

FIRST REPORT OF *DELPHINELLA ABIETIS* (O. ROSTRUP) E. MÜLLER ON *ABIES ALBA* MILL. IN BULGARIA

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Abstract

Fungus *Delphinella abietis* (O. Rostr.) E. Müll., causing wilting and drying of Silver fir needles was recorded for first time in Bulgaria. Symptoms of *Delphinella* shoot blight were detected on young fir trees under the canopy and along the edge of spruce forests in locality Mostovete in the area of Yundola Training and Experimental Forest Range, at altitude 1400 m in the fall of 2015 and winter of 2016-2017. On the same trees was diagnosed another species new to Bulgaria - *Scolicosporium camposperma* (Peck) Höhn., considered a saprophyte.

Key words: *Delphinella abietis*, *Abies alba*, fir needles wilting and drying, *Scolicosporium camposperma*

Forests with presence of European silver fir (*Abies alba* Mill.) in Bulgaria have a distribution limited to the mountains the Rhodopes, Rila, Pirin, Osogovo, Stara Planina, Slavyanka and Belasitsa, at an altitude of 450 to 2000 m, with an optimal development between 1000 and 1700 m (Dimitrov, Rousakova, 2015). The area coverage of these forests decreases as a result of drying, due to the global drought, displacement by beech forests at the lower altitudes, unregulated felling, and construction developments. The causes for the deteriorating health of fir forests are subject to multiple studies (Rossnev et al., 1989; Rossnev, Petkov, 1994; Tsankov et al., 1994; etc.).

This report presents a first record of the fungus *Delphinella abietis* (O. Rostrup.) E. Müller as a new species for Bulgaria. The fungus was first described in Denmark by Rostrup (1992) but in recent years the greatest damages were found in the coastal areas of South Norway, where the mild humid climate favours the development of the disease. It was found on *Abies alba*, *A. lasiocarpa*, *A. bornmuelleriana*, *A. sibirica*, *A. nordmanniana*, *A. procera*, *A. cephalonica*, *A. balsamea*, *A. pinsapo* (Talgø, Stensvand, 2008, 2012), mainly in fir plantations for Christmas tree production.

D. abietis parasitizes on living fir needles (*Abies* spp.), causing their wilting and drying out (shoot blight disease). It spreads in North America and Europe (Chastagner et al., 2015), although another species of the same genus – *D. balsameae* (Waterman) E. Müll. has a wider spreading in North America and it occurs in the Asian part of Russia as well (Morozova, 2006). *D. abietis* is a problem mainly in Northwestern Europe, but limited attacks have also been found in regions more southern than that – Austria (Talgø, Stensvand, 2008), Denmark, Great Britain (Solheim, Skage, 2002), Serbia (Karadžić, 2008).

D. abietis kills current year young needles attacking them in the beginning of their development. Symptoms include redness, and later dark brown or gray-black

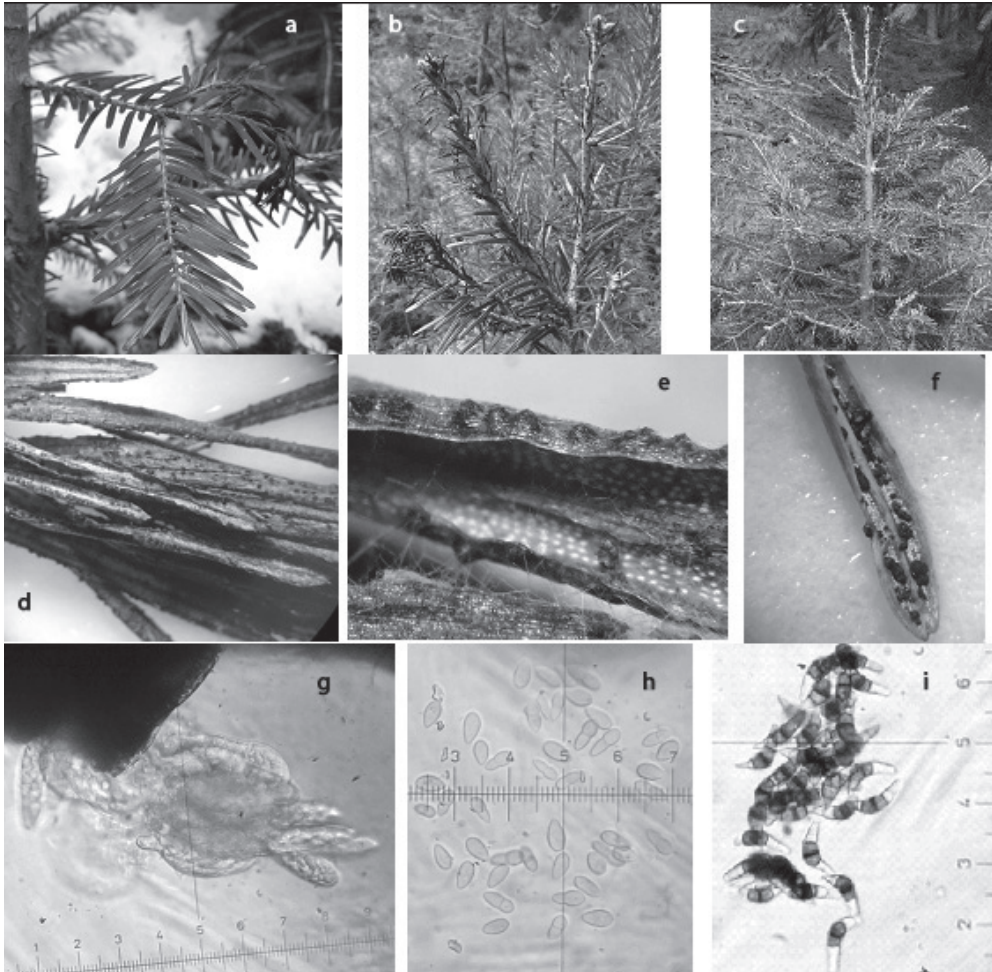


Fig. 1. *D. abietis* – symptoms (a-c), pseudothecia (d, e), asci (g) and ascospores (h); *S. camposperma* – aservuli (f) and conidia (i)

colouring and drying of some or all needles. In most cases they remain on the branches for one year. At a mass attack shootings also dry out (Solheim, Skage, 2002). The needles curl down and are usually covered with numerous black pycnidia and pseudothecia, especially on their upper surface, visible with naked eye (Fig. 1 a-e). When all needles on young shootings turn yellow and die, the symptoms can be confused with late spring frosts damage.

Fir forests in Bulgaria usually occupy the lower parts of the slopes with northern exposure and deep coombs, where soil and air humidity are relatively high (Dimitrov, Rousakova, 2015). Similar are the conditions at the site where symptoms of *D. abietis* infection were detected on the fir undergrowth beneath the canopy of Spruce forests and along their peripheral parts by Evtimov (personal communication, September 28,

2015). He observed an unusual drying of the young needles on fir saplings in the locality Mostovete in the area of Yundola Training and Experimental Forest Range (on the border between Rila and the Western Rhodopes mountains), at altitude 1400 m. The dried out needles on the samples had the typical for *D. abietis* large number of black pseudothecia, but no spores were separated from them. Spores were not found on the samples collected in October and December 2016 either. Asci and ascospores were found only on the outdoor wintering needles, collected in April 2017, which confirms the conclusion of Talgø, Stensvand (2008), that on needles collected in autumn or winter, pseudothecia are still not mature.

Fungus *D. abietis* was identified based on morphological characteristics. Pseudothecia (Fig. 1 d, e) are erumpent, without conspicuous ostioles, diameter 175.1 (135-216) μm . Asci (Fig. 1 g) are cylindrical, clavate with shaped base, 72.6 (64.8-78.3) x 19.4 (13.5-24.3) μm . Ascospores (Fig. 1 h) are hyaline, bicellular, ellipsoid, faintly constricted at the septum, 16 per ascus. Measured ascospores had an average length of 19.5 μm (16.2-24.3 μm) and width of 8.7 μm (5.4-10,8 μm). These dimensions are larger than those indicated by Talgø et al. (2016): 13.4 (10.9-15.9) x 4.2 (3.4-5.7) μm , but they are close to those values listed in the database Fungi of Great Britain and Ireland (Cannon, 2011): stromata 150-200 μm diam., asci 50-90 x (14-)18-22 μm , ascospores 11-21 x 4-6.5 μm .

Currently the life cycle of the fungus has still not been described in detail. It has been found, that the ascospores ripen in the spring, when they infect the young tissues during the bursting of the buds (Talgø et al., 2016). *D. abietis* attacks only species of the genus *Abies*.

Low temperatures may contribute to the spreading of the disease, especially in plantations of high density, but are not a leading factor (Solheim, Skage, 2002). The importance of rainfall amounts decreases as the disease begins to develop. The typical for the region of Yundola rainfall maximum is in May-June and the precipitation amount is within the range 115-130 mm. The maximum temperature values recorded in July-August are under 30°C, while the minimums are rarely below -15°C (in January and February). The relative air humidity is at its highest (about 80%) during the winter (January-March) and probably is of main significance for the development of the fungus.

In addition to *D. abietis*, on the same needles another species new for Bulgaria was also diagnosed – *Toxosporium abietinum* Vuill. (now *Scolicosporium camposperma* (Peck) Höhn.), considered a saprophyte, but according to Stevens (2013) caused drying of fir needles as well. The fungus forms black aservuli on them (Fig. 1 f), containing curved conidia (27 x 8.1 μm), beaked at each end, 3-5 septate, with dark central and hyaline apical cells (Fig. 1 i).

To maintain a low level of the disease caused by *D. abietis*, Talgø, Fløistad (2015) recommend cutting and burning infected shootings, and in case of a mass attack removal of whole trees. Fallen dead branches are an important source of infection (Talgø, Stensvand, 2008). To reduce the spread of the disease, continuous monitoring is needed, especially in nurseries and young plantations, where fir saplings are most vulnerable

to the disease in the period of active growth (May-June). At this stage, fungicides may also need to be used, particularly under conditions of high humidity. In Yundola forests where the disease was observed these measures are difficult to apply.

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