Fungal Diseases of Chickpea (*Cicer arietinum* L.) Cultivated in the South Region of Poland

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Abstract

The investigations carried out in the last years showed that weather conditions were conductive to growth of chickpea (*Cicer arietinum* L.) in Poland. Our experiments started since 2000 on two cultivars Myles and Sanford. Evans replaced cv. Sanford in second year. The results pointed to the cv. Myles as generally healthiest and the percentage of infested plants was 3.2% in the first year and 0.92% in the next year. The experiment showed that the most important threats for plants during vegetation season were fungi from the genus *Fusarium* and *Rhizoctonia solani*, isolated most often from roots. The basal parts of the stems affected mainly *Alternaria* genus. *Botrytis cinerea*, *Fusarium avenaceum* and *Alternaria* sp. attack most frequently pods and seeds.

Keywords: chickpea; healthiness; fungi

INTRODUCTION

In many regions of the world chickpea (*Cicer arietinum* L.) belongs to the most popular group of vegetables. After soya bean and bean is a third plant in relation to surface cultivated area (CZUCHAJOWSKA 1994; MUEHLBAUER 1994). Nowadays in Poland experiments are conducted to examine an effectiveness method of growing this valuable vegetable. Studies conducted in recent years indicate a possibility of growing some cultivars in the south region of Poland (PONIEDZIAŁEK *et al*. 1996). However, in a cultivation of chickpea some problems appeared connected with the healthiness which diminished a field emergence, a plant development and yielding of the species. First research on the health status of this plant conducted in the south region of Poland indicate a possibility of transformation some fungi on seeds as well as of plant infection by soil born pathogens (WAGNER 1999; MAZUR *et al*. 2001). It is known from literature that chickpea can be attack through pathogens in all development stages. Fungi from *Fusarium* genus can be dangerous parasite during germination period and in the next development stages (DWIVEDI 1989). The most detrimental disease during vegetation period is parasitic wilting caused by *F. oxysporum* f.sp. *ciceris* (KOTASTHANE *et al*. 1987; KUNWAR *et al*. 1989). *F. moniliforme* and *F. solani* causing scale of seedlings and root rot are dangerous pathogens of chickpea (REDDY *et al*. 1990; BHATTI & KRAFT 1992). Similar importance has also *Ascochyta rabiei*, which can infect overground parts of plant (TRAPERO-CASAS & KAISER 1987; DWIVEDI & SHUKLA 1990). *Botrytis cinerea* during rainfall and in lower temperature can cause scale of seedlings, infestation of leaves, stems, flowers and pod rot (SHAHU & SAH 1988; RHATI & TRIPATHI 1991). The main reason of growth inhibition apart ascochyta blight caused by *Ascochyta rabiei* is *Rhizoctonia bataticola* (DHRUB-SINGH *et al*. 1987; TRAPERO-CASAS & KAISER 1987; KAISER & MUEHLBAUER 1998). Another fungus *Alternaria alternata* can also attack all overground parts of plant (RANT & SOMANI 1988). In available literature but rather rarely there are *Sclerotinia sclerotiorum* and *Stemphylium botryosum*, which cause leaf spot disease and pod rot (SIMAY 1989). Black root rot caused by *Thielaviopsis basicola* was also observed in California on chickpea (BUDDENHAGEN & WORKNEH 1988). The lack on information about the fungal diseases of chickpea in polish weather conditions led us to take up the subject.

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MATERIAL AND METHODS

The field experiment was conducted between 2000–2001 on two cultivars: Myles and Sanford. Evans replaced variety Sanford in second year of cultivation. The experiment was performed for all cultivars in four replications. During the vegetation period the health status evaluation was carried out and the percentage of infested plants was estimated. Infestation index was assessed according to 5-grade scale (WOJDYŁA & WIŚNIEWSKA-GRZESZKIEWICZ 2000). The data obtained were subjected to an analysis of variance to determine the differences in infestation of tested cultivars. Plants with evident symptoms of disease were collected from the plantations and macroscopic and microscopic analyses of roots, stems, leaves and pods were done in laboratory. Isolation and identification of fungi was based on standard methods (KIRALY *et al*. 1977).

RESULTS AND DISCUSSION

Analyse of differences between all tested cultivars were significant only in the first year of investigations (Table 1). For Myles percentage of diseased plants was 35.5% in the first year and 24.5% in the second year. In the first year of investigations the percentage of diseased plants cv. Sanford was higher and constituted 42.3%. In the second year when Evans replaced Sanford the percentage of diseased plants was 27.4%. No differences were observed among cultivars (Table 1). As the result of performed mycological analysis 41 species of fungi as well as bacterial colonies were obtained from the diseased plants (Table 2). Their participation in occurrence on morphological parts of plants was differentiated. The result of this study is confirmed by the results of WAGNER (1999) conducted on cv. Giza in the eastern part of Poland. The main number of fungi was noted down on roots, especially through the *Fusarium* genus. The pathogens were present on wilting plants with symptoms of chlorosis. Internal symptoms were associated with necrosis and discoloration of the basal part of the stem. In available literature there is such description of infestation but the authors pay attention on *F. oxysporum* f.sp. *ciceris*. Intensification of the disease depends on type of soil, date and sowing depth (KOTASTHANE *et al*. 1987; KUNWAR *et al*. 1989). In relation to intensity of occurrence *F. avenaceum* is on the second place and *F. solani* on the third place. *F. avenaceum* was frequently isolated from chickpea seeds and had high pathogenicity to seedlings in laboratory and glasshouse conditions investigated in earlier experiments (MAZUR *et al*. 2001). Although it seems to be that *F. solani* can cause big economic problem in our research occurred in lower degree to the others from *Fusarium* genus but many recent works pointed out its high pathogenicity to chickpea (GAUR & TAYAGI 1988; DEB & DUTTA 1991; WAGNER 1996). *Rhizoctonia solani* was isolated mostly from the roots, probably because of the earlier cultivation of potatoes on this place. In countries with big area of chickpea cultivation, *R. bataticola* is the most important fungus, which can cause rotting of seeds, root rot of seedlings and later necrosis of root collar (DHRUB-SING *et al*. 1987; TAYA *et al*. 1988). From the diseased stems especially from the stems near to soil additionally *Alternaria alternata* was isolated. *Alternaria alternata* was also isolated from the dry leaves and pods, from which overgrow to seeds what was confirmed by examine seeds immediately after their collecting (MAZUR *et al*. 2001). According TIWARI and SAHU (1989) dominance of this species in settling phyllosphere fall on blooming season. However, results of our experiment did not confirm it because in all terms of isolation it dominated the others. Similarly *Botrytis cinerea* and *F. avenaceum* outnumber isolates obtained from browning spots occurring on pods diseased plants. It is known from literature that there is dependence between intensification of occurrence *Botrytis cinerea* and cultivar as well as term of sowing and in conse-

Table 1. Healthiness of chickpea during the years 2000–2001

Cultivar	Plants' healthiness			
	2000		2001	
	infestation index	percentage of diseased plants	infestation index	percentage of diseased plants
Myles	3.2 a	35.5 a	0.92 a	24.5 a
Sanford	6.0 b	42.3 a	–	–
Evans	–	–	1.85 a	27.4 a

Means in columns, followed by the same letter do not differ with 5% of significance (Duncan's multiple range test)

Table 2. Microorganisms isolated from diseased parts of plants

Microorganism	Analysis of plants			
	roots	steams	leaves	pods
Acremoniella atra (Corda) Sacc.		+	+	+
Acremonium strictum W. Gams				+
Acremonium kilienze Grutz				+
A. murorum (Corda) W. Gams				+
Alternaria alternata (Fr.) Keissl.	++	+	++	++
A. chartarum Preuss		+	+	+
A. tenuissima (Kunze) Wiltshire		+	+	+
Ascochyta sp.			++	+
Botrytis cinerea Pers.	+	+	++	++
Chaetomium globosum Kunze ex Steud		+		
Chrysosporium pannorum (Link) Hughes	+			
Cladosporium cladosporioides (Fres.) de Vries			++	+
Cylindrocarpon didymum (Hartig) Wollenw.	+	+		
Epicoccum purpurascens Ehrenb. ex Schl.	+	+	+	+
Fusarium avenaceum (Corda ex Fr.) Sacc.	+++	++	+	+
F. culmorum (W.G. Sm.) Sacc.	++	+		+
F. lateritium Nees ex Link	+	+		+
F. moniliforme Sheldon	+	+		
F. oxysporum Schl. ex Fries, emend. Snyd. et Han.	+++	++		
F. solani (Mart.) Sacc.	+++	++		
Geotrichum candidum Link ex Leman	++	+		
Gilmaniella humicola Barron	++	+		
Mucor sp.	+	+	+	+
Papularia immersa Hotson				+
Pestalotia sp.				+
Penicillium expansum Link ex Gray emend. Thom	+	+	+	+
Penicillium vermiculatum Dangeard	+	+	+	+
Penicillium spp.	+	+	+	+
Phoma sp.		+	+	
Phytium sp.	+			
Rhizoctonia solani Kuhn.	++	+		
Rhizopus sp.	+	+		
Sclerotinia sclerotiorum (Lib.) de Bary		+		+
S. rolfsii (Sacc.) Curzi	++			+
Sordaria fimicola (Roberge) Ces. Et de Not.	++			
Stachybotrys chartarum (Ehrenb. ex Link) Hughes	+	+		
Stemphylium botryosum Wallroth	+	+	++	+
Torula herbarum Pers. ex Gray	++	+		
Trichocladium opacum (Corda) Hughes				++
Trichothecium roseum (Pers.) Link ex Gray				++
Ulocladium consortiale (Thum.) Simmons	+	+	++	+
Bacteria	+	+	+	+

+++ = a species great intensity (to 70%), ++ = a species in medium intensity (to 40%), + – weak and sporadically occurrence of species (to 10%)

quence it has influence on yield (SHAHU & SAH 1988). Another species and form of fungi are listed in Table 2 occurred in a less degree or occasionally. Bacteria were isolated from all diseased parts of plants, but their percentage participation among all obtained isolates was not high (Table 2). Overall, results of two-year experiments demonstrate that there is threaten because of the mycopathogens occurring in cultivated area of chickpea in the south region of Poland. Furthermore, some species proved to be very pathogenic for chickpea (WAGNER 1996; MAZUR *et al*. 2001).

References

BHATTI M., KRAFT J.M. (1992): Reaction of selected chickpea lines to *Fusarium* and *Thielaviopsis* root rot. Plant Disease, **76**: 50–54.

BUDDENHAGEN I.W., WORKNEH F. (1988): Chickpea improvement and chickpea diseases in California. Int. Chickpea Newslet., **19**: 9–10.

CZUCHAJOWSKA Z. (1994): Process for fractionating legumes to obtain pure starch and a protein concentrate. Washington State University Research Fundation. U.S. Patent, 5: 364, 471.

DEB P.R., DUTTA B.C. (1991): Studies on biological control of root rot disease of soybean caused by *Fusarium solani*, *Rhizoctonia solani* and *Sclerotium rolfsii*. Z. Pfl.-Schutz Krankh., **98**: 539–546.

DHRUB-SINGH K., NEMA K.G., SIMGH D. (1987): Effect of soil amendment on *Rhizoctonia bataticola* causing dry root rot of chickpea. Int. Chickpea Newslet., **17**: 23–25.

DWIVEDI S.N. (1989): Effect of invasion on sugars of gram (*Cicer arietinum* L.) seed during storage. Indian J. Mycol. Plant Pathol., **19**: 10–13.

DWIVEDI S.N., SHUKLA T.N. (1990): Effect of methods of storage on germinability and myco ora of gram (*Cicer arietinum*) seed. Seed Res., **18**: 82–85.

GAUR V.K., TAYAGI R.N.S. (1988): Reaction of certain gram to *Fusarium* black root rot at different dates of sowing. Indian J. Mycol. Plant Pathol., **18**: 62–63.

KAISER W.J., MUEHLBAUER F.I. (1998): An outbreak of *Ascochyta* blight of chickpea in the Pacific Northwest USA in 1987. Int. Chickpea Newslet., **18**: 16–17.

KIRALY Z., KLEMENT Z., SOLYMOSY T., VOROS J. (1977): Fitopatologia – wybór metod badawczych. PWRiL Warszawa.

KOTASTHANE S.R., KHARE M.N., GUPTA O. (1987): Surveying *Fusarium* of chickpea in Madhya Prades, India. Int. Chickpea Newslet., **17**: 21–23.

KUNWAR I.K., SATYAPRASAD K., RAMARAO I. (1989): Histopathology of chickpea plants infected with *Fusarium oxysporum* f.sp. *ciceri*. Int. Chickpea Newslet., **20**: 17–18.

MAZUR S., NAWROCKI J., KUĆMIERZ J. (2001): Fungi isolated from chickpea (*Cicer arietinum* L.) seeds. Vegetable Crops Res. Bul., **54**: 77–81.

MUEHLBAUER F.I. (1994): Description and Culture of Chick peas. Washington State Univ. Pullman: 1–23.

PONIEDZIAŁEK M., SĘKARA-BANDUŁA A., CYWIŃSKI M. (1996): The value of some cultivars of chick pea (*Cicer arietinum* L.) in South Poland. In: II Ogólnopolskie Symp. Nowe rośliny i technologie w ogrodnictwie. 17–19 września, Poznań: 56–62.

RANT B.T., SOMANI R.B. (1988): Alternaria pod blight of gram (*Cicer arietinum* L.) – a new disease in Vidarbha. PKV – Res. J., **12**: 83–85.

REDDY M.V., RAJU R.N., PUNDER R.P.S. (1990): Additional sources of resistance to wilt and root rots in chickpea. Int. Chickpea Newslet., **20**: 36–38.

RHATI Y.P.S., TRIPATHI H.S. (1991): Host range of *Botrytis cinerea* the casual agent of grey mould of chickpea. Int. Chickpea Newslet., **24**: 37–38.

SHAHU R., SAH D.N. (1988): Effect of *Botrytis* grey mould on chickpea owers, pod formation and yield in Nepal. Int. Chickpea Newslet., **18**: 13–15.

SIMAY E.I. (1989): Fungi observed on chickpea (*Cicer arietinum* L.) in 1985–1988. Novenytermeles, **3**: 435–442.

TAYA R.S., TRIPATHI N.N., PANWAR M.S. (1988): In uence of soil type, soil moisture and fertilizers on the severity of chickpea dry root rot caused caused by *Rhizoctonia bataticola* (Taub.) Butler. Indian J. Mycol. Plant Pathol., **18**: 133–136.

TIWARI K.L., SAHU S.K. (1989): Aero-phyllo mycoflora of *Cicer arietinum* L. Adv. Plant Sci., **2**: 39–47.

TRAPERO-CASAS A., KAISER W.J. (1987): Factors influencing development of the telemorph of *Ascochyta rabiei*. Int. Chickpea Newslet., **17**: 27–28.

WAGNER A. (1996): Pathogenicity of some isolates of *Fusarium solani* (Mart.) Sacc. to chickpea (*Cicer arietinum* L.). In: Mat. Symp. Nowe kierunki w fitopatologii, Kraków 11–13 września: 357–360.

WAGNER A. (1999): Fungi colonizing wilting plants of chickpea (*Cicer arietinum* L.) In: Mat. VIII Ogólnopolskiego Zjazdu Naukowego Hodowla Roślin Ogrodniczych u progu XXI wieku. Lublin: 393–396.

WOJDYŁA A.T., WIŚNIEWSKA-GRZESZKIEWICZ H. (2000): Evaluation of rose and species to fungal disease susceptibility. III. Powdery mildew (*Sphaerotheca pannosa* var. *rosae*). Zeszyty Naukowe ISiK, **6**: 177–187.