RESEARCHES ON THE EFFICIENCY OF SOME FUNGICIDES IN MUSTARD ALTERNARIA BLACK SPOT CONTROL

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Abstract

Mustard (*Brassica alba* L) is cropped in Romania for its seeds used in food industry. Researches followed the determination of the efficiency of some fungicides (Caramba Turbo SL, Pictor SC and Matiz EW) in alternaria black spot management of the mustard, caused by the fungus *Alternaria brassicae* (Berk.) Sacc. The varieties of mustard Alex and Amog were monitored. Each variety was cropped in 4 experimental varieties. The experiences were of bifactorial type (variety x fungicide) and were made in the period 2012 - 2013. The variety Amog registered an attack level of the alternaria black spot of 13.0 % in the year 2012 and 24.0% in the year 2013, in the non-treated varieties. At the Alex variety, the level of attack in the witness version was of 9.0% in 2012 and 18.75% in 2013. The efficiency of the fungicides varied from 72.2% to 76.9%.

Key words: mustard, variety, alternaria black spot, attack level, efficiency

In terms of seed infection, the fungus *Alternaria* sp. was detected at more varieties of plants (Cristea S. *et al.*, 2008, Cristea S. *et al.*, 2013, Radu E. *et al.*, 2011, Pană M. *et al.*, 2014, Mardare E.S. *et al.*, 2014, Cristea S. (Manole) *et al.*, 2015, Berca L.M. *et al.*, 2015, Dudoiu R. *et al.*, 2016, Gruia L. *et al.*, 2016). In terms of field, the attack was seen at the crops in the south of Romania (Berca L.M. *et al.*, 2015).

Alternaria brassicae (Berk) Sacc. is one of the biotical factors limiting the production of seeds (Gruia *et al.*, 2015), leading to production losses of 17,0-45,0% at mustard (*Brassica alba* L.), (Singh R.B. and Singh R.N., 2005-a; Singh R.B. and Singh R.N., 2006; Kumar S. *et al.*, 2009).

Alternaria black spot causes the reduction of the size of the seeds, but it affects also the colour of the seeds and the content of oil. In the absence of resistant varieties, fungicides are the most reliable means of alternaria black spot control (Singh R.B. and Singh R.N., 2005-b).

The alternaria black spot control of the mustard has a special importance, especially in the years with conditions very favourable to their appearance and evolution.

MATERIAL AND METHOD

The field experiences were made during the vegetation period in the years 2012 and 2013, in the commune Malu, county of Ialomița.

The technological conditions consisted in the provision of a density of sowing of 45-50 b.g./m²; the sowing was performed in the first decade of April, using seed treated with Royal Flo 42 S – 3,75 l/t; the basic fertilization consisted in the application of complex fertilizers of the 8-24-24 type in dose of 250 kg/ha at tillage in autumn and urea in dose of 170 kg/ha at the beginning of April; weed control was done with the herbicide Galera SL in dose of 0,3 l/ha, in the phenophase of the stem elongation; pest control was performed with Fastac 10 EC – 0,15 l/ha, by three treatments, applied in the phenophases: the elongation of the stem, floral buds swelling and start of flowering.

Two varieties of mustard were tested, Alex and Amog, approved in Romania, in terms of natural contamination.

We analyzed the reaction of the varieties taken in the study against the alternaria black spot during the two experimental years by observations where we calculated, the frequency, the intensity and the attack level, as well as the possibility to protect the crop by treatments applied in the vegetation period. The intensity of the disease was assessed a week after the last treatment using a 0-4 scoring scale (0 = no disease; 1 = up to 25% infected plant; 2 = 26-50% infected plant; 3 = 51-75% infected plant; 4 = over 76% infected plant. The frequency of the attack was calculated using the formula F (%) = nxN/100, and for the attack level we used the formula GA (%) = FXI/100. The efficiency of the treatment was calculated as follows: E (%) = [GAm-GAv/Gam]100.

The versions placed in the customized blocks sized 4x3 m and the sowing distances were of 37,5x10 cm, placed in 4 repetitions.

The experiences comprised 4 experimental versions: V_1 – non-treated mustard; V_2 – 1

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treatment applied in the phenophase of stem elongation of the mustard - stem elongation (BBCH 31); V_3 – 2 treatments (one applied in the phenophase of stem elongation, and the second in the phenophase of yellow bud); V_4 – 2 treatments (one applied in the phenophase of stem elongation - but with a fungicide different from the one used in V_3, and the second in the phenophase of yellow bud (BBCH 59 – Feller and colab., 1995-a).

The experiences were bifactorial type, where: - the factor a was represented by the variety, with the graduations: - a1 – Alex; - a2 – Amog - the factor b was represented by the fungicide, with the graduations - b1 – Caramba Turbo SL (one treatment) ;- b2 – Caramba Turbo SL (at the first treatment) + Pictor SC (the second treatment); - b3 – Matiz EW (at the first treatment) + Pictor SC (at the second treatment).

RESULTS AND DISCUSSIONS

Alternaria black spot mustard had more favourable conditions for manifestation in 2013.

In 2012 (*table 1*) it is seen that the variety Alex registered a very significant negative attack level against the average. The highest values of the attack of the pathogen *Alternaria brassicae* were highlighted at the variety Amog, being very significant against the average. Both the average values of the frequency, and those of the attack intensity of alternaria black spot were higher at the variety Amog: F (%) = 65.0% and I (%) = 20.0%, against the variety Alex, where F (%) was of 60.0% and I (%) was de 15.0%. At both varieties the average intensity of alternaria black spot was scored with 1.

Table 1

Attack caused by the pathogen *Alternaria brassicae* at mustard (year 2012)

Variety	F (%)	I - % (score)	G.A. (%)	% against the average	Differences % against the average	Significance
ALEX	60	15 (1)	9.0	81.8	-2.0	000
AMOG	65	20 (1)	13.0	118.2	2.0	***
Average	62.5	17.5	11.0	100	-	-

DL 5% - 0,98% G.A.; DL 1% - 1,43% G.A.; DL 0,1% - 1,97% G.A.

In 2013 (*table 2*) we also saw a similar behaviour of the two varieties of mustard against alternaria black spot, in the sense that Amog was more sensitive. Alternaria black spot mustard attacked 75,0% of the variety Alex plants and 80,0% of the variety Amog. The intensity varied between 25.0% at Alex and 30.0% at Amog. In terms of statistics, the variety Alex registered an very significant negative attack level against the average, while at the variety Amog, they were very significant against the average. At the variety Alex the average intensity of alternaria black spot was scored with 1, and at the variety Amog with 2.

Table 2

Attack caused by the pathogen *Alternaria brassicae* at mustard (year 2013)

Variety	F (%)	I - % (score)	G.A. (%)	% against the average	Differences % against the average	Significance
ALEX	75	25 (1)	18,75	- 16,94	-2,62	000
AMOG	80	30 (2)	24,0	12,3	2,63	***
Average	77.5	27.5	21,37	100	-	-

DL 5% - 1,08% G.A.; DL 1% - 1,63% G.A.; DL 0,1% - 2,49% G.A.

In terms of efficiency of the fungicides used in the period of vegetation for the prevention and mustard alternaria black spot attack control (*figure 3*), the application of a single treatment in vegetation, in the phenophase of the stem elongation was materialized by a reduction of the attack level as follows:

In 2012 at the variety Alex from 9.0% to 6.25%, and at Amog from 13.0% to 9.0%, which corresponds to an efficiency of the treatment with the fungicide Caramba Turbo by 30.6% in the case of the variety Alex and by 30.8% in the case of the variety Amog. In 2013 at the variety Alex from 18.75% to 10.5%, and at Amog from 24.0% to 13.25%, which corresponds to an efficiency of the treatment with the fungicide Caramba Turbo of 44.0% in the case of the variety Alex and of 44.8% in the case of the variety Amog.

In the versions where two treatments were applied, Caramba Turbo at the elongation of the stem and Pictor in the phenophase of the yellow bud, the efficiency of the treatments for the prevention of the attack of *Alternaria brassicae* varied between 72.2% at the variety Alex in 2012

and 73.3% in 2013, and at the variety Amog the efficiency of the two treatments was of 76.9% in 2012 while in 2013, at a pressure of higher infection of the fungus *Alternaria brassicae*, following some conditions more propitious of growth and development, the efficiency was a bit smaller, of 72.9%.

At the versions where the fungicides Matiz and Pictor were applied, in the same phenophases the efficiency was between 72.2% (2012) and 72.0% (2013) at the variety Alex and 73.1% (2012) and 71.8% (2013) at the variety Amog.

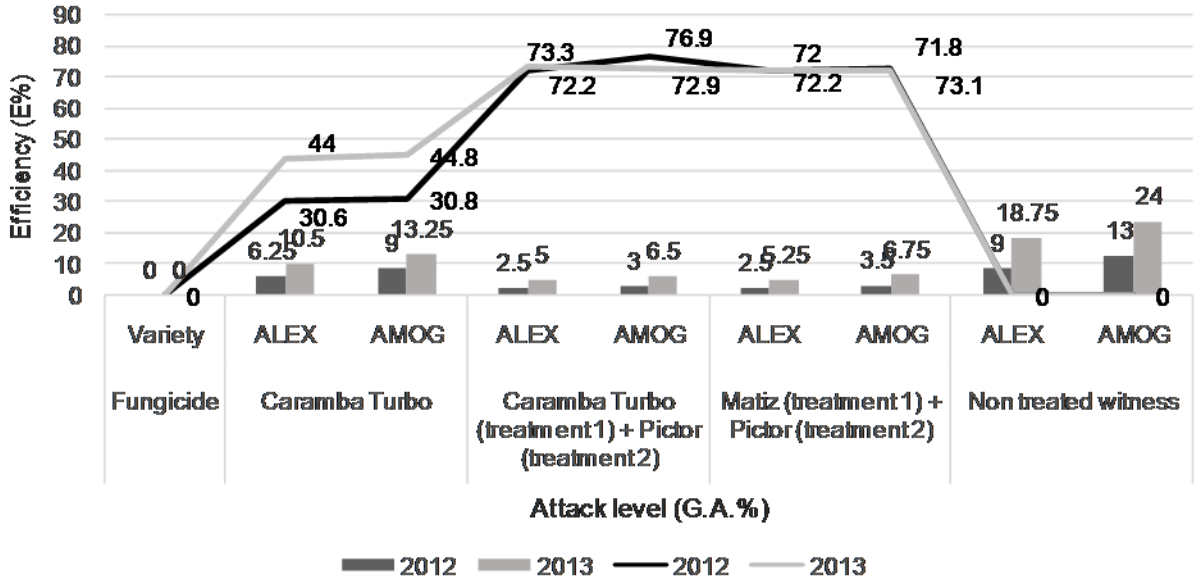

Figure 3 **Efficiency of some fungicides used in Alternative black spot control at mustard (2012 – 2013)**

CONCLUSIONS

The application of appropriate fungicides in the moment of the appearance of the first typical symptoms of alternaria black spot plays an important role in disease management.

The attack level of alternaria black spot was higher than the variety Amog (13.0% in 2012 and 24.0% in 2013), against the variety Alex (9.0% in 2012 and 18.75% in 2013).

In the versions where two treatments were applied, the efficiency varied between 72.2% and 76.9%.

The more reduced values of the efficiency, in the two years of experimentation, were registered in the versions where a single treatment was applied against the attack of alternaria black spot.

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