՆԿԸ

Ամփոփում

Ուսումնասիրվել է Իրանի Բույսերի պաշտպանության գիտահետազոտական ինստիտուտի herbarium-ի *Salix* spp.-ի վրա մակաբուծող *Septoria* ցեղի տեսակների հավաքածուն: Նմուշները որոշվել են ըստ ձևաչափական չափանիշների: Հետազոտությունների արդյունքում որոշվել են *Septoria didyma* Fuckel, *Septoria capreae* Westend., *Septoria albaniensis* Thuem. տեսակները: Սա Իրանի միկոֆլորայի համար *Septoria albaniensis* սնկի մասին առաջին հաղորդումն է:

ХУСЕЙН АЗИМИ

SEPTORIA ALBANIENSIS THUEM., ВЫЗЫВАЮЩИЙ ПЯТНИСТОСТЬ ЛИСТЬЕВ *SALIX TRIANDRA* В ИРАНЕ

Резюме

Изучена коллекция видов *Septoria* на *Salix* spp. гербария Иранского исследовательского института защиты растений. Образцы определялись на основе морфометрических критериев. В результате исследования были определены виды *Septoria didyma* Fuckel, *Septoria capreae* Westend., *Septoria albaniensis* Thuem. Это первое сообщение о *Septoria albaniensis* Thuem. для иранской микофлоры.