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Effect of *Colletotrichum* spp. on Yield Components and Grain Quality of Soybean

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Abstract: Under conditions of a natural infection in field, in Corsoy variety the effect of anthracnose on the yield components and grain quality of soybean was studied. *Colletotrichum dematium* was found to cause a reduction in plant height, grain number per plant and grain yield by 3-6%, 9-22% and 8-23%, respectively. *Colletotrichum destructivum* was also found to cause plant height, grain number per plant and grain yield to reduce by 3%, 5-15% and by 8-18%, respectively in relation to the healthy plants of soybean. However, these fungi were not found to essentially exert the synthesis of raw proteins and oils in the grain.

Key words: soybean, *Colletotrichum dematium* var. *truncata*, *Colletotrichum destructivum*, yield, grain quality

Introduction

The group of diseases affecting soybean is often caused by the fungi from the family *Colletotrichum*. Thus, Sinclair and Backman (1989) reported about four fungi, leading to anthracnose most often: *Colletotrichum truncatum* (Schw) Andrus & W.D. Moore (Syn. *Colletotrichum dematium* (Pers. ex. Fr.) Grove var. *truncata* (Schw.) Arx., *Colletotrichum destructivum* O'Gara

(teleomorphous stage being *Glomerella glycines* (Hori) Lehman & Wolf), then *Colletotrichum gleosporoides* (Penz.) Sacc. (teleomorphous stage being *Glomerella cingulata* (Ston.) Spauld & Schrenk) and, *Colletotrichum graminicola* (Ces.) Wilson (teleomorphous stage, being *Glomerella graminicola* Politis).

Two species from the family *Collettotrichum* i.e. *Colletotrichum destructivum* O'Gara (Robotic, 1981) and *Colletotrichum dematium* var. *truncata*, (Jasnic, 1983) have been depicted in domestic literature so far (N'dzi and Djukic, 1997).

Since anthracnose has been discovered only recently, its destructiveness in the current environmental conditions of Vojvodina remains to be seen.

Therefore, the main objective of the paper was to understand how anthracnose might affect soybean yield and its grain quality.

Material and Methods

Based on the differences and the degree of plant infection with anthracnose between unhealthy and healthy plants, it was possible to assess the effect of soybean anthracnose on its yield components and grain quality.

In Becej, 1990, three groups of plants were picked out from the trial plots in irrigation conditions before the harvest: healthy, those with spots on the stems (3-4 or 30-40% of spot) and those with severer signs of infection (6-7 or 60-70% of spot).

Diseased plants were naturally infected with *C.dematium* var. *truncata* and *C.destructivum*. No disease symptoms other than those caused by these parasites, were revealed on the selected plants. The plants with typical symptoms of such fungi were taken from four randomly chosen points. Four specimens (replications) 25 plants each, i.e. 100 plants per replication were taken from each group of plants. The following properties were analyzed: stem height, the number of pods per plant, the number of grains per pod and per plant, respectively. The plants were threshed by hand and grain yield per replications measured. 1000- grain weight (g), oil and raw proteins content were determined. Thus, it was possible to present the obtained results in per cent. For statistical data processing, Student-Newman-Keuls test, was used.

Results and Discussion

From Tab. 1, one can see the results of the effects of the parasite causing soybean anthracnose on the plant height, yield components and grain quality.

C. dematium var. *truncata* apparently caused plants to decrease in height and in the number of grains per plant by 3-6% and by 9-22%, respectively.

The poorest yield was noticed in the plants with a stronger intensity of infection. Thus, the grain yield of soybean was decreased by 8-22.8%.

According to Student-Newman-Keuls test, highly significant differences existed in the number of grains per plant and in grain yield between single categories of infected and healthy plants.

Tab.1. Effect of *C.dematium* var. *truncata* and *C.destructivum* on the degree of infection, plant height, yield components and grain quality of soybean

Variety	Corsoy			Corsoy			Lsd 0.05
Fungus	<i>C. dematium</i> var. <i>truncata</i>			<i>C. destructivum</i>			
Degree of infection	healthy	30-40%	60-70%	healthy	30-40%	60-70%	
Plant height(cm)	117.3	113.9	110.3	117.3	114.6	113.9	8.1
Healthy100%	100.0	97.1	94.3	100.0	97.7	97.1	
Pod no. per plant	27	26	26	27	27	26	3.1
Grain no. per pod	2	2	2	2	2	1	0.1
Grain no. per plant	60	55	47	60	57	51	6.6
Healthy100%	100.0	91.0	78.0	100.0	95.0	85.0	
Grain yield/g (25 plants)	206	189	160	206	189	169	28.2
Healthy100%	100.0	92.0	77.8	100.0	91.9	82.2	
1000-grain weight/g	132.41	131.88	132.46	132.41	126.79	131.23	5.9
Healthy100%	100.0	99.5	100.0	100.0	95.7	99.1	
Oil content (%)	22.8	22.9	22.7	22.8	22.8	22.6	0.4
Raw protein content (%)	39.1	39.6	40.6	39.1	39.4	40.5	1.1

Based upon the 1000-grain weight and the content of oils and raw proteins, the effect of *C.dematium* var. *truncata* on grain quality could be established. Thus, the data show that 1000-grain weight is approximately the same in all the treatments. However, oil content was largely reduced in the grains of infected plants, whereas that of raw proteins remained uniform or even increased. Obviously, this parasite had no direct impact on the synthesis of raw proteins, but it did have an indirect one on the stem height to reduce by 3% and on the grain number per plant to decrease by 5-15%. Thus, the grain yield was decreased by 8.1-17.8%.

Student-Newman-Keuls test has shown extremely high differences in grain number per plant and in grain yield between affected and healthy plants of the Corsoy variety. Nonetheless, 1000-grain weight, oil and raw proteins content remained unaffected by *C.destructivum*.

Little is known about the significance of *C.destructivum* for soybean. For example, its significance in the soybean production in U.S. seems to be much less than that of *C.dematium* var. *truncata*. Considering the possibility of extremely dangerous effects of the soybean anthracnose, Signoret (1990) warned once more that effects of *C.dematium* var. and *C.destructivum* on the yield and quality of soybean had not sufficiently been studied in Europe so far.

While studying the effect of anthracnose on the plant height, grain number per plant and grain yield, all these seemed to have been largely reduced due to the parasite causing anthracnose. Similarly, Backman et al. (1982) established a yield decline by 16-26% averaging 19% in 3 soybean varieties due to an attack by *C.dematium* var. *truncata*. As cited by these authors, the more affected soybean pods, the lower yield would take place. Hepperley et al. (1983) established a reduction in plant height by 1/5 to 1/4 and, in the number and weight of grains, accordingly. These authors also emphasized that in Jupiter variety, *C.dematium* var. *truncata* had brought about remarkable differences in plant height and grain number as well as those in the number of pods and grain

weight. However, in the variety Coob, the number of pods, grains and their weight significantly varied, whereas plant height didn't.

These results are similar to those of Backman et al. (1982) in light of yield decrease, whereas the others seem closer to those obtained by Hepperley et al. (1983).

Such high discrepancies in the results obtained by some authors could be accounted for by different environmental conditions under which these investigations proceeded as well as by the use of different varieties, which consequently caused different disease symptoms.

Conclusion

Based upon current results, the following may be concluded:

- *C.dematium* var. *truncata* caused plant height, grain number per plant and grain yield to reduce by 3-6%, 9-22% and 8-22,8 %, respectively;
- *C.destructivum* also led to a reduction in the plant height, grain number per plant and grain yield by 3%, 6-15% and 8.1-17.8%, respectively, and
- both fungi, causing anthracnose didn't directly lead to the synthesis of raw proteins and oils in the grain, yet their entire amount per unit area did reduce due to a lower yield in the soybean plants suffering anthracnose.

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UTICAJ *Colletotrichum* spp. PROUZROKOVAČA ANTRAKNOZE NA PRINOS I KVALITET SOJE

-originalni naučni rad-

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Rezime

U uslovima prirodne zaraze u polju, kod sorte Corsoy, ispitan je uticaj gljiva prouzrokovaca antraknoze na komponente prinosa i kvalitet zrna soje. Utvrđeno je da *Colletotrichum dematium* var. *truncata* utiče na smanjenje visine stabljika za 3-6%, broj zrna po biljci za 9-22% i prinos zrna za 8-23%. Takodje, *Colletotrichum destructivum* je uticao na smanjenje visine biljaka za 3%, broj zrna u biljci za 5-15% i prinos zrna za 8-18% u odnosu na zdrave biljke soje. Pomenute gljive nisu znacajno uticale na sintezu sirovih proteina i ulja u zrnju.