CONTRIBUTION CONCERNING THE METHODOLOGY OF ASSESSING AGGRESSIVENESS OF *HELMINTHOSPORIUM TURCICUM PAS*. THAT PRODUCES HELMINTHOSPORIOSIS OR NORTHERN CORN LEAF BLIGHT

CONTRIBUŢII PRIVIND METODOLOGIA DE APRECIERE A AGRESIVITĂŢII CIUPERCII *HELMINTHOSPORIUM TURCICUM PASS*. CARE CAUZEAZĂ HELMINTOSPORIOZA SAU PĂTAREA CENUŞIE A FRUNZELOR DE PORUMB

Gh. POPESCU, Floarea ADAM, D. JURCA

Agricultural and Veterinary University of the Banat, Timişoara, Romania
Corresponding author: Adam Floarea, e-mail:jurca_flori@yahoo.com

Abstract: *Helminthosporium turcicum Pass. is the main leaf parasite of corn that encounters problems for plant inbreeders, and the cultivators suffer average loses in comparison with other continents as is North America where the loses are sometimes very important. In the experimental field from Şagu (Arad County area), we have realised a comparative crop with eight corn hybrids produced by "Afumaţi Pioneer Research Centre" of "Pioneer Dupont Company" during 2006. This comparative crop is analysed under the aspect of Helminthosporium turcicum attack. For the data registered during 10-12 September, we have a repetition with 10 plants, and after eliminations, there remained 116 plants that have entered in experimental calculus. Observation phenophase is ten leaves. Classical study methodology refers to the aggressiveness as referring to corn plants, and the new study methods are having in view to establish these parasitic features at the leaves level, following this the aggressiveness for a hybrid is the average from the plants and leaves level. This method appreciate more accurate the hybrids comportment with very important aspects for inbreeders and corn cultivators. PR 37D25 hybrid is considered by "Pioneer Dupont Company" as tolerant for Helminthosporium turcicum and Ostrinia nubilalis being considered good as control variant. Fungus aggressiveness for PR 39D81, PR 38R92, PR 38A24, PR 37D25, PR 37M34, PR 37 W05, PR 35P12, PR 36R67 hybrids is average being comprised between 43.19% (control variant) and 87.1% in case of extra-early hybrid PR 39D81 at plants level. At leaves level the fungus aggressiveness is almost a half (40.7-59.2%), and on hybrids level the amplitude variability is 34.93-60.75%, after the new study method. Is very important to include the corn hybrids on a scale as resistant, medium resistant, or tolerant and sensitive, and is also important to compare them with the aggressiveness values from the plants level. Analysed hybrids are not containing major genes (Ht1, Ht2, Ht3, and HtN), minor, or their combinations. The tolerance of PR 37D25 is genetically controlled, but not with resistance genes.*

Rezumat: *Deuteromicotina Helminthosporium turciucm Pass. este principalul parazit maculicol al porumbului, cu care amelioratorii au mari probleme, iar cultivatorii acuză de pagube medii, spre deosebire de alte continente, cum este America de Nord, unde pagubele ating uneori nivelul de calamitate. În câmpul experimental, localitatea Şagu (zona Arad), în anul 2006, o cultură comparativă de 8 hibrizii de porumb, produşi de "Centrul de Cercetări Pioneer Afumaţi" al "Pioneer Dupont Company", a fost urmărită sub aspectul comportării la atacul ciupercii mai sus menţionată. Pentru observaţiile făcute în 10-12 septembrie, o repetiţie a avut ca număr 210 plante, iar în urma eliminărilor au rămas 116 plante, care au intrat în calculul experimental. Fenofaza observaţiilor a fost de 10 frunze. Dacă în metodologia clasică agresivitatea avea ca referinţă plantele de porumb, noua metodologie are în vedere stabilirea acestei însuşiri parazitare nivelul frunzelor, urmând ca agresivitatea faţă de hibrid să fie media de la nivelul plantelor şi frunzelor. Prin această metodă se apreciază mult mai corect "calificativul" comportării hibrizilor, un aspect foarte important pentru amelioratori şi cultivatori. Hibridul de porumb PR 37D25 considerat de "Pioneer Dupont Company" tolerant la helminthosporioză şi sfredelitor i s-a dat calitatea de variantă "martor" sau "control". Agresivitatea ciupercii faţă de PR 39D81, PR 38R92, PR 38A24, PR 37D25, PR 37M34, PR 37 W05, PR 35P12, PR 36R67 a fost în medie cuprinsă între 43,19% (varianta martor) şi 87,1%, cât a înregistrat hibridul extratimpuriu PR 39D81 la nivelul plantelor. La nivelul frunzelor se înregistrează aproape la jumătate (40,7-59,2%), pentru ca la nivelul hibrizilor, după noua metodologie să aibă o amplitudine de variabilitate de 34,93-60,75% foarte importantă în includerea hibrizilor în scara calificativelor de rezistent, mijlociu rezistent sau tolerant şi sensibil, comparativ cu valorile agresivităţii la nivelul plantelor. Hibrizii cercetaţi nu conţin gene majore (Ht1, Ht2, Ht3, HtN), minore sau combinaţiile lor; toleranţa hibridului PR 37D25 este controlată genetic, dar nu de gene de rezistenţă.*

Key words*: Helminthosporium turcicum, Drechslera turcica, aggressiveness, resistance, Zea mays*
Cuvinte cheie*: Helminthosporium turcicum, Drechslera turcica, agresivitate, rezistenţă, Zea mays*

INTRODUCTION

In case of maize *Helminthosporium turcicum*, being the disease (mycosis) that produces average loses in Europe and is devastating in America.

Helminthosporium turcicum Pass is studied under climatic conditions aspect (S. BENTOLIA *et al*., 1991), physiologic specialisation (R.R. BERGQUIS, O.R. MASIAS, 1974), and viral researches (genetics) of *Helminthosporium turcicum – Zea mays* pathologic system are extremely divert. As an example, corn genetic resistance for *Helminthosporium turcicum* can be monogenic, when Ht 1, Ht 2, Ht 3, Ht M, Ht N/o, Ht N/Ht 1, Ht 2, Ht 3 genes are exteriorising in corn phenotype a vertical resistance or oligogenic (AL. HOOKER, 1963, 1975, S.M. LIM *et al*., 1974; P.E. LIPS, R.H. HITE, 1982; W.A. ROBBINS, H.L. WARREN, 1993; K.D. SIMCOX, J.L. BENNETZEN, 1993; A. TEFFERI *et al*., 1996; P.E. LIPPS *et al*., 1997; R. SINGH *et al*., 2004; LISA M. FERGURSON, M.L. CARSON, 2004; JULIANA O. BERNARDI *et al*., 2005) or polygenic when minor genes or polygenes are controlling in corn an horizontal resistance (M.T. JENKINS, ALICE L. ROBERT, 1952, 1959, 1961, MARINA TÂRCOMNICU, O. COSMIN, 1968, 1974; ANETA ELENA DRĂCEA, 1968; MARINA TÂRCOMNICU, 1971; N. CEAPOIU, FLOARE NEGULESCU, 1983; M.L. CARSON, Z.W. WICKS, 1993; M.L. CARSON, 1995).

Another appreciation method for fungus aggressiveness on corn hybrids is represented by resistance forms. We have analysed them in a comparative crop of American hybrids, this being the purpose of this work.

MATERIAL AND METHOD

In the experimental field is realised in 2006 a comparative crop near Şagu –S.C. Agrogil (Arad County). This comparative crop contains eight American corn hybrids (PIONEER DUPONT COMPANY), this being analysed for the comportment in case of the aggressiveness of *Helminthosporium turcicum* Pass. fungus.

In classical marking method, the fungus aggressiveness has as reference the corn plants, but we propose that this parasitic feature to be reported to plant leaves. Those are proposed having in view that this pathogen attacks especially leaves. In this case, fungus aggressiveness on corn hybrid represents the average of this feature from plants and leaves level. With this method, the marks will be established more accurate for the analysed hybrids (resistant, tolerant, or sensitive).

For our observations, we have a repetition with 10 corn plants and after the eliminations, there have remained 116 corn plants that have entered in the variance analysis calculus. PR 37D25 corn hybrid is considered by the American company as tolerant for this disease and for Ostrinia nubilalis attack, this being the reason to be our control.

RESULTS AND DISCUSSIONS

Helminthosporium turcicum Pass. fungus aggressiveness for corn hybrids registered during 10-12 September is presented at plants level in table 1, at leaves level in table 2, and at hybrid level in table 3.

At plants level the amplitude of this feature is comprised between 43.19% in case of PR 37D25 hybrid (control) and 87.1% in case of extra-early PR 39D81 hybrid. Indifferent by the maturity group of the hybrids (extra-early, early, half-early, and half-late) the American corn hybrids have registered aggressiveness increases (infection) statistically provided (table 1). In comparison with the aggressiveness per entire experience, that is 70.25%, the aggressiveness increases are found in case of extra-early hybrids, early hybrids (PR 39D81, PR 38R92), and half-early (PR 37M34, PR 37W 05), excepting PR 37D25, PR 38A24 hybrids and half-late hybrids that have shown infection decreases statistically provided.

At leaves level the fungus aggressiveness amplitude variation in case of corn hybrids is between 5.9-59.2% (PR 36K67 half-late hybrid and PR 38A24 half-early hybrid) (table 2). In this case, the values are lower with 17.29-27.9% in comparison with the manifestation this threat at corn plants level. In addition, the experience average decrease from 70.5% to 4.55% at leaves level. Concerning maturity group of the hybrids there are registered infection significant increases only in the case of two hybrids: PR 38R92 (early) and PR 38A24 (half-early). The other hybrids are presenting infection decreases statistically provided only in case of PR 36K67 half-late hybrid.

The analysis in comparison with experience average is similar with the interpretation of the differences realised by the hybrids in comparison with control variant (table 2).

At hybrids level, the fungus aggressiveness amplitude variation on corn hybrids is comprised between 43.93% (PR 37D25 – control hybrid) and 60.75% (PR 38R92), those values being extreme, and higher then at leaves level, and lower in comparison with the plants average (table 3).

Table 1

Helminthosporium turcicum Pass fungus aggressiveness on corn hybrids difference signification in comparison with the control and experience average at plants level

No.	Hybrid	X	Difference in comparison with control	Signification	Difference in comparison with X	Signification
1	PR 39D81	87.1	43.91	XXX	16.85	XX
2	PR 38R92	84.14	40.95	XXX	13.88	XX
3	PR 38A24	53.97	10.78	X	-16.28	OO
4	PR 37D25 (Mt.)	43.19	-	-	-27.06	OOO
5	PR 37M34	83.35	40.16	XXX	13.10	XX
6	PR 37W05	83.95	40.76	XXX	13.70	XX
7	PR 35P12	67.78	24.59	XXX	-2.47	-
8	PR 36K67	58.53	15.34	XX	-11.72	O
X	70.25					

DL 5% - 8.75
DL 1% - 12.12
DL 0.01% - 16.85

Table 2

Helminthosporium turcicum Pass fungus aggressiveness on corn hybrids difference signification in comparison with the control and experience average at leaves level

No.	Hybrid	X	Difference in comparison with control	Signification	Difference in comparison with X	Signification
1	PR 39D81	37.0	-3.7	-	-5.55	-
2	PR 38R92	55.5	14.8	x	12.95	x
3	PR 38A24	59.2	18.5	xx	16.65	x
4	PR 37D25 (Mt.)	40.7	0	Control	-1.85	-
5	PR 37M34	37.00	-3.7	-	-5.55	-
6	PR 37W05	48.1	7.4	-	5.55	-
7	PR 35P12	37.00	-3.7	-	-5.55	-
8	PR 36K67	25.9	-14.8	o	-16.65	o
X	42.55					

DL 5% - 12.45
DL 1% - 17.26
DL 0.01% - 23.98

Table 3

Helminthosporium turcicum Pass fungus aggressiveness on corn hybrids difference signification in comparison with the control and experience average

No.	Hybrid	X	Difference in comparison with control	Signification	Difference in comparison with X	Signification
1	PR 39D81	56.51	21.58	xxx	6.44	-
2	PR 38R92	60.75	25.82	xxx	10.68	x
3	PR 38A24	46.11	11.18	x	-3.94	-
4	PR 37D25 (Mt.)	34.93	-	-	-15.12	oo
5	PR 37M34	54.63	19.17	xxx	4.57	-
6	PR 37W05	58.63	23.7	xxx	8.57	-
7	PR 35P12	46.85	11.92	x	-3.20	-
8	PR 36K67	42.05	7.12	-	-8.01	-
X	50.06					

DL 5% - 9.82
DL 1% - 13.62
DL 0.01% - 18.92

CONCLUSIONS

Because of the analysis from the point of view of hybrids maturity groups and of the statistics is similar with the results from the plants level, these are arguments that determinates the conclusion that in the case of fungi with trophic specificity for certain plant organs the proper formula for calculus is F% = n × 100/N. This formula is better explained at plants organs (leaves), and not at the plants level.

Analysed corn hybrids are not containing major genes (Ht 1, Ht 2, Ht 3, Ht N – the most effective) singular or double, neither minor genes, and their combination that leads to a increased resistance, more stable, then in case when the are activating separately (N. CEAPOIU, FLOARE NEGULESCU, 1983, GH. POPESCU, 2005).

PR 37D25 corn hybrid shows a tolerance reaction determined by genes that are implicated in the realisation of some intense physiologic and biochemical processes, but not in resistance genes (GH. POPESCU, 2005).

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