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FIRST REPORT OF *CYLINDROCLADIUM SCOPARIUM* ON *CUPHEA HYSSOPIFOLIA* IN POLAND

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Abstract: *Cylindrocladium scoparium* Morgan was isolated from diseased stem parts of *Cuphea hyssopifolia* cuttings, which were rooting on greenhouse benches. In the laboratory trial, the species colonized leaf blades as well as stem parts and roots with a significantly quicker spread of necroses on cv. Violet than on cvs. White and Rose. In the greenhouse trial, yellowing and dying of cuphea leaves was observed already after 7 days of rooting the cuttings in substratum infested by *C. scoparium*. After 2 weeks, all cuttings that were rooting in noninfested substratum produced roots, and no symptoms were observed on leaves. On plants growing in substratum infested with the tested species, yellowing, dying of leaf blades and only rooting of 1/5 of the cuttings was observed on cv. Violet, whereas cvs. White and Rose were less susceptible.

Key words: *Cuphea*, rooting, *Cylindrocladium*, symptoms, cultivars

Cuphea hyssopifolia is a perennial plant grown for about 4–6 weeks under cover and later on flower beds or in balcony compositions. The genus *Cuphea* includes approximately 250 species of annual, evergreen perennials, and short shrubs native to central and south America (Cacciola *et al*. 2006). In the early stage of plant development, species of *Pythium* and *Phytophthora* may be responsible for seedling blight and damping-off (Berti *et al*. 2008). In Poland, cutting which are about 6-weeks-old, and rooted on greenhouse benches, are export products to western European countries. In February 2011, in one commercial ornamental nursery, inhibition of rooting or lack of roots forming, yellowing and dying of lower leaves, defoliation and rotting of stem bases was observed (Fig. 1).

Fig. 1. *Cuphea* cv. Violet affected by *C. scoparium*

During the rooting process, greenhouse benches were covered with greenhouse film for about 2 weeks, with the temperature fluctuating between 20 to 24°C. The disease symptoms occurred in points with a few pots, and usually on cv. Violet but also occasionally on cvs. Rose and White. On leaves of dying plants white mycelium with spores, and very small, white and later dark microsclerotia were observed. The purpose of the study was to evaluate a causal agent of cuphea collapse.

Isolation of fungi from symptomatic cuphea cuttings and from substratum

About 50 cuttings showing disease symptoms were collected in plastic bags. Additionally, substratum from affected plants was also collected and transferred to the laboratory. After washing under the tap and washing with distilled water, drying between layers of blotting paper, and sterilizing over a burner flame, about 3–5 mm long pieces of symptomatic stem parts were plated on PDA medium in 90 mm Petri dishes, and incubated 3 days at 25°C in the dark. Parts of colonies growing around inocula were transferred into PDA plants. Rhododendron leaf baits and the procedure described by Themann and Werres (1998) were used for detection of fungi from substratum. Obtained isolates were grouped by growth pattern and their morphology. Representative cultures were identified to species based on morphology features (Linderman 1972).

Colonisation of cuphea parts and cuttings by *Cylindrocladium scoparium*

In laboratory trials, the colonization of leaf blades, stem parts, and roots of 3 cuphea cultivars were studied using the procedure described by Orlikowski and Szkuta

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(2002). In the greenhouse experiment, the cuttings of 3 cuphea cultivars were planted into peat which was free of *C. scoparium*, and to substratum artificially infested with the tested species (Orlikowski 1999). Plants were covered with greenhouse film, and cuttings were rooted over a 14 day time period. The number of infected leaves, and the rooted and dead cuttings were evaluated 1 and 2 weeks after planting. The experimental design was completely randomized with 4 replications and 5 plant parts and cuttings in each replication. Trials were repeated twice.

RESULTS AND DISCUSION

C. scoparium dominated among the fungal species obtained from affected cuphea cuttings. The species was isolated from 9/10 of the analysed cuttings of stem parts, whereas *Botrytis cinerea* Pers. from 1/5, and *Pythium ultimum* Trow. from 1/10 plants. *Mucor* and *Penicillium* species were isolated only sporadically. Using rhododendron leaf blades as the bait resulted in the detection of *C. scoparium* from substratum taken from under diseased cuttings.

In vitro inoculation of cuphea parts by *C. scoparium* resulted in their colonization, and necroses spread significantly quicker on cv. Violet than 2 other cultivars (Table 1). Plant roots were colonized quicker than leaves and stem parts (Table 1).

In the greenhouse trial, after a 7-day-rooting of cuttings in substratum infested by *C. scoparium*, yellowing and dying of leaves was observed on 3 cultivars, with the highest number on cv. Violet and the lowest on cv. White (Fig. 2, 3). More cuttings which were dying were observed on cv. Violet than 2 other cultivars (Fig. 2). One week later, all cuttings rooted in noninfested substratum produced roots and their leaves did not show any disease symptoms. Only part of the cuttings produced roots in substratum infested with *C. scoparium* (Table 2). Only 1/5 of the cuttings of cv. Violet were rooted, and 2/5 of them died. Most of the leaves on such cuttings were yellow brown or dead (Table 2). On cv. White, only about 3/8 of leaves were yellow or necrotic in comparison to 6/8 on cv. Violet (Table 2).

Burnes and Linderman (2001) indicated Cylindrocladium diseases as being primary during nursery propagation. The damage can occur at all stages of plant production but cuttings are the most vulnerable to infection during propagation because of high temperature, substratum moisture and close spacing. Severe leaf infection, their yellowing and defoliation can result due to the high levels of ethylene induced by the pathogen. Intensive sporulation of *C. scoparium* on infected leaves at cuphea cutting bases, was connected mainly with their contact with moist, infested substratum. Overhead irrigation of young plants disseminates conidia and provides favourable conditions for spore germination and infection (Linderman 1972). The species was previously noticed as the stem base and root pathogen of coniferous rootstocks (Orlikowski and Jarecka 2005). This is, however, the first report describing Cylindrocladium cutting rot of *C. hyssopifolia* in Poland.

Table 1. Colonisation of *C. hyssopifolia* parts by *C. scoparium*; 4(a) and 6 (b) days after inoculation; diameter/length of necrosis in mm in laboratory trial

Cultivars	Leaf blades		Stem parts		Roots	
	a	b	a	b	a	b
Rose	8.7 b–d	10.8 a	7.0 ab	16.0 b	6.9 ab	20.0 c
White	7.3 a–c	11.5 a	5.7 a	10.9 a	7.2 ab	17.3 b
Violet	9.2 cd	15.2 b	10.0 d	17.6 b	25.8 e	33.8 d

Means in columns, followed by the same letter do not differ with 5% of significance acc. to Duncan's multiple range test. Means separation for each observation period

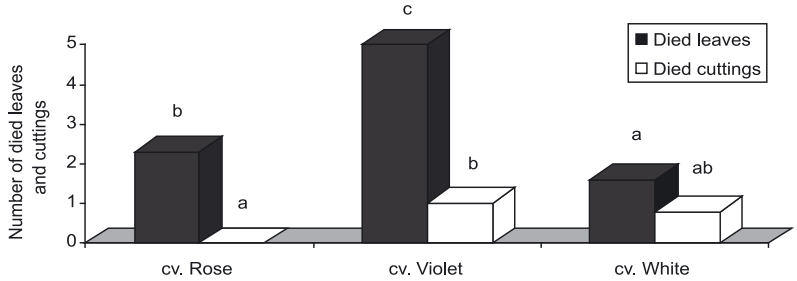

Fig. 2. Influence of *C. scoparium* on healthiness of rooted *Cuphea* cuttings 7 days after planting; greenhouse trial

Fig. 3. *Cuphea* cuttings of 3 cultivars, rooting in peat infested with *C. scoparium.* From left to right: control noninfested; cvs. White; Rose; Violet

Table 2. Influence of *C. scoparium* on rooting of *C. hyssopifolia* cuttings 14 days after planting; greenhouse trials

Cultivars	Number of dead leaves	Number of rooted cuttings* (n = 5)	Number of dead cuttings
Rose	4.3 b	1.5 b	1.0 a
White	2.9 a	1.8 b	0.8 a
Violet	5.5 b	0 a	1.8 a

*all cuttings rooted in noninfetsed substratum produced roots and were healthy

Means in columns, followed by the same letter do not differ with 5% of significance acc. to Duncan's multiple range test. Means separation for each observation period

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POLISH SUMMARY

PIERWSZE DONIESIENIE O WYSTĘPOWANIU *CYLINDROCLADIUM SCOPARIUM* NA *CUPHEA HYSSOPIFOLIA* W POLSCE

Z porażonych sadzonek *Cuphea hyssopifolia,* ukorzenianych na parapetach w szklarni, izolowano *Cylindrocladium scoparium*. W doświadczeniach laboratoryjnych badany gatunek kolonizował blaszki liściowe, części łodyg i korzeni 3 odmian kufei z istotnie szybszym rozwojem nekrozy na odmianie Violet. W doświadczeniach szklarniowych na sadzonkach ukorzenianych w substracie torfowym zakażonym przez *C. scoparium* już po 7 dniach stwierdzono żółknięcie i zamieranie dolnych liści. Po 2 tygodniach wszystkie sadzonki rosnące w niezakażonym podłożu wytworzyły korzenie, a ich liście były zdrowe, podczas gdy na roślinach ukorzenionych w torfie zakażonym przez *C. coparium* obserwowano żółknięcie blaszek liściowych i ich zamieranie. Sadzonki odmiany Violet ukorzeniły się w około 1/5 podczas gdy 2 pozostałe odmiany były bardziej tolerancyjne na badanego patogena.