

Phomopsis pseudotsugae Wilson — Discula pinicola (Naumov) Petr. as a Saprophyte on Coniferous woods.

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The fungus *Phomopsis pseudotsugae* was described by Wilson (1920, 1925) as a parasite on Douglas fir, larches and *Abies grandis* Lindl. on which trees it caused either cankers or die-back of young shoots and stems or both kinds of injury combined. Since then, some other conifers have been added to its host list and new facts brought about concerning its distribution. (v. f. i. Lagerberg 1934, Ferdinandsen and Jørgensen 1938, Robak 1946 a.o.). The majority of authors seem to agree that the fungus is a parasite. In England, however, Day failed to obtain positive results when inoculating healthy trees and is inclined to consider the fungus a saprophyte or — at most — a weak, facultative parasite attacking only trees and organs already debilitated from other causes (Day 1935, 1938, 1949). On the other hand, van Vloten at the VII. International Botanical Congress Stockholm 1950 gave strong evidence of its being an active wound parasite on Japanese larches.

In 1926 the Russian mycologist Naumov described as *Lignella pinicola* n. g. et sp. a fungus growing saprophytically on pine wood. Lagerberg and Melin (1927) isolated from blue-stained pine and spruce logs in Sweden a pycnidiferous mycelium which, on the suggestion of Dr. Petrak, Vienna, they identified with Naumov's species, this identification checked by comparison with original material sent them by Prof. Naumov himself. On Petrak's authority they named their fungus *Discula pinicola* (Naum.) Petr. With its very characteristic mycelium and pycnidia the same is very easily recognizable in culture. Later the author (Robak 1932) and Melin & Nannfeldt (1934) have isolated it from coniferous ground-wood pulp and from „white water“ in chutes at wood pulp mills.

In recent years the author has isolated its mycelium repeatedly from died-back tops of spruce in Norway. The cause of the die-back is not yet fully ascertained. In this connection, however, our fungus can be put out of question. Even among tops recently dead the individual specimens yielded different fungi when bits of the inner bark from the border between dead and sound tissue were cut out aseptically and transferred to a culture medium.

Our *Discula* was not even the dominant species. Of my *Discula*-isolates from spruce one typical (No. 131-h) and one (No. 30-I) deviating by its lower and denser air mycelium and a certain proportion of spiny-pointed spores, were sent to Prof. Lagerberg, Stockholm.

19. 3. 1949 he writes: „That (fungus) named 131-h is without doubt identical with *Discula pinicola*“. Even 30-I he would consider a *Discula*. Besides from spruce, the typical form of our mycelium has been isolated from the dead bark of *Dasyscypha* cankers on larch (*Larix decidua* Mill.)

Now, in April 1948 I had isolated what I considered the same mycelium (No. 100 : 2) from a died-back top of young Douglas fir (*Pseudotsuga taxifolia* Britt.) collected at Førde in the district of Sunnfjord. In this case, however, the culture material were spores from pycnidia which I supposed must belong to *Phomopsis pseudotsugae* Wils. It may be of interest in this connection that a neighbouring specimen of Douglas fir, although presenting exactly the same picture of die-back, carried numerous pycnidia of the saprophyte *Zylostroma pinastri* (Karst.) v. Höhn. and no such of *Phomopsis*. These facts indicate, I think, that the fungi were not the causal agencies of the injury observed.

Here, however, spores of what I had reason to identify with *P. pseudotsugae* had developed a pycnidiferous mycelium which I recognized as *D. pinicola*. Regarding the very accurate illustrations given by Lagerberg & Melin (1927, fig. 33) and by Hahn (1930, fig. 24) of *D. pinicola* and *P. pseudotsugae* respectively, only negligible divergencies are seen; concerning the form and size of spores and sporophores. The mode of spore formation is the same in both cases. Thus the identity of the two fungi seemed rather probable.

In February 1949 I sent cultures of 100 : 2 and 30-I to Dr. G. G. Hahn, New Haven, U.S.A., who has — more intensively than any other, I think studied conifer-inhabiting *Phomopses* in culture. He also received original material of pycnidiferous Douglas bark from Forde. Dr. Hahn was inclined to think the two isolates identical and writes 6. 7. 1949: „The fungus, if not the same as *Phomopsis pseudotsugae*, is certainly closely related to that species, perhaps a form or strain of *pseudotsugae*.“ Unfortunately, cultures of 100 : 2 and of a new isolate, both sent to Prof. Lagerberg, were broken during transport.

The new isolate mentioned originated from a died-back branch of *Larix sibirica* Ledeb. collected at Os in Hedmark county, June 1949. At the base of the dead part the branch carried numerous pycnidia which, without hesitation, I identified with *P. pseudotsugae*. several bark- and monospore-cultures were isolated which presented,

all of them, the appearance characteristic to *D. pinicola*, apart from their extremely vigorous growth. Their pycnidia and spores were just like those of that fungus. I sent the original sample and cultures of this isolate (No. 241) to Dr. Hahn who had already received cultures of the above-mentioned *Discula* No. 131-h and another *Discula*-isolate (No. 239) from spruce. 1. 12. 1949 he writes: „The fungus which you isolated from the larch twig (cultures 241 & 241-m), the specimen of which you sent me, is undoubtedly *Phomopsis pseudotsugae* Wilson 1920 (= *P. strobi* Syd. 1922)“ and further: „Culturally your isolates submitted for examination with the following determinations namely:

Discula pinicola

30-I from spruce

239-3 from spruce

100 : 2 from Douglas fir

131-h from spruce (confirmed Lagerberg)

Phomopsis pseudotsugae

241 from larch (identification Robak)

241-m from larch (identification Robak)

resemble each other so closely on synthetic malt and potato dextrose agars that we can only regard them as all the same thing. At the present time I am not actively engaged in work on *Phomopsis pseudotsugae* and unfortunately do not have cultures of it in stock for direct comparison with your isolates from Norway. I reisolated your *pseudotsugae* in monospore culture, however, from the Siberian larch twig you sent me and my isolates are identical with yours (241 and 241-m). The culture characters are those I recognize as typical for Wilson's species. It now seems evident that the fungus our good friend Prof. Lagerberg regards as *Discula pinicola* (Naum.) Petr. on spruce and pine is none other than Wilson's *P. pseudotsugae* on Douglas fir etc.“

In December Prof. Lagerberg received new cultures of 100 : 2 and 241 and a culture of 239. Lagerberg who had never himself studied *P. pseudotsugae* in culture, hesitated in drawing any definite conclusions although he thought the isolates sent him very like each other. No. 239 was — and has remained — sterile. On Prof. Lagerberg suggestion I transferred inoculi of my *Discula* or *P. pseudotsuga* isolates to sectors of stem sections from freshly cut *Pinus silvestris* L. in sterile Petri dishes. The sectors had been subject to a partial sterilisation by the method of Lagerberg & Melin modified by the author.

During several months no pycnides were formed. Recently, however, when the author had intended to condemn the cultures, fertile pycnides were discovered on the tangential and end surfaces of one sector inoculated with the Douglas fungus 100—2, and

sterile pycnides occurred on the tangential wood surface of one sector inoculated with the larch fungus 241. In both cases the pycnides did in all respects conform with culture pycnides described by Lagerberg and Melin in *Discula pinicola*. Several of the isolates caused a distinct „blueing“ of the just the same colour as that induced by *Discula pinicola*, according to the illustrations given by Lagerberg & Melin (1927, Pl. I), and which is actually no blue but more like a dark olive grey. The most intensive and rapidly spreading stain was caused by No. 241 whose identity with *P. pseudotsugae* has now been fully settled.

In pair cultures all the isolates have intermingled more or less completely. The only exception was No. 30-I. Between this isolate and any of the rest a distinct border has persisted. With this exception, we are now justified, I think to conclude that all the isolates mentioned belong to one and the same species, i. e. that *Discula pinicola* (Naum.) Petr. and *Phomopsis pseudotsugae* Wilson are identical. The last name is the oldest and must be the valid one. Regarding No. 30-I, it seems somewhat uncertain whether it does not represent a distinct variety. However, I hesitate in adding still another such to the crowd of forms and varieties already described within the *Phomopsis*.

From the viewpoint of a pathologist the main conclusion must be that *Phomopsis pseudotsugae* is a wide-spread saprophyte on various conifers and can be reckoned among the „blueing fungi“. Obviously, however, fruiting occurs very rarely on pine and spruce in nature. The only example reported in literature seems to be that of Naumov.

Further, the existence of strains of varying virulence seems most probable. In the case of the Siberian larch mentioned above all facts observed favoured the assumption that here the fungus acted parasitically, just as in similar cases described from larch by the author (Robak 1946). Although not at all conclusive of its parasitism, it is worth noting that the mycelium isolated (No. 241) was of a strikingly superior vigour when compared with the rest of isolates.

I am highly indebted to Dr. Hahn and Prof. Lagerberg for the most valuable help they have yielded me during the work reported on in the present paper.

Forest Research Station of Western Norway, Bergen, April 1952.

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Zoologisch-Botanische Datenbank/Zoological-Botanical Database

Digitale Literatur/Digital Literature

Zeitschrift/Journal: [Sydowia](#)

Jahr/Year: 1952

Band/Volume: [6](#)

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Artikel/Article: [Phomopsis pseudotsugae Wilson - Discula pinicola \(Naumov\) Petr. as a Saprophyte on Coniferous woods. 378-382](#)