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SPOROTRICHUM NARCISSI SP. N. PARASITIC ON *NARCISSUS* BULBS

BY

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Sporotrichum Narcissi sp. n. による水仙の一新病害に就きて

栃内吉彦　島田昌一

Introduction

In the spring of 1930 the senior author found a severe hindrance in the growth of *Narcissus pseud-Narcissus* L. in Tokio. At the end of April, while the plants growing near by were sound and in full bloom, the plants under consideration had grown only from 6.7 cm. to 3 cm. high above the ground bearing no flowers. They looked something like the plants newly shooted, and the tips of the leaves yellowed slightly. These diseased plants have been observed continuously by family members from their late shooting in the early spring up to the end of April. They have grown only about several cm. above the ground during the period of nearly a month.

Neighboring to the row of the diseased *Narcissus* a row of *Crocus* was planted. The *Crocus* also showed a very sickly growth remaining one or two cm. high above the ground without bearing any flowers, and the leaves were found almost in a damping-off state. They were digged up and examined on May 2nd.

The bulbs of the *Narcissus* were severely attacked by a fungus which produced dark green colored acervuli abundantly on the surface of the bulbs.

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Those of the *Crocus* were also affected by apparently the same fungus, and the substance of the bulbs was already decayed out, leaving only the outer scales intact. The specimens were brought to the laboratory where the further investigations have been done.

Diagnosis

The leaves were so severely hindered in their growth as to be only several cm. high above the ground at the end of April, when the normal individuals have bloomed already. However, no lesions or other striking outward symptoms, except the dwarf growth and a slight yellowing at the tips of the laeves, were observed. But remarkable indications of a fungus disease appeared on the bulbs. An abundance of small cushion-shaped and dark green colored acervuli were found scattered all over the surface of the bulbs. Young mycelial cushions were snow-white in color at first, and then became green turning deeper by degrees to dark green by the formation of conidia.

In cases of the severely affected bulbs the apical and basal parts decayed more or less. In such cases the hindrance in the growth of the shoots was quite remarkable and the leaves remained 4 or 3 cm. in height.

Sections of the diseased bulbs revealed that the decay advanced lengthwisely along the scales and not across them, but in cases of the severely affected bulbs the decay advanced deeply into the substance of the scales at the upper and basal parts.

In insignificant cases of the disease the affected plants seem to grow almost alike to the healthy one in size, but they bear no flowers in general. The leaves of such plants are somewhat slender compared with those of the healthy ones, looking rather weak and feeble in appearance.

The Causal Fungi

Two kinds of fungi belonging to the genus *Sporotrichum* were found by microscopical tests of the acervuli produced on the surface of the diseased bulbs. They were isolated by the diluting method in apricot juice agar medium. On the artificial culture medium two different kinds of *Sporotrichum* were clearly

distinguishable from each other.

One of them is apparently identical with *Sporotrichum radicicolum* ZIMMERMANN. A. ZIMMERMANN (1902), who had reported on the fungi observed on some tropical cultural plants, described this fungus as a new species. His description of the fungus is cited in full as follows:

"*Sporotrichum radicicolum* sp. n.: Auf abgestorbenen Wurzeln erst weisse, apäter spangrüne Polster bildend, die aus hyalinen, bis 4 μ dicken Hyphen bestehen. An diesen entstehen die niederliegenden Conidienträger teils seitenständig, teils endständig; diese tragen auf flashenförmigen Sterigmen eine Conidie. Conidien oval, grün, 4–3 μ lang, 2.5–2 μ breit. Bilden sich auf versiedenartigen abgestorbenen Wurzeln, die einige Zeit in feuchter Luft bewahrt waren."

The details of the description of *Sporotrichum radicicolum* above cited are almost identical with one of the fungi found on the bulbs of *Narcissus* and *Crocus*.

The mycelial masses produced on the surface of the bulbs consist of loosely gathering conidiophores in small cushion-like forms which are white in color at first, becoming pale yellowish green or buff color by the formation of conidia. Conidiophores are hyaline, branched, and 5.5–4.5 μ wide. Sterigmata, characteristic to the genus *Sporotrichum*, are produced laterally on the conidiophores or terminally on the branches of the conidiophores, and are short flask-shaped, and 9.5–4.5 × 5,0–3.3 μ, most frequently 5.5 × 3.5 μ. Conidia are produced on the attenuated end of the flask-shaped sterigmata, and are mostly oval or ellipsoidal, pale yellowish green or almost colorless, and 4.5–2.5 × 3.0–1.8 μ in size.

In the ZIMMERMANN's description it is understood that *Sporotrichum radicicolum* is a saprophyte and develops only on dead roots of various kinds of plants. The fungus in question, however, being a facultative parasite can infect living *Narcissus* bulbs through wounds. Setting aside this slight difference in the parasitic behavior of the present fungus and the ZIMMERMANN's species and considering the striking morphological likeness observed between them, the authors should like to consider that the fungus in question is identical with *Sporotrichum radicicolum* ZIMMERM. The occurrence of this species in Japan has not been reported up to the present time.

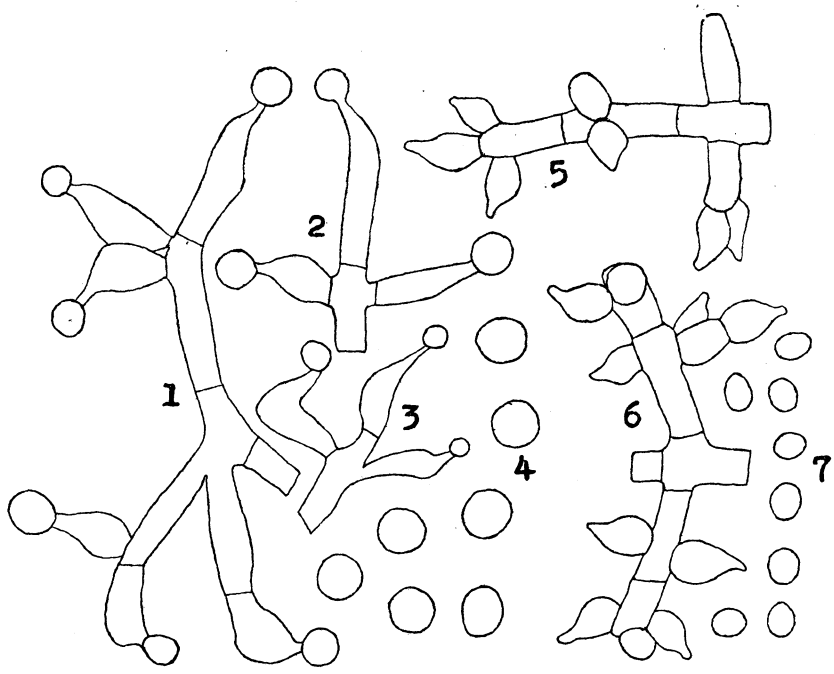

Fig. 1.

Figures 1–4. *Sporotrichum Narcissi* sp. n. (×1520)
1. A conidiophore bearing sterigmata and conidia.
2 & 3. Sterigmata producing conidia.
4. Conidia.
Figures 5–7. *Sporotrichum radicicolum* ZIMMERMANN. (×1520)
5 & 6. Conidiophores bearing sterigmata.
7. Conidia.

Another species of *Sporotrichum* found parasitic on the bulbs of *Narcissus* and *Crocus* is obviously different from *Sporotrichum radicicolum* ZIMMERM. in several important morphological characters and in the parasitic behavior. Furthermore the present fungus could not be identified with any other described species of *Sporotrichum*. For these reasons the authors should like to treat this fungus as a new species, giving the following name and description:

Sporotrichum Narcissi TOCHINAI et SHIMADA, sp. n.

The mycelial cushions formed on the surface of the substrata consist of loosely gathered conidiophores, white in color at first, turning dark green later

by the formation of conidia. Conidiophores hyaline, variously branched, 4.5–2.0 μ wide. Sterigmata produced laterally on the conidiophores or at the ends of short branches of the conidiophores, oblong, straight or curved, attenuated, or acute, 15.0–5.0 × 4.0–2.0 μ, most frequently 10 × 3.0–2.5 μ. Conidia produced directly on the tips of the conidiophores or on the sterigmata, almost sphaerical but sometimes slightly ovoid or ellipsoid in shape, green in color, 5.0–3.3 × 4.5–3.0 μ.

Parasitic on the bulbs of *Narcissus peudo-Narcissus* L., (collected in Tokio by TOCHINAI), on the bulbs of *Crocus* (collected in Tokio by TOCHINAI), and on the bulbs of *Lilium* (collected in Sapporo by Y. HOMMA).

Sporotrichum Narcissi can quite easily be distinguished from *Sporotrichum radicicolum*. At first sight by the naked eyes the mycelial cushions formed by loosely gathering conidiophores bearing abundant conidia are dark green in color in the former, but light cress green or pale olive buff in the latter. Remarkable differences in the character of the sterigmata are observed between them. Short flask-shaped sterigmata are formed laterally on the branched conidiophores in abundance in *Sporotrichum radicicolum*, while the sterigmata of *Sporotrichum Narcissi* are generally somewhat twice longer and more irregular in shape than those of the former species and do not develop so well as in the case of the former species, especially in old cultures they are no longer found at all. The conidia of *Sporotrichum Narcissi* are larger in size and darker in color than those of *Sporotrichum radicicolum*.

Pathogenicities and Cultural Characters of the Fungi

The bulbs of *Narcissus pseud-Narcissus* L. attacked by the fungi, which were collected by one of the authors in Tokio, had their leaves been cut off after the flowering season of the preceding year, and left over winter in the garden soil. Other rows of the *Narcissus* neighboring to the affected row having bloomed profusely without any sign of the disease had been left as usual without cutting the leaves. Other conditions being quite similar it is reasonable to assume that the cutting of the leaves gave an occasion for the outbreak of the disease. The dead cells of the unhealed cut surface of the leaves and

mucilaginous substances oozing out of the wounds might promote the wound infection of the facultative parasites.

The infective power of the fungi was tested with a series of infection experiments.

The apparently healthy bulbs of the *Narcissus* were sterilized with 1‰ aqueous solution of corrosive sublimate and their leaves were cut off with a pair of sterilized scissors. The bulbs were put in the sterilized moist vessels and inoculated with the fungi in the following ways. (1) The leaves were cut off close to the bulbs and the conidia of the fungi were inoculated to the wounds. (2) Similar wounds were burned with a gas flame and inoculated with the conidia of the fungi. (3) The bulbs were given cross incission wounds by sterilized knives and the conidia of the fungi were inoculated in the wounds. (4) The bulbs were given cross incission wounds with red heated knives and the conidia of the fungi were inoculated in the wounds.

In all cases of the present inoculation experiments the infection occurred more or less. The most vigorous infection took place in the 2nd series of the experiments, and the 1st series came next. No difference in the vigour of the infection appeared between *Sporotrichum Narcissi* and *Sporotrichum radicicolum* in the cases of the 2nd series, but in the 1st series the former grew more vigorously than the latter. In the 3rd series the infection and the mycelial growth of *Sporotrichum radicicolum* were slightly recognized, while *Sporotrichum Narcissi* grew on the wounds more vigorously. The infections in the 4th series occurred somewhat better than those in the preceding cases, and *Sporotrichum Narcissi* produced typically colored mycelial cushions.

It is to be inferred from the results of the inoculation experiments that both fungi can attack the *Narcissus* bulbs at least through wounds, and the parasitic behavior of *Sporotrichum Narcissi* is stronger than that of *Sporotrichum radicicolum.*

Both fungi grew readily on the following culture media at room temperature ranging from 28° to 15° C.: apricot juice agar, onion decoction agar, *Narcissus* bulb decoction agar, Koji decoction agar, steamed *Narcissus* bulb, and steamed rice.

In the cultures of *Sporotrichum Narcissi* white aerial mycelium grew rapidly

over the surface of the media, and within several days after inoculation the small mycelial cushions were produced abundantly. They were white in color at first, turning to deep green color later by the formation of the conidia. The colors of the mycelial cushions varied a little according to the difference of the culture media, for instance dusky olive green on apricot juice agar and dark green on Koji decoction agar. Characteristic sterigmata were formed in fresh cultures conspicuously, but they have on longer been found in old cultures in which the conidia were produced directly on the branched conidiophores.

Vegetative mycelium becomes often swollen terminally or intercalarly, thus producing gemmae which are sphaerical to short ellipsoidal in shape and 12–7.5 μ in size. The gemmae germinate readily without distinct resting.

In the cultures of *Sporotrichum radicicolum* the vegetative mycelium crept on the surface of and in the media, and aerial mycelium was hardly observed in general. The mycelial cushions were white in color at first and turned light cress green color on apricot juice agar and to pale olive buff color or tilleul buff color on the other kinds of media examined. Sterigmata were produced abundantly on variously branched conidiophores even in old cultures.

Further investigations on the physiology of the fungi and the prevention measures will be published in other days.

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Literature

SACCARDO, P. A.:—Sylloge Fungorum XVIII, p. 525.

ZIMMERMANN, A.:—Ueber einige tropischen Kulturpflanzen beobachtete Pilze. II. Cent. Bakt. 2 Abt., VIII, p. 216–221, 1902.

摘　　要

昭和五年五月初旬、東京に於て一列のラツパズイセン (*Narcissus pseudo-Narcissus* L.) が顯著なる生長障害に陷り、健全なるものゝ滿開時期に、草丈やうやく 6.7-3 cm. に止まり、全然花をつけず、葉端少しく黃化せるを認め、鱗莖を堀り出して驗するに其の表面に、夥しく綠色の菌叢を着生して、之を縱斷すれば腐蝕、鱗片に沿ひて縱に進行し、侵害部の褐變せるを見たり。

病植物鱗莖上に現れたる菌叢の檢鏡、分離、培養及び接種試驗の結果、病源菌は *Sporotrichum* 屬の二種の菌なる事を知れり。其の一は植物の枯死せる根に死物寄生的に着生する *Sporotrichum radicicolum* ZIMMERM. にして、本邦に於ては未だ本菌に關する報告の發表せられたものあるを聞かず、他の一は全く未記載の種類なる事を認め、之に對して *Sporotrichum Narcissi* TOCHINAI et SHIMADA なる學名を附し、記載を與へたり。

兩者ともに傷痍寄生菌にして、前者は A. ZIMMERMAMNN によりて死物寄生菌として記載されたるものなれども、著者等の接種試驗に於ては、水仙鱗莖の傷部に接種をおこして生活ある組織にも侵入し、之を侵害する点余等の新種に似たり。然れども後者即ち、著者等の種類は ZIMMERMANN の種類に比して、病源性一層强盛なるを見たり。

Sporotrichum Narcissi sp. n. と *Sporotrichum radicicolum* とは菌叢の色が、前者は濃青綠色、後者は淡黃綠色乃至軟皮色、分生胞子が前者は大にして綠色、後者は小にして無色乃至微綠色、小柄 (sterigmata) が前者は不整長フラスコ形にして大、後者は整短フラスコ形にして小なる点等に於て、容易に明かに區別する事を得可し。

前記東京に於て發見せる被害水仙は、その列に限り前年の花期後に葉を剪除し、其のまゝ花壇の土中に越年せしめたるものにして、剪葉による傷部の死細胞組織及び其の部分に漏出せる粘液質物は、半死物寄生菌たる兩菌の接種を助長せるものと推測せらる。

兩菌はラツパズイセンの外、前記被害水仙に隣接して植栽されたるサフランの鱗莖を犯して之を枯死に陷らしめ、尙又、七月札幌に於て著者等の菌が、百合の地下部を犯して之を枯死に瀕せしめたるを見出したり。

本菌の生理及び豫防驅除に關する詳細の研究は、後日發表する處ある可し。

北海道帝國大學農學部植物學教室に於て