COMPORTAREA UNOR SOIURI ROMÂNEŞTI DE NUC LA ATACUL DE ANTRACNOZA (*GNOMONIA LEPTOSTYLA*)

BEHAVIOUR OF SOME ROMANIAN WALNUT VARIETIES AT ANTRACHNOSIS (*GNOMONIA LEPTOSTYLA*) ATTACK (DC.) Trav.

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Abstract

The goal of the present research was to study and compare the behavior of six Romanian walnut varieties to the *Gnomonia leptostyla* attack, prior their extent in the production orchards. The researches were conducted at RIFG Pitesti Romania between 2012-2014 on 29-30 years old experimental orchard on 'Jupânești', 'Roxana', 'Mihaela', 'Bratia' varieties and 'Secular RM' generative rootstock, their behavior to anthracnosis attack being assessed under natural conditions. The results obtained during the study period revealed that the environmental conditions were very favorable to the fungi attack, higher frequencies (F%) and severity (I_{0-5} notes) being recorded in the second semesters of each year. Under such circumstances none of the six studied genotypes were resistant to the fungi attack on leaves or shoots and growing fruits, but 'Bratia' and 'Mihaela' varieties revealed very good tolerance (F%=5.17-6.42 on leaves and shoots and F%=1.5-1.71 on growing fruits; I_{0-5} =1.79-1.96 on leaves and shoots and 1.50-1.71 on growing fruits). Also good tolerance revealed 'Jupânești', 'Geoagiu 65', 'Roxana' varieties and 'Secular RM' generative rootstock, (F%=10.08-11.75 on leaves and shoots and F%=1.71-2.63 on growing fruits; I_{0-5} =2.04-2.50 on leaves and shoots and 1.71-2.63 on growing fruits). The accumulated data suggest the possibility to select new highly tolerant walnut genotypes, using their behavior to anthracnose or to propagate and extend into the culture the homologated ones and to recommend adequate technological measures aimed to increase the plantings performances.

Cuvinte cheie: nuc, soiuri, antracnoza, comportare.
Key words: walnut, varieties, anthracnosis, behavior.

INTRODUCTION

In Romania and all across the Europe there is an increased interest for walnut *Juglans regia* L., culture development. Walnuts anthracnosis (*Gnomonia leptostyla*) (DC.) Trav. sin. *G. leptostyla* (Fr.) Ces et de Not) is one of the major fungal diseases affecting the walnuts plantings and their performances. Therefore in many European countries and in U.S.A, researches are carried out in order to better understand the pathogen biology ecology and epidemiology under favorable and very favorable environment conditions of the last years, cultivars reactions under lab or these environment conditions and recommendation of adequate technological conditions in order to prevent or to contain the damages produced by the mycosis and to increase the plantings performances.

MATERIAL AND METHOD

The goal of the present research was to study and compare the behavior of six Romanian walnut varieties to the *Gnomonia leptostyla* attack, prior their extent in the production orchards. The researches were conducted at RIFG Pitesti Romania between 2012-2014, on 29-30 years old walnut orchard on 'Jupanesti', 'Roxana', 'Mihaela', 'Bratia' varieties and 'Secular RM' generative rootstock, grafted on *Juglans regia* L., planted at 8 m x 5 m, with the canopies trained as modified leader.

The experimental device was located on a soil unit from the superior terrace of the Arges River and on an alluvial soil unit from the right shore of the Budeasa creek, an affluent of the Doamnei River. The climatic conditions are very favorable for fruit growing. (The annual average temperature: 9.8-10.2 ◦C; the absolute maximum temperature in July: 37.6 ◦C; the absolute minimum temperature in January: -24 ◦C; the average precipitation amount: 665 mm / year. First autumn frost occurs at the end of October, and the latest spring frost in the second decade of the April and accidentally later on).

To assess the biological material behavior to the key diseases on leaves, shoots and green fruits, an evaluation scale with six steps and intermediary steps (0-5 notes) was used, the area of the lesions being converted in percentage (Table 1).

The weather data were collected using a Watch Dog 200 weather automatic station, then stored, processed and analyzed using the facilities of the SpecWare 9.0 Profesional software (Spectrum Technologies Inc. 60544 Plainfield Illinois, USA).

Relevant photos were taken with SONY Cybershoot F828 (Carl Zeiss Vario-Sonnar T* optical block, 2-2.8/7.1-51) and SAMSUNG ES90, 14.2MP (SAMSUNG 4.9-24.5mm, 1:35-5.9, 27.0mm optical block), and processed with Irfan View 4.38 and Photo Philtre 7.0.2. free software.

The data sets were stored, ranged and processed MS Excel 2010 facilities, statistical analyses were carried out using ANOVA and Duncan test and the final results are presented in tables and graphs.

RESULTS AND DISCUSSIONS

Usually the anthracnosis *Gnomonia leptostylla* (DC.) Trav. sin. *G. leptostyla* (Fr.) Ces et de Not), from *Ascomycetes* class, is one of the major fungal diseases affecting many walnuts species as like *Juglans regia* L., *J. nigra, J. cinerea, Juglans hindsi* and their hybrids as well as some *Carya* species. Their leaves are attacked during all development stages. During the heavy infections the walnuts leaves may turn in yellow are brown spotted and falls before the time. On the leaves petiole and walnut shoots the brown spots can turn into severe lesions. The nuts can be attacked in all development stages the attack intensity ranging from very few spots up to browning of the fruits and premature fall (Hatman et all 1989, A. Belisario, 1999; Amzăr and Ivascu, 2003).

Assessment of the figures 1 and 2 reveals that during the study period the weather conditions were favorable to the anthracnosis attack.

During 2012 in April, May and June, the average precipitations ranged between 74.2 and 112.2 mm with the leaves wetness period ranging from 74h in April to 188h in May. The average temperatures were between 12.3 and 21.5 ◦C, which were good for the perithecia maturation and ascospores release and first infections. During the second semester, the monthly average precipitations were between 60 mm and 99.2 mm in August and October with a leaf wetness period of 82h to 101h respectively.

In 2013 the highest average precipitations amounts were registered in March, May and June when between 63.2 and 113.7 mm were fallen down, and the monthly leaves wetness period was between 81.8 h and 108.8 h in May and June.

During the same months the average temperatures oscillated between 17.7-19.8◦C, very closed to the optimum domain for anthracnosis ascospores germination.

Along the second semester of the year, especially from July to September the monthly average precipitations were between 86.8 mm and 141.4 mm but with a lower leaves wetness extent ranging from 48.5 h to 87 h. During the same months, the average temperatures oscillated between 10.4-21.1◦C, optimum for summer and autumn infections with anthracnosis conidia and microconidia.

During 2014, the highest average precipitations levels were recorded in the first semester, from April to June the average precipitations ranged between 118.0 mm and 174.3 mm, with a leaves wetness period between 154.3 h and 167.5 h. On the same months, the average temperatures balanced between 10.9-18.1◦C, very closed to the optimum domain for anthracnosis ascospores germination. In the second semester of the year, the most rainy months were July and October with average precipitations levels of 157.8 h and 60.2 h. with the leaves wetness period ranging from 123.8 to 163.3h. During the same months, the average temperatures oscillated between 10.5-20.8◦C, optimum for summer and autumn infections with anthracnosis conidia and microconidia.

The examination of the figures 3 and 4 referring to the overall attack frequency (F%) of *Gnomonia leptostyla* on leaves, shoots and fruits suggest how the meteo conditions influenced the anthracnosis attack in which year and semester and how responded the walnuts to the pathogen aggression. It can be clearly seen that, for the anthracnosis attack frequency on leaves and shoots, the most favorable years were 2013 and 2014 (F%=11.48-11.88), with a peak in the second semester (F%=12.10). Also, for the anthracnosis attack frequency on fruits, the most favorable years were 2013 and 2014 (F%=4.35-5.7), with a peak in the second semester of the year (F%=6.32).

The assessment of the figures 5 and 6 referring to the overall attack intensity ($I_{\_0\text{-}5}$) of *Gnomonia leptostyla* on leaves, shoots and fruits reveal that the anthracnosis attack intensity on leaves and shoots, was higher in 2012 and 2013 ($I_{0\text{-}5}$=2.21-2.29) with very small differences among the semesters ($I_{0\text{-}5}$=2.10-2.22). Also, for the anthracnosis attack intensity on fruits the most favorable years were 2012 and 2014 ($I_{0\text{-}5}$=1.92-2.17), with a peak in the second semester of the year ($I_{0\text{-}5}$=2.29).

The examination of the figures 7 and 8 referring to the overall attack frequency (F%) of *Gnomonia leptostyla* on leaves, shoots and fruits of reveal the differences among the six walnut genotypes studied.

It can be seen that, on leaves and shoots, the most affected genotypes were the varieties 'Roxana', 'Geoagiu 65', 'Jupanesti' and the generative rootstock 'Secular RM' on which the anthracnosis attack frequency was 11.75-10.08% and the less affected were the varieties 'Mihaela' and 'Bratia' (F%=6.42-5.17%). As regard the anthracnosis attack frequency on fruits, it was registered almost the same trend, 'Roxana' variety (F%=2.63), Secular RM' generative rootstock (F%=2.25), 'Geoagiu 65' (F%=1.83), 'Jupanesti' and 'Bratia' varieties, (F%=1.71) and 'Mihaela' variety (F%=1.5%).

A deep look into the figures 9 and 10 referring to the overall attack intensity of *Gnomonia leptostyla* on leaves, shoots and fruits of shows the differences among the six walnut genotypes studied. In the case of their response to the anthracnose attack intensity, the same hierarchy is displayed. As regard the attack intensity of *Gnomonia leptostyla* (I_{0-5}) on leaves, shoots these was varied between I_{0-5}=2.50 at 'Roxana' variety to I_{0-5}=1.79 at 'Mihaela' variety. On the fruits, the anthracnose attack intensity was ranging from I_{0-5}=2.63 at 'Roxana' variety to I_{0-5}=1.50 at 'Mihaela' variety.

In the case of the varieties studied the disease spreads faster in the trees canopies in the second semester of the year, by conidia and microconidia and the leaves and shoots vulnerable to anthracnosis infections even in the second semester of the year.

Our results confirm the find that while the intensity of the attack I (%) express the resistance which opposes the genotype after the pathogen infection, the attack frequency F (%) provide information on plant susceptibility to the infection and disease distribution into the crown, or into the orchard space, previously stated by Martins, J.M.S in 1995.

This study results revealed that each studied variety had a very specific behavior to the *Gnomonia leptostyla* on leaves, shoots and fruits.

The genotypes behavior is related on the weather conditions, pathogen presence and aggressiveness genotypes provenience and genetic background but also to the training and technological exploitation system.

The study results demonstrate that the studied varieties a good and very good behavior to the anthracnosis *Gnomonia leptostylla* (DC.) Trav. sin. *G. leptostyla* (Fr.) Ces attack, and can be extended in modern walnuts orchards. Also, especially in wet years, to master the anthracnosis attack, means close monitoring of meteo conditions, soil tillage along the tree rows to reduce of the biological reserve of the pathogen, resonate irrigation and fertilization especially with nitrogen and application of an integrated phytoprotection program including 6-7 treatments.

Anyway, in favorable years, due their very good behavior to the anthracnosis attack, the cultivars 'Jupanesti', 'Bratia'and 'Mihaela' can be cultivated with even less phytosanitary treatments.

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Tables and Figures

Table 1. The evaluation scale for the diseases severity (I 1-5 notes) on walnut leaves

N.	Field intensity note [n]	Necrosis area [%]
1	**0**	**0**
2	0,5	2
3	**1,0**	**3**
4	1,5	6
5	**2,0**	**10**
6	2,5	18
7	**3,0**	**26**
8	3,5	38
9	**4,0**	**50**
10	4,5	64
11	**5,0**	**76**

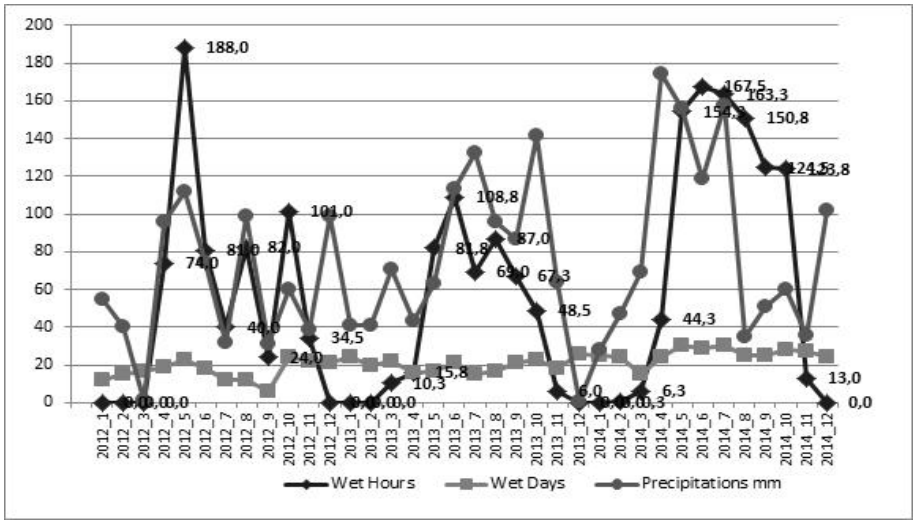


Fig. 1. Monthly average wet hours and wet days dynamic RIFG Pitesti Romania, January 2012 - December 2014

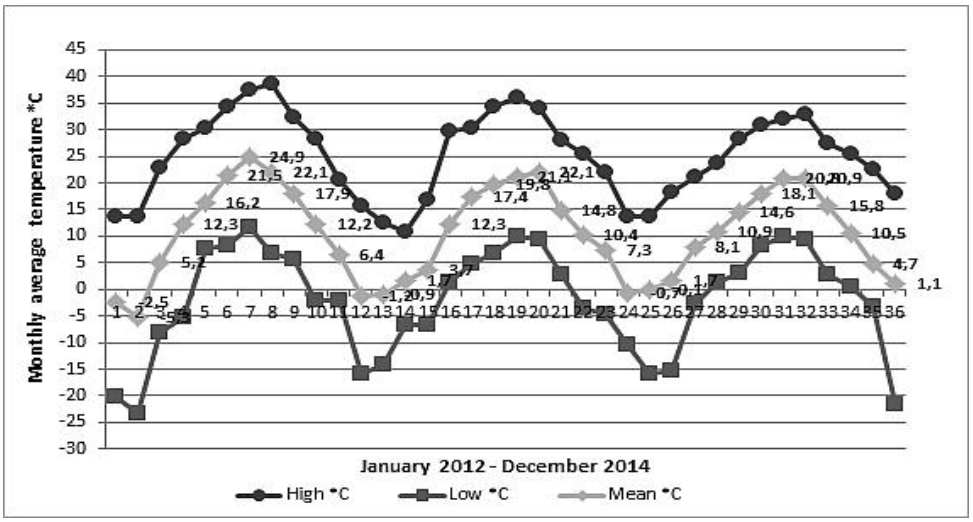


Fig. 2. Monthly average temperature dynamic
RIFG Pitesti Romania, January 2012 - December 2014

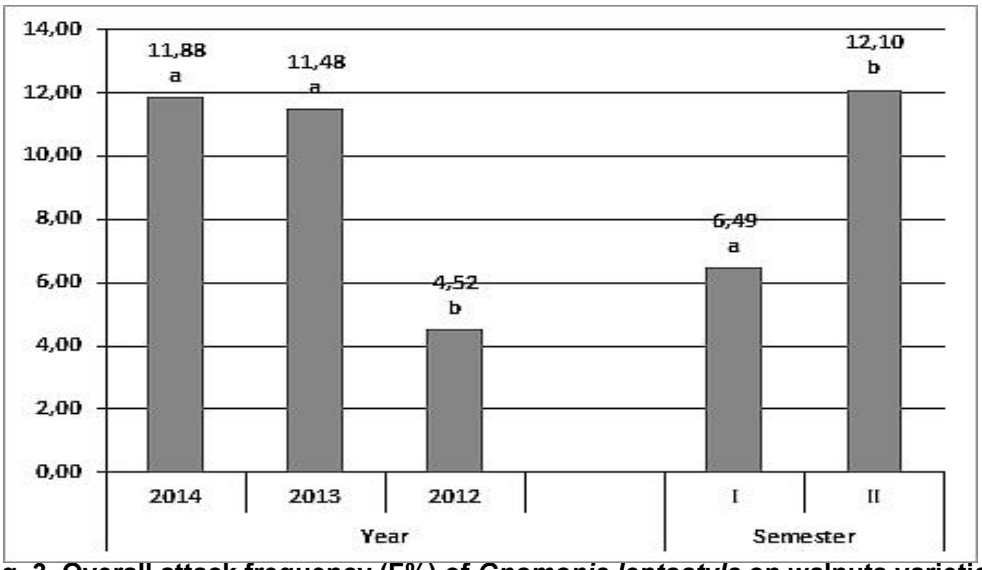


Fig. 3. Overall attack frequency (F%) of *Gnomonia leptostyla* on walnuts varieties leaves and shoots, RIFG Pitesti Romania, January 2012 - December 2014

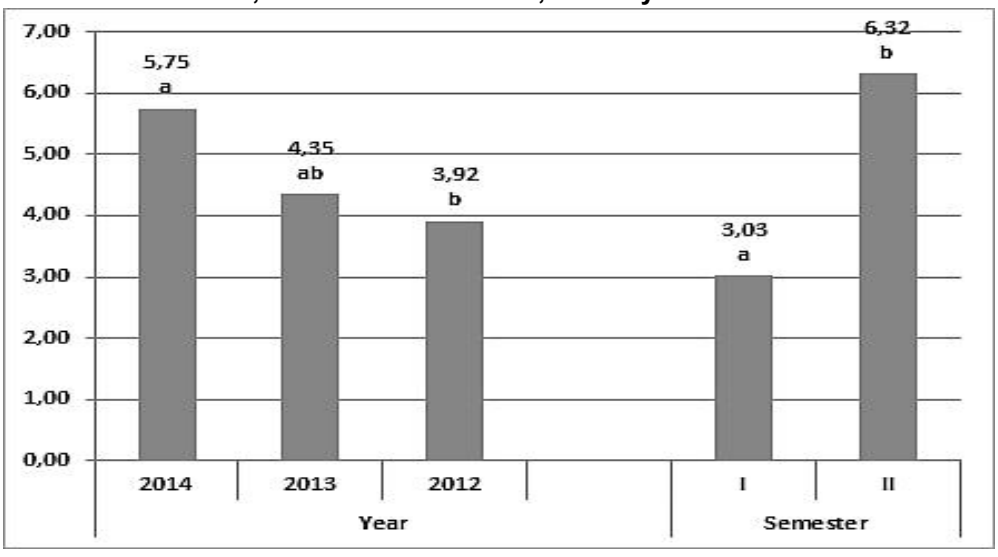


Fig. 4. Overall attack frequency (F%) of *Gnomonia leptostyla* on walnuts varieties fruits RIFG Pitesti Romania, January 2012 - December 2014

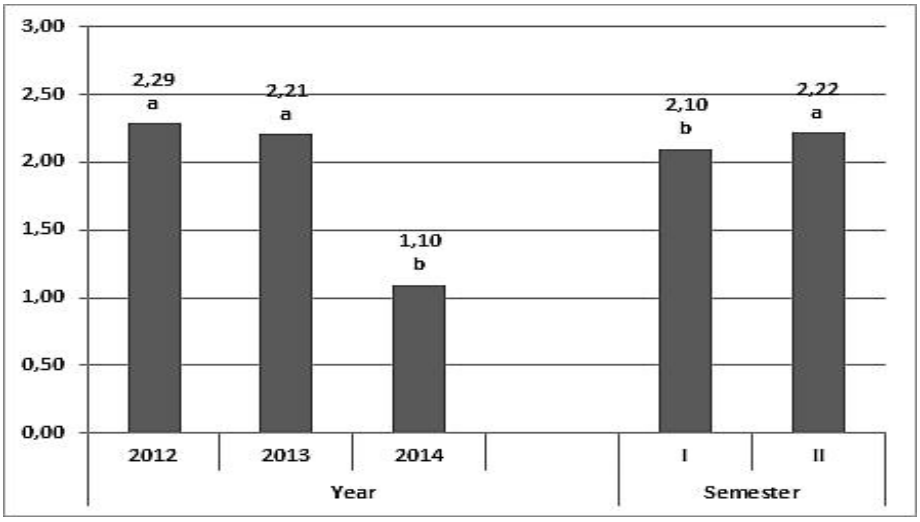


Fig. 5. Overall attack intensity (I_{0-5} notes) of *Gnomonia leptostyla* on walnuts varieties leaves and shoots, RIFG Pitesti Romania, January 2012 - December 2014

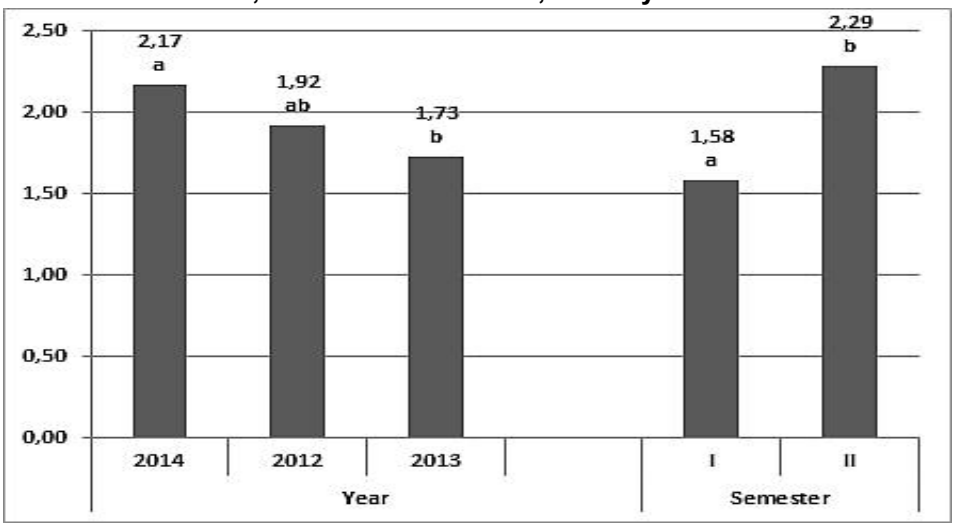


Fig. 6. Overall attack intensity (I_{0-5} notes) of *Gnomonia leptostyla* on walnuts varieties fruits, RIFG Pitesti Romania, January 2012 - December 2014

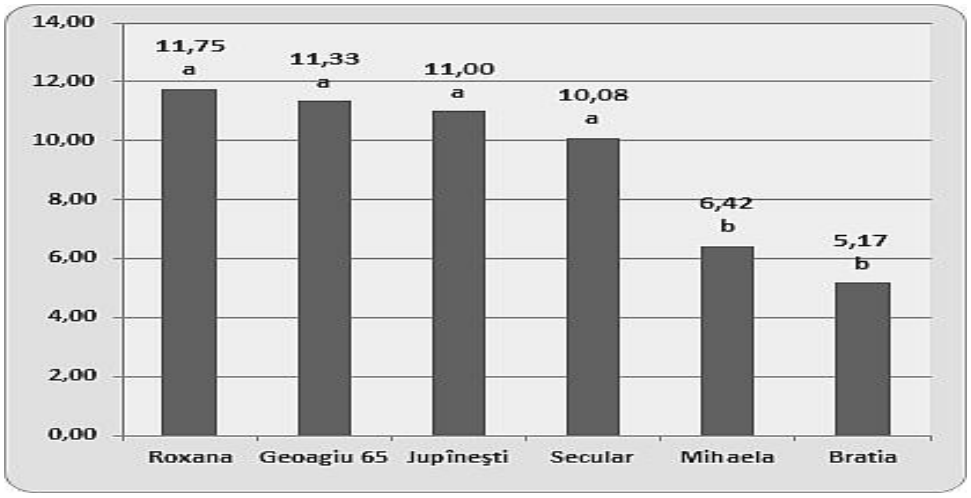


Fig. 7. *Gnomonia leptostyla* attack frequency (F%) on six walnuts varieties leaves and shoots, RIFG Pitesti Romania, January 2012 - December 2014

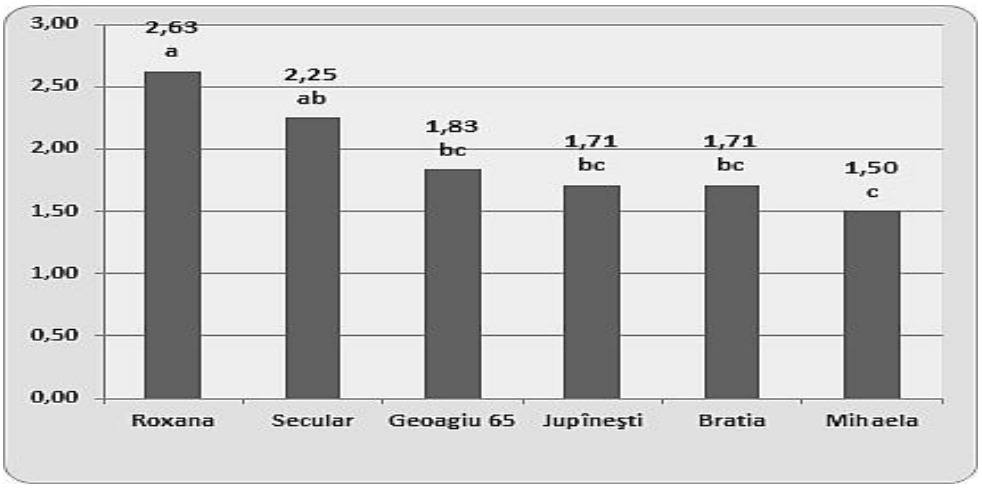


Fig. 8. *Gnomonia leptostyla* attack frequency (F%) on six walnuts varieties fruits, RIFG Pitesti Romania, January 2012 - December 2014

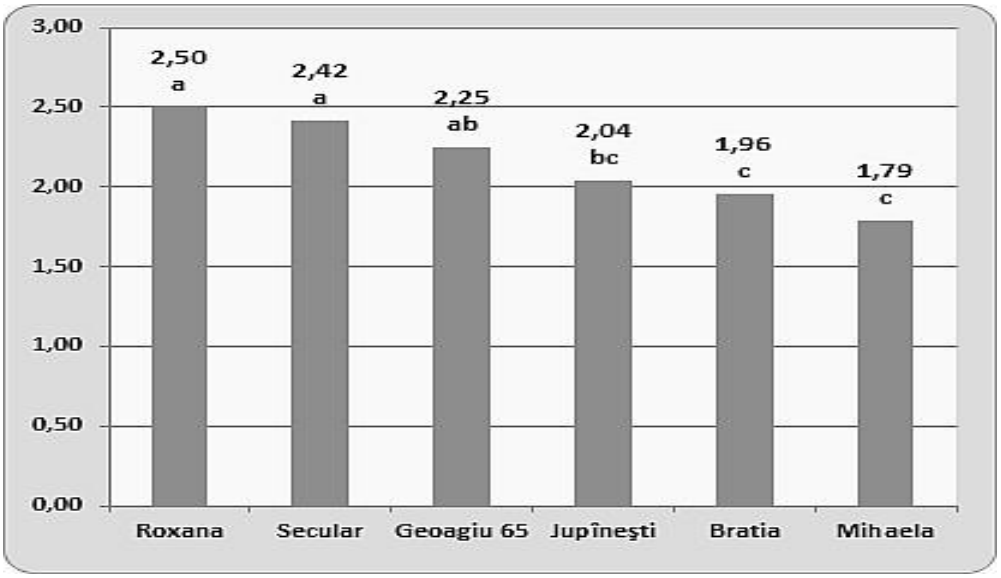


Fig. 9. *Gnomonia leptostyla* attack intensity (I_{0-5} notes) on six walnuts varieties leaves and shoots, RIFG Pitesti Romania, January 2012 - December 2014

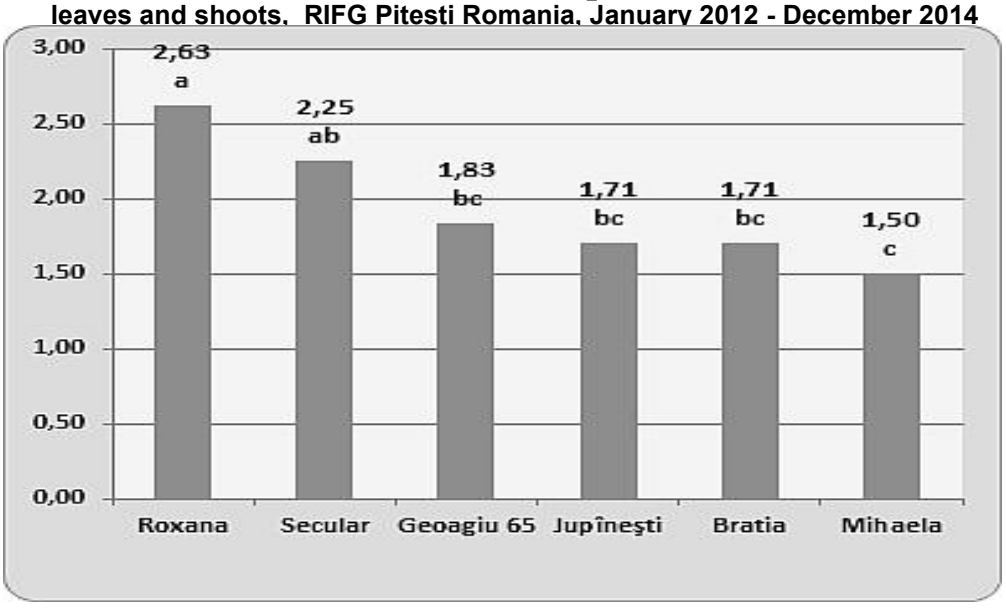
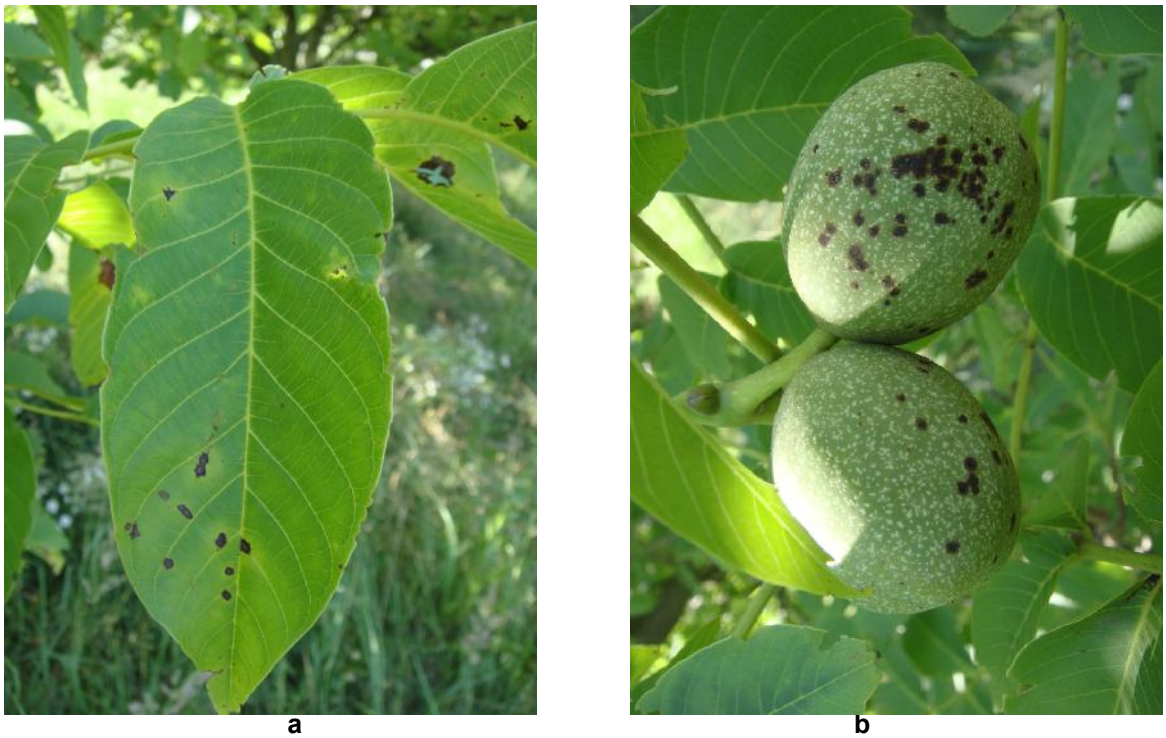


Fig. 10. *Gnomonia leptostyla* attack intensity (I_{0-5} notes) on six walnuts varieties fruits, RIFG Pitesti Romania, January 2012 - December 2014



a b

Fig. 11 'Mihaela' walnut variety with symptoms of *Gnomonia leptostyla* attack on leaves (a) and fruits (b)

a b

Fig. 12 'Secular RM' walnut generative rootstock with symptoms of *Gnomonia leptostyla* attack on leaves (a) and fruits (b)