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DETERMINATION OF TACTILE SCALE AND INTENSITY BY APPLE SCAB (*VENTURIA INAEQUALIS*), THROUGH THE EVALUATION OF THE SENSITIVITY OF SOME APPLE CULTIVARS IN THE DISTRICT OF KORÇA

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Abstract

Apple fruit tree cultivation is the most important culture for the fruit culture in the region of Korça. Basic structure consists of 3-4 cultivars, where Golden Delicious, Starking, Paragold cultivars dominate. Other cultivars such as Granny Smith, Idared, and Jonathan continue to be rapidly planted. As e very intensive culture apple crop presents a major problem in terms of sensitivity to pests and diseases, where apple scab remains the most maleficent disease in production and concern for farmers of Korça region. This study aims to determine for the first time the natural sensitivity based on apple cultivars and the scale of proliferation and intensity index infestation by apple scab after a number of traditional treatments with fungicide performed by the majority part of farmers in the region.

Kewwords: apple scab, proliferation rate, tactile intensity

1. INTRODUCTION

The apple crop is one of the main fruit trees, widely cultivated in the district of Korça. It represents 70% of the total number of fruit trees. Last years it has taken e strong development, cultivating both new and traditional cultivars, with a high demand by internal and external markets. New technologies already applied for apple crop are the most modern and therefore they increase apple production from year to year. The disease that faces the biggest problem for farmers of Korça is obviously the Apple scab (Venturia inaequalis).This disease is considered as the most dangerous and maleficent disease, which may cause up to 60% the reduction of apple production. Another negative aspect caused by apple scab is the deterioration of quality, decreasing the product competition in the market. Different apple cultivars face different sensitivity to apple scab. This study aims to present the natural sensitivity of three apple cultivars in untreated conditions and in conditions when they are treated with fungicides.

2. MATERIAL AND METHOD

The location of the orchard is situated in Commune of Drenova with 7,2 ha by surface. The crown type of trees is kept in berth (palmate) form supported by a 4 wire system. The apple tree crown height was of 2,7 m for cultivars grown on EM-9 rootstock and 3 m for cultivars grown on MM-106 rootstock. The orchard was planted on 2004 and the dropping irrigation system on the soil surface was established. Variants are represented by the cultivars Golden Delicious, Starking and Paragold and three blocks represent the third iteration. Each variant in each iteration is represented by 10 apple trees. For every tree were analyzed 10 leaves and 10 apples fruits collected randomly on all sides. 900 leaves and 900 apple fruits were analyzed in total in laboratory.
The variants setting scheme was one factorial, in randomized block. 8 chemical treatments were carried out according to traditional methods. The sample block was not treated with any pesticide. For spraying a hydro pneumatic motor blower pump and 1000 l/ha solution by volume was used.

Sprayings carried out during a season are:

First spraying with Champion 50 WP	26.03.2010
Second spraying with Dodine WG 0,15%	15.04.2010
Third spraying with Bavistine 0.05%	26.04.2010
Fourth spraying with Captan 80 WG 0.15 % + Sulfur	08.05.2010
Fifth spraying with Score 250 EC 0.015% + Captan 80 WG 0.15 %.	26.05.2010
Sixth spraying with Zato 0.015%+Captan 80 WG 0.15 %.	02.06.2010
Seventh spraying with Zato 0.015%+ Antracol 70 WP	13.06.2010
Eighth spraying with Captan 80 WG 0.15 % +Zato 0.015%.	23.06.2010

The apple scab proliferation rate was calculated through the formula:

$$P = n \times 100 / N$$

Where:
P = degree of tactile or promotion
n = number of leaves and/or fruits infected by apple scab.
N = total number of leaves analyzed for each variant.

For each variant the category was determined based on the leafy surface affected by apple' s scab.

Category		Intensity in %	
0	Practically nothing	0	of leave or fruit surface affected
1	Light intensity	0-5	of leave or fruit surface affected
2	Medium intensity	5-15	of leave or fruit surface affected
3	Strong intensity	15-30	of leave or fruit surface affected
4	Very strong intensity	30-45	of leave or fruit surface affected
5	Destructive intensity	> 45	of leave or fruit surface affected

Tactile intensity is calculated by McKinney formula:

$$i = \frac{\sum(nxk)}{NxK} \text{ x } 100$$

Where:
i = tactile index by the disease
$\sum$ = Amount of output,
n = number of leaves or fruits according to category,
k = number of each category,
N = number of leaves or apple fruits analyzed,
K = total number of categories.
After these calculations, for the statistical authenticity, the statistical processing of data was done.

3. RESULTS AND DISCUSSIONS

The cultivar sensitivity to apple scab for proliferation range and index of tactile intensity, to untreated apple trees compared to the treated fruit trees is shown as follows in table 1 and table 2:

Table 1. The range of apple scab proliferation expressed in %

Cultivars	The range of apple scab proliferation in %			
	In fruits		In leaves	
	Un-treated	Treated	Un-treated	Treated
Golden delicious a_1	100	2.3	76	36.7
Starking a_2	98	42	82	34.7
Paragold a_3	100	65.3	89	45

Table 2. The range of index of tactile intensity expressed in %

Cultivars	The index of tactile intensity in %			
	In fruits		In leaves	
	Un-treated	Treated	Un-treated	Treated
Golden delicious a_1	48	0.4	32	15.3
Starking a_2	48	14.8	37	15.7
Paragold a_3	50	25.3	43	18.2

The proliferation rate of apple scab in fruits in untreated variant is almost 100%, whereas in leaves this index varies from 76-89%, or 11-24% lower than in fruits. The tactile intensity in leaves belongs to category 5, whereas this index in fruits belongs to category 4, or 7-18% lower than in fruits.
In the treated variant the tactile intensity and proliferation rate in fruits and in leaves vary 2-3 times lower compared to untreated ones.
The data of the proliferation rate of apple scab in fruits are given in table 3.

Table 3. The proliferation rate of apple scab in fruits

Cultivars	The proliferation rate by blocks in %			$\Sigma^n Xij$	Aver. Xi
	I	II	III		
Golden delicious a_1	0	3	4	**7**	**2.3**
Starking a_2	42	43	41	**126**	**42**
Paragold a_3	68	62	66	**196**	**65.3**
$\Sigma^a Xij$	**110**	**108**	**111**	**329**	

After the statistical evaluation the data of variance analysis are set in the table 4, which express the analysis of variance:

Table 4. The analysis of variance for the proliferation rate of apple scab in fruits.

The source of variance	DF	Q Sum	Q. Ave-rage	Calc "F"	Table value "F"	
					0.95	0.99
Total	axn-1=8	6116	-	-	-	-
Variants	a-1=2	6086	3043	423	6.94	18
Replicat/s	n-1=2	1.33	0.66	11	6.94	18
Error	(a-1) (n-1)=4	28.67	7.2	-	-	-

For variants, in both probabilistic levels "F" table values (Fisher Distribution) are $F_{0.05}$ (2;4) =6.94 and $F_{0.01}$ (2;4)=18. Although replications are not the object of our study, Calculated value "F" for replications is not calculated.
Comparing the calculated value and table value of "F" results that "F"v=423> $F_{0.05}$ (2;4) =6.94 and $F_{0.01}$=18. as we see that cultivars face differences in proliferation rate of apple scab are proved statistically.
The values of Student test for probabilistic levels of 0.05 and 0.01, are respectively 2.8 and 4.6, whereas the values of AMD are respectively: $AMD_{0.05}$ = 6.2 and $AMD_{0.01}$ = 10.
From the differences of variance (cultivars) averages only three values are higher than AMD values (6.2 and 10) for both probabilistic levels $F_{0.05}$ and $F_{0.01}$. These differences, shown in table 5, are a_2-a_1 42-2.3=39.7; a_3-a_1 65.3-2.3=63; a_3-a_2 65.3-42=23.3.

Table 5. The comparisons of AMD with variants differences. for the proliferation of apple scab in fruits.

Cultivars	a_1		a_2		a_3	
	0.05	0.01	0.05	0.01	0.05	0.01
a_1	-	-	-	-	-	-
a_2	+	+	-	-	-	-
a_3	+	+	+	+	-	-

So, the proliferation rate in fruits is higher in Paragold and Starking cultivars, compared to Golden delicious cultivar. The data of proliferation rate of apple scab in leaves are shown in table 6.

Table 6. The proliferation rate by blocks in % in apple leaves

Cultivars	The proliferation rate by blocks in %			$\Sigma^n Xij$	Aver. Xi
	I	II	III		
Golden delicious a_1	38	35	37	**110**	**36.7**
Starking a_2	36	33	35	**104**	**34.7**
Paragold a_3	49	42	44	**135**	**45**
$\Sigma^a Xij$	**123**	**110**	**116**	**349**	

The data of variance analysis are shown in the following table 7.

Table 7. The analysis of variance for the proliferation rate of apple scab in leaves.

The source of variance	DF	Q Sum	Q. Ave-rage	Calc "F"	Table value "F"	
					0.95	0.99
Total	axn-1=8	216	-	-	-	-
Variants	a-1=2	181	90.5	57	6.94	18
Replicat/s	n-1=2	28.7	14.4	9	6.94	18
Error	(a-1)(n-1)=4	6.3	1.6	-	-	-

For variants, for both probabilistic levels "F" table values (Fisher Distribution) are $F_{0.05}$ (2;4) =6.94 and $F_{0.01}$ (2;4)=18. Comparing the calculated value and table value of "F" results that "F"v=57> $F_{0.05}$ (2;4) =6.94 and $F_{0.01}$=18. in this way the variants (cultivars) face a variability source and they perform differences in apple scab proliferation which are proved statistically.

The values of Student distribution for probabilistic levels of 0.05 and 0.01, are respectively 2.8 and 4.6, whereas the values of AMD are respectively: $AMD_{0.05}$ = 2.9 and $AMD_{0.01}$ = 4.7. For determining which of the cultivars is less sensitive to apple scab proliferation, the average differences between variants were calculated. a_3-a_1 45-36.7=8.3 a_3-a_2 45-34.7=10.3. From the calculations, the differences 8.3 and 10.3 are higher than AMD values (2.9 and 4.7), for both probabilistic levels $F_{0.05}$ and $F_{0.01}$, which are shown in table 8.

Table 8. The comparisons of AMD with variants differences. for the proliferation rate of apple scab in leaves.

Cultivars	a_1		a_2		a_3	
	0.05	0.01	0.05	0.01	0.05	0.01
a_1	-	-	-	-	-	-
a_2	-	-	-	-	-	-
a_3	+	+	+	+	-	-

The proliferation rate in leaves in Paragold cultivar is higher compared to two other cultivars. The data of index of tactile intensity by apple scab in leaves are shown in table 9.

Table 9. The index of tactile intensity by apple scab in apple fruits.

Cultivars	The intensity by blocks in %			$\Sigma^n Xij$	Aver. Xi
	I	II	III		
Golden delicious a_1	0	0.5	0.66	**1.16**	**0.4**
Starking a_2	14	15.6	14.6	**44.2**	**14.8**
Paragold a_3	27.6	23.8	24.6	**76**	**25.3**
$\Sigma^a Xij$	**41.6**	**39.9**	**39.9**	**121.4**	

The data of variance analysis are shown in the following table 10.

Table 10. The analysis of variance for the index of tactile intensity by apple scab in apple fruits

The source of variance	DF	Q Sum	Q. Ave-rage	Calc "F"	Table value "F"	
					0.95	0.99
Total	axn-1=8	949	-	-	-	-
Variants	a-1=2	939.4	470	209	6.94	18
Replicat/s	n-1=2	0.6	0.3	7.5	6.94	18
Error	(a-1)(n-1)=4	9	2,25	-	-	-

For variants, for both probabilistic levels "F" table values (Fisher Distribution) are $F_{0.05}$ (2;4) =6.94 and $F_{0.01}$ (2;4)=18. Comparing the calculated value and table value of "F" results that "F"v=209> $F_{0.05}$ (2;4) =6.94 and $F_{0.01}$=18. In this way the variants (cultivars) face a variability source and they perform differences in apple scab proliferation which are proved statistically.

The values of Student distribution for probabilistic levels of 0.05 and 0.01, are respectively 2.8 and 4.6, whereas the values of AMD are respectively: $AMD_{0.05}$ = 3.4 and $AMD_{0.01}$ = 5.5. Comparing the differences of variants averages (cultivars), three values are higher than AMD values (3.4 and 5.5) for both probabilistic values $F_{0.05}$ and $F_{0.01}$: a_2-a_1 (14.8-0.4=14.4), a_3-a_1 (25.3-0.4=24.9) a_3-a_2 (25.3-14.8=10, which are shown in table 11.

Table 11. The comparisons of AMD with variants differences, for the index of tactile intensity by apple scab in apple fruits.

Cultivars	a_1		a_2		a_3	
	0.05	0.01	0.05	0.01	0.05	0.01
a_1	-	-	-	-	-	-
a_2	+	+	-	-	-	-
a_3	+	+	+	+	-	-

The tactile intensity in fruits in Paragold and Starking is higher compared to Golden Delicious.
The data of index of tactile intensity by apple scab in leaves are shown in table 12.

Table 12. The index of tactile intensity by apple scab in apple leaves.

Cultivars	The intensity by blocks in %			$\Sigma^n Xij$	Aver. Xi
	I	**II**	**III**		
Golden delicious a_1	16	14.3	15.6	**45.9**	**15.3**
Starking a_2	16.6	13.3	17.1	**47**	**15.7**
Paragold a_3	20.8	16.6	17.1	**54.5**	**18.2**
$\Sigma^a Xij$	**53.4**	**44.2**	**49.8**	**147.4**	

The calculated value of "F" for variants is "F"v = 4.35. For variants, for both probabilistic levels, the "F" table values are $F_{0.05}$ (2;4) =6.94 and $F_{0.01}$ (2;4)=18.
Comparing the calculated and table values, results that "F"v=4.35< $F_{0.05}$ (2;4) =6.94 and $F_{0.01}$=18, so the differences are not proved statistically and cultivars are not a variability source.

4. CONCLUSIONS

1. In fruits apple scab proliferation rate is higher in *Paragold* cultivar, then at *Starking* cultivar and lowest in *Golden Delicious* cultivar.
2. In leaves apple scab proliferation rate is higher in *Paragold* cultivar compared to *Starking* and *Golden delicious* cultivar, respectively.
3. Index of tactile intensity of apple scab is higher in *Paragold* cultivar, then at *Starking* cultivar and lower in *Golden delicious* cultivar.
4. The index of tactile intensity in apple leaves infested by apple scab is an indicator that can not be statistically verified because the values of Calculated "F" are smaller than the theoretical ones. Cultivars do not face a variability source for this index.

5. REFERENCES

[1] Teki Kaltani, Burhan Celo: Fitopatologjia e përgjithshme, 1982.
[2] Enver Isufi : Mbrojtja e integruar e bimëve. 1997.
[3] Lufter Xhuveli, Adem Salillari: Bazat e eksperimentimit shkencor në bujqësi 1984.
[4] I.Tarelli, I.Skenderi, S.Barolli..Pesticidet, 1997.
[5] Aleksandër Kolaci. Manual i Fitofarmacisë 1997.