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OCCURRENCE OF ROOT ROT OF SUGAR BEET CULTIVARS

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Abstract: Serious losses caused by root rot of sugar beet were observed in Poland in 2001 and 2002. The disease occurred in most of regions of sugar beet cropping from June to the end of growing season. Very high losses of yield were observed on many fields especially on cultivar Lolita in 2001.
The aim of this work was to detect the casual agent of root rot (2001) and to compare susceptibility of sugar beet cultivars to this disease (2002–2003). The laboratory tests (2001) showed that most of destroyed roots were infected by *Aphanomyces cochlioides* Drechsler. This species is very well known as a pathogen of sugar beet seedling damping-off in Poland. The fungus *Rhizoctonia solani* Kühn was found only in 12% of rotten roots collected in south-eastern part of Poland. In field trails the highest number of infected roots and the highest infection index were found for cultivar Arthur (2002–2003). That cultivar was significantly more susceptible to root rot than the rest of tested cultivars.

Key words: *Aphanomyces cochlioides, Rhizoctonia solani.* sugar beet, root rot diseases, susceptibility

INTRODUCTION

The fungus *A. cochlioides* is one of the most serious soil-borne pathogens of sugar beet. It occurs as two distinct forms on this plant (Buchholtz and Mrerdith 1944). In the early season it causes damping-off of sugar beet seedlings. This pathogen can also invade older roots during the periods when soils are wet and hot (Windles and Nabben-Schindler 1996). Infected plants usually occur in patches on a field. Leaves of infected plants can wilt during the hot sunny days and very often they become yellowed. The symptoms start as yellowish-brown water-soaked lesions on any part of taproot but they mostly occur on the distal end as a tip rot. The disease progress can continue through the growing season if soil conditions are favourable. The pathogen attacks the underground part of root and very often only fibers and vascular elements remain intact. The crown is usually symptomless. Very similar symp-

toms are observed in the case of *R. solani* infection. *R. solani* usually infects root under the crown and the infected area spreads over the root surface. The first symptoms of infection is a dark brown-grey rot. It can be accompanied by cracking or the presence of slightly sunken lesions scattered over the surface of infected taproots. Rhizoctonia rot causes yellowing and wilting of leaves and petioles are often blackened and rotten at the point of attachment to the crown. This root rot occurs very frequent in Europe especially in Germany (Büttner and Benker 1999).

The unexpected outbreak of root rot symptoms on a sugar beet crops was observed in Poland in 2001 and 2002 seasons. Especially a very strong infection was observed in 2001. Heavy rainfall followed by high temperature stimulated activity of the pathogens. The disease occurred mainly on the fields with a poor soil structure and plough pan where the high content of water was maintained for a long time. The largest infected areas were observed in south-east, north and some regions of central Poland. In the past root rot caused by *A. cochlioides* was described in Poland only once in 1996 (Maćkowiak 1998) but the disease was rare in that time.

The aim of this work was to indentify the pathogen which caused root rot of sugar beet crops in Poland during the growing season (2001) and to compare susceptibility of some beet cultivars to this disease (2002 and 2003).

MATERIALS AND METHODS

One hundred and thirty three decaying roots were collected from twenty seven plantations in three regions of sugar beet production from June till the end of growing season in 2001. To find the pathogen three fragments from the edge between healthy and decayed tissue were cut from each root and incubated on water agar in moist chamber for two days. Then they were examined with the microscope for the presence of mycelium of *A. cochlioides* and *R. solani*. In the second test three fragments of rotten roots were put into water for one day to stimulate production of zoospores of *A. cochlioides*.

In two experiments in 2002 and three experiments in 2003 eighteen cultivars of sugar beet were searched for the presence of root rot in field conditions on the experimental plots of British Sugar Overseas in Poland during harvest time. Six cultivars were tested in both years. Each of them was examined for rot symptoms on roots during harvest time. Alltogether two hundred roots were evaluated – fifty per plot in four replications.

Root rot was estimated using the following scale:

9 – root without disease symptoms
8 – some little scars present on the surface of root
7 – area of rotten or scarred tissue occupies about 25% of root surface
6 – decaying scars are sunken into root tissue but they occupy about 25% of surface or less
5 – 50% of surface is with disease symptoms, rotting process occurs in deeper parts of root
4 – rotting process is observed on the whole surface of root, the central part of root is still healthy

3 – the whole root is rotten, only crown above the soil is healthy, leaves still alive but yellowed
2 – also the head above the soil level shows symptoms of rotting, it is very easy to break the plant
1 – root completely rotten, leaves dead.

Dunkan's test was used to compare the results. Per cent index of infection was calculated using Abbot's formula.

RESULTS AND DISCUSION

The rot root of sugar beet occurred in all regions of sugar beet growing in Poland in 2001. The high number of destroyed roots were observed in south-east and north of Poland. Symptoms of this disease were mainly observed on cultivar Lolita. Because of high susceptibility to rot root this cultivar was removed from the market by the breeder.

In laboratory tests the presence of mycelium of *A. cochlioides* was observed in 48% of all examined rotten roots. *Pythium* sp. was found in 26% of them, always in association with *A. cochlioides*. *R. solani* was present only in 12% of rotten roots. This pathogen was isolated mainly from roots collected in the area of Lublin district (south-eastern part of Poland) but always in association with *A. cochlioides*. It was found that *A. cochlioides* was the main pathogen causing root rot in all three regions of Poland from which the samples were collected. The very similar situation was observed in Belgium in 1991 (Wauters et al. 1993). The situation observed during these two years in Poland was different from that usually observed in Europe where *R. solani* is the main problem on the sugar beet fields with root rot (Ayala et al. 2000; Büttner et al. 2003).

The scale used in this work is different than the scale used by Windels and Nabben-Schindler (1996). They used 8 grade scale which gives no opportunity to differentiate between the infection observed on the surface of root and the deep infection which very often does not occur on a larger root surface. The scale used in this search is useful to distinguish differences among roots with only slight symptoms on their surface.

Eighteen cultivars of sugar beet were evaluated for susceptibility to rot root in 2002 and 2003 but only six of them in both years. The results are presented in table 1. The level of root infection on the experimental plots was higher in 2002 than in 2003. Strongly decayed roots were found in 2002 only. Very slight symptoms were observed in 2003. The significant differences were found among the estimated cultivars in both years of researches. The highest level of infection was found for cultivars Arthur, the lowest for Eureka. The cultivars: Cortina, Isolda, Korab, and Polko showed very similar susceptibility for decaying process. Among the rest of tested cultivars the lowest infection of roots was observed on cultivars Eureka and Leo in 2002 and the higher on cultivar Solist in 2003. It indicates that such tests can be used to find the most useful cultivars for cropping in the regions of root rot occurrence. The problem is that sometimes the two diseases occur together in the same fields and so far there is no cultivar of sugar beet with good resistance against both *A. cochlioides* and *R. solani* (Harveson and Carlson 2003).

Table 1. The occurrence of root rot of sugar beet cultivarss caused by *A. cochlioides* – 2002 and 2003

	Index of infection in %				
Year	2002		2003		
Location	Tłubice	Kowal	Komorowo	Wróblewo	Ogorzelice
Cultivar	% of infection (coefficiant)				
Arthur	8.7	18.6	1.7	0.2	1.8
Cortina	2.8	2.9	0.3	0.3	0.4
Eureka	1.0	1.2	0.8	0.5	0.2
Isolda	1.9	9.8	0.0	0.1	0.2
Korab	1.5	7.6	0.4	0.1	0.7
Polko	2.4	3.5	0.1	0.7	0.3
Arosa	2.9	2.9	not tested	not tested	not tested
Haven	3.4	3.4	not tested	not tested	not tested
Jantar	2.8	2.8	not tested	not tested	not tested
Kujawska	2.0	2.0	not tested	not tested	not tested
Leo	1.2	1.2	not tested	not tested	not tested
Ulla	1.6	1.6	not tested	not tested	not tested
Hetman	not tested	not tested	0.1	0.1	0.6
Lubelska	not tested	not tested	0.1	0.4	0.2
Nabucco	not tested	not tested	0.2	0.1	0.6
Prince	not tested	not tested	0.1	0.1	0.5
Solist	not tested	not tested	0.8	0.9	1.1
Vectra	not tested	not tested	0.1	0.1	0.1
LSD (0.01)	1.3	-	-	-	0.9
LSD (0.05)	-	8.7	-	-	-

CONCLUSIONS

1. *A. cochlioides* was the main causal agent of root rot of sugar beet in central part of Poland in 2001–2003.
2. There are big differences among sugar beet cultivars in susceptibility to *A. cochlioides*. The most affected cultivar was Arthur in both years of tests.

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POLISH SUMMARY

WYSTĘPOWANIE ZGNILIZN KORZENI NA ODMIANACH BURAKA CUKROWEGO

W latach 2001 i 2002 w uprawach buraka cukrowego w Polsce zaobserwowano znaczne straty spowodowane wystąpieniem zgnilizn korzeni. Zjawisko to obserwowane było we wszystkich rejonach uprawy buraka, szczególnie na południowym wschodzie, północy kraju oraz częściowo w Polsce Centralnej. Szczególnie duże straty odnotowano na plantacjach obsianych odmianą Lolita, co było bezpośrednią przyczyną wycofania przez hodowcę tej odmiany z rynku.

Na podstawie badań laboratoryjnych przeprowadzonych na grupie 133 korzeni pobranych w trakcie sezonu wegetacyjnego z 27 plantacji buraka z różnych rejonów uprawy tej rośliny stwierdzono, że głównym sprawcą tego zjawiska chorobowego był grzyb *Aphanomyces cochlioides*. Jego obecność stwierdzono w 48% badanych prób. Grzyb *Rhizoctonia solani*, który jest najczęstszym sprawcą zgnilizn w krajach Europy Zachodniej został stwierdzony jedynie w 12% prób pochodzących z Lubelszczyzny i wykrywany był w tych samych korzeniach co *A. cochlioides*.

Obserwacje zdrowotności korzeni buraka w latach 2002–2003 prowadzono podczas zbioru doświadczeń odmianowych British Sugar Overseas w Polsce. Uzyskane wyniki wykazały w badanej grupie istotnie wyższą podatność na zgnilizny odmiany Arthur. Badania takie mogą być pomocne w doborze odmian buraka do uprawy w danych rejonach.