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RESEARCH ON IMPROVING THE RATE OF GERMINATION TO THE OAK SAPLINGS BY APPLYING THE TREATMENTS BEFORE SOWING ACORNS

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Abstract
In order to study a plant disease, one needs to know the symptomatic manifests, morphology and biology of the pathogen that causes mutual relations between the host plant and the pathogen, and the influence exerted by environmental conditions. In the fight against plant diseases, preventive measures are mainly used.
These sought to determine the degree of impairment in nature pests of the acorn crop emergence percentage and seedling development in the first year of vegetation under the influence of prophylactic or curative treatments applied at sowing. using some new fungicides.
To control these pathogens fungicides series of new generations were tested. Tests were made in several forest nurseries using acorn of several origins and several species of the genus Quercus. Acorns were treated before sowing and the effect of these treatments in health and seedling emergence percentage obtained was observed.

Keywords: fungicides, acorns, nursery, germination, pathogens.

1. INTRODUCTION

If until the early nineteenth century, our country was known as an "oak country", and beech was found only in 14-15% of the forests, natural forest composition was modified continuously over time, being influenced by major anthropogenic changes and climatic conditions changes. The structure of the country's forests, dominated by sessile oak, oak, Turkey oak, Hungarian oak pure or mixed stands, whose ratio exceeded 47%, has radically changed. This occurred mainly due to uncontrolled deforestation of oak stands in plain areas or of sessile oak stands from low hill areas,

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reaching today 17.7% of the forest area. However, many of these have an inadequate vegetation state, are frequently attacked by diseases and pests or are confronted with inadequate technical solutions (Oleksyn and Przybyl, 1987; Chira and Chira, 1998; Giurgiu, 2004).

Taking into account the importance of oak species in the structure of pure and mixed stands and the difficulties that occur even since the regeneration process of these forests has begun and which continues for the stands' development period, it must be said that managing these forests represents a permanent challenge for foresters. It requieres a higher level of knowledge and involvement than other forest ecosystems (Liese and Siwecki, 1991; Kelly, 2002).

It follows that in many cases artificial regeneration is the only solution. In order to realize this, it is required that the production of healthy and vigorous afforestation material of the required assortment, quality and quantity is met. In intensive cultures (solariums. nurseries), where these young plants are produced, in conjunction with the provision of optimal development conditions, premises are created for the occurrence of infections with different pathogens or en masse infestations with various pests. Application of both preventive treatments (essential in the case of pathogens) and curative treatments is imposed.

Any plant disease is characterized by a decrease of the quantity of organic compounds produced and stored in the plant and by morphologic, anatomic, hystologic, cytologic, physiologic and biochemical changes, which renders a decreased harvest in the case of cultivated plants (Bobes 1994; Parvu, 2008).

According to Georgescu (1957) in order for a disease to occur the following fundamental condition must be satisfied:

-the parasite has to possess the qualities to cause the disease on a host plant – affinity, aggressivity, virulence;

-the host has the properties to integrate the parasite;

-the parasite to be in the most favorable conditions for its development and the host to be at an inadequate moment and in improper conditions.

Applying large scale fungicide and pesticide treatments, besides positive aspects, has pointed out a series of negative phenomena in time. The most important are the production of perturbations in the fauna of the forest biocenosis, the disorganization of biocenosis, by en masse destruction of insect-eating insects and the occurrence of pesticide resistant strains.

In the climate conditions of the observed area, the acorn ripens early, in the second half of September. When it ripens, the acorn retains a large amount of water due to its high content of starch. It acts like a fleshy fruit.

Previous research shown that the acorn keeps a maximal germination capacity and a satisfactory health state for a water content of 60-65%. Keeping the acorn at these parameters is important because a decrease under 50% of water content inhibits the germination capacity, while overdamping causes an easy development of pathogens of the following genus: *Sclerotinia, Phomopsis, Erwinia, Botrytis, Schizophyllum, Cytospora, Fusarium, Penicillium etc* (Kowalsky and Butin, 1990; Bolea et al., 1991; Kelbel, 1996).

It is known the fact that in nurseries, the seeds are subject to the variation of edaphic, climatic or biotic factors. Their effect and the values through which they can cause a decrease in germination values must be known.

2. MATERIALS AND METHODS

The chemistry of pesticides has been and is very well developed and there exists a wide range of producers. However, in forestry, unlike in agriculture, some difficulties appear. They are caused by additional criteria regarding the degree of toxicity and selectivity of the chemical product, the

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specificity of the forest environment etc. The decisive criterion for practical usage of a pesticide is the economic one. Moreover, the relatively reduced quantities used in forestry do not encourage the producers to produce highly specialized fungicides to counter forestry pathogens, apart from special cases.

An ideal pesticide should be toxic only for the animal or vegetal pest that is designed to control, not to be toxic for humans and useful living beings, to be harmless for the treated plants, to work fast, not to leave toxic residues on plants or food, to be stable for storage and usage, to act efficiently in small quantities, to be easy to produce and to be cheap.

Up the present day, no substance to meet all of the above requirements has been found. Thus, the extent of current and perspective research on finding substances that have characteristics as close as those mentioned above is explained.

The used fungicides were: TOPSIN 500 SC (Tyophanate-methyl 500 g/l), TELDOR 500 SC (Fenhexamid 500 g/l), LAMARDOR 400 FS (250 g/l Prothioconazole,150 g/l Tebuconazole), CANTUS (Boscalid 50%).

During lab experiments, methods specific to general phytopathology adapted for forestry phytopathology were used.

In the processes of infection and symptoms' expression of a plant disease, two main moments are distinguished: attack and damage.

The attack is numerically represented by frequency, intensity and degree of attack.

The frequency (F) of the attack is the ratio between the number of plants or organs attacked by a phytopathogen (virus, bacteria, fungus) (n) and the number of observed plants or organs (N). The frequency is obtained by direct observation of a number of plants or organs. The result is given by:

$$F = \frac{n\ x\ 100}{N}$$

The intensity (I) of the attack is the value given by the degree of coverage or extent of the attacked, obtained as a ratio between the surface of the attacked area and surface of the observed area. To render the intensity of the attack, scales having different numbers of classes are used. In most cases, in Romania the scales with 4. 5 or 6 classes of intensity are used. These classes are related to various percentage ranges of the intensity of the attack. The relative value of the intensity of the attack is given by the formula (Prochazkova et. al., 2005):

$$I = \frac{\Sigma(i\ x\ f)}{n}$$

where

- i= the attacked surface (%);
- f= the number of attack cases for each i;
- n= total number of attack cases.

The degree of attack (GA) is the extension of the severity of the attack to the total number of plants observed:

$$GA(\%) = \frac{\Sigma(n\ x\ v)}{N\ x\ V} x\ 100$$

where

- n= the degree of infection determined by a certain scale;
- v= the number of individuals from that category;
- N= total number of classes;
- V= total number of individuals.

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Effectiveness of treatment. In assessing control measures for plant diseases, knowing the effectiveness of treatment has a great practical importance. The effectiveness (E) is given by the formula:

$$E = 1 - \frac{\text{Gav}}{GAMt}\, x\, 100$$

where

- Gav= the degree of attack for the treated plant;
- GAMt= the degree of attack for the untreated control plant.

Determining the frequency, intensity and degree of attack has a great importance in assessing the produced damage, in production estimation during vegetation, in determining the treatment application rate, as well as in determining the effectiveness of various methods and means of protecting cultures against phytopathogens (Colnot, 1989; Bastien, 1991; Pârvu, 2008).

In order to determine the effect of fungicide treatment on acorns before sowing, two different situations were taken into consideration:

- one situation when after harvesting, the acorn is picked, sorted and is subject to thermal treatment before sowing;
- one situation when the harvested acorn is sown without being subject to thermal treatment.

For sowing in Keria Nursery, in Bălan vilage, the acorns were chosen such that they had medium or large sizes no mechanical damage, no sting of chewing marks no traces of pathogen attack and intact pericarp. Before sowing they were kept in a hot water tank at approximatively 40°C for 2.5 hours being buoyant at the same time.

The acorns sown in Gherla Nursery were randomly chosen having all dimensions marks of mechanical damage diseased acorns etc. Before sowing they were just buoyant.

It is to mention that for a better display of treatments’ effect, a solution of isolated spores from diseased acorns was added in the water used for thermal treatment or flotation.

After drying, the acorns were sown (classical schema. 30 acorns for one meter) and before burial they were sprayed by Vermorel sprayer.

Seven experimental variants arranged in five repetitions, with 350 acorns per variant were used.

3. RESULTS AND DISCUSSION

Native quercus genus species fructifies abundant once 4-8, with with splashing larger or smaller intermediate years. By treating acorn before seeding aims to increase the percentage of emergence and reducing the influence of specific pathogens. The results obtained from measurements and statistical analyses are outlined below (table 1 and table 2).

The analysis of variance is noted that treatment options do not differ significantly from each other ($\mathbf{F_{calc}} < \mathbf{F_{teoretic\ 0,05}}$) values obtained in the general ranking it above their production standards (70 %), which is somewhat explained by the high quality of sample acorn studied (table 3).

Given the high degree of affection, acorn storage becomes a difficult thing, being created prerequisites for the outbreak of disease, so that in addition to ensuring a constant temperature and humidity in storage is mandatory to apply several antifungal treatments. The emergence percentage for acorns of oak in various treatment options is presented in table 4.

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Table 1. ***The number of springed-up and viable plants of Turkey oak (Quercus cerriss) species, from treated before planting acorn***

Treatment variant		V1	V2	V3	V4	V5	V6	V7
repetition		***Keria nursery***						
R1	nr	264	240	266	234	287	250	273
	%	75.32	68.66	75.99	66.86	82.00	71.32	77.99
R2	nr	292	231	205	221	288	259	245
	%	83.32	65.99	58.66	63.14	82.29	73.99	69.99
R3	nr	292	287	226	287	267	264	280
	%	83.32	81.99	64.66	82.00	76.29	75.32	79.99
R4	nr	252	282	303	239	237	212	278
	%	71.99	80.66	86.65	68.29	67.71	60.66	79.32
R5	nr	285	289	254	286	256	233	252
	%	81.32	82.65	72.66	81.71	73.14	66.66	72.00
media *average*	nr	276.69	265.96	251.03	253.40	267.00	243.57	265.50
	%	79.06	75.99	71.72	72.40	76.29	69.59	75.86

V1- untreated control plant; V2- Tyophanate-methyl 500g/l; V3- Prothioconazole 250 g/l + Tebuconazole 150 g/l; V4- Fenhexamid 500 g/l; V5- Boscalid 50%; V6- acetylsalycilic acid 0.21 g/l; V7- aqueous extract. Juglone 15%.

Table 2. ***The springed-up percentage of Turkey oak (Quercus cerris) treated before planting acorn***

Treatment variant		V1	V2	V3	V4	V5	V6	V7
repetition		***Gherla Nursery***						
R1	nr	201	197	273	219	225	245	234
	%	57.43	56.29	78.00	62.57	64.29	70.00	66.86
R2	nr	206	234	249	235	250	213	204
	%	58.86	66.86	71.14	67.14	71.43	60.86	58.29
R3	nr	198	209	253	247	231	206	221
	%	56.57	59.71	72.29	70.57	66.00	58.86	63.14
R4	nr	223	269	257	287	283	212	203
	%	63.71	76.86	73.43	82.00	80.86	60.66	58.00
R5	nr	213	243	224	255	222	233	191
	%	60.86	69.43	64.00	72.86	63.43	66.57	54.57
media *average*	nr	208.20	230.40	251.20	248.60	242.20	221.86	210.60
	%	59.49	65.83	71.77	71.03	69.20	63.39	60.17

V1- untreated control plant; V2- Tyophanate-methyl 500g/l; V3- Prothioconazole 250 g/l + Tebuconazole 150 g/l; V4- Fenhexamid 500 g/l; V5- Boscalid 50%; V6- acetylsalycilic acid 0.21 g/l; V7- aqueous extract. Juglone 15%.

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Table 3. ***The variance analysis and the determination of springed-up percentage of the Turkey oak (Quercus cerris) treated before planting acorn according to Duncan test***

Variability source	SPA	GL	S^2	F calculated	F theoretic 0.05	F theoretic 0.01
(SPAt) *total*	698.91	34	-	2.79*	2.45	3.53
(SPAvar) *between treatment variants*	261.63	6	43.60			
(SPA rep) *between repetition-Error*	437.29	28	15.62			
$Fcalc_{2.79}$ *> Ftheor 0.05 $_{2.4}$						

Gherla Nursery

Treatment variant	*Experimental differences between the efficiency of the used fungicides*						
	V3	V4	V5	V2	V6	V7	V1
average	57.97	57.59	56.42	54.33	53.27	51.46	50.46
V3	-	0.38	1.55	3.63	4.70	**6.51***	**7.50***
V4	-	-	1.17	3.25	4.32	6.13	**7.12***
V5	-	-	-	2.09	3.15	4.96	5.96
V2	-	-	-	-	1.07	2.87	3.87
V6	-	-	-	-	-	1.81	2.80
V7	-	-	-	-	-	-	1.00
V1	-	-	-	-	-	-	-

V1- untreated control plant; V2- Tyophanate-methyl 500g/l; V3- Prothioconazole 250 g/l + Tebuconazole 150 g/l; V4- Fenhexamid 500 g/l; V5- Boscalid 50%; V6- acetylsalycilic acid 0.21 g/l; V7- aqueous extract. Juglone 15%.
$Ds_{5\%}$ =5.72-6.51; $Ds_{1\%}$ = 7.72-8.67

Table 4. ***The springed-up percentage of sessile oak (Quercus petraea) treated before planting acorn***

Treatment variant		V1	V2	V3	V4	V5	V6	V7
repetition		***Gherla Nursery***						
R1	nr	208	215	238	224	213	222	203
	%	59.43	61.43	68.00	64.00	60.86	63.43	58.00
R2	nr	179	211	256	225	246	219	217
	%	51.14	60.29	73.14	64.29	70.29	62.57	62.00
R3	nr	209	207	244	259	247	189	192
	%	59.71	59.14	69.71	74.00	70.57	54.00	54.86
R4	nr	199	206	219	231	217	236	196
	%	56.86	58.86	62.57	66.00	62.00	67.43	56.00
R5	nr	186	234	267	229	227	217	225
	%	53.14	66.86	76.29	65.43	64.86	62.00	64.29
aver age	nr	196.20	214.60	244.80	233.60	230.00	216.60	206.60
	%	56.06	61.89	69.94	66.74	65.71	61.31	59.03

V1- untreated control plant; V2- Tyophanate-methyl 500g/l; V3- Prothioconazole 250 g/l + Tebuconazole 150 g/l; V4- Fenhexamid 500 g/l; V5- Boscalid 50%; V6- acetylsalycilic acid 0.21 g/l; V7- aqueous extract. Juglone 15%.

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Table 5. ***The variance analysis and the determination of springed-up percent of sessile oak (Quercus petraea) treated before planting acorn according to Duncan test***

variability source	SPA	GL	S^2	Fc	Ft 0.05	Ft00.1
total	436.94	3	-	**6.13**	2.45	3.53
(SPAvar) *between treatment variants*	248.09	6	41.35			
(SPA rep) *between repetition-Error*	188.85	28	6.74			
Gherla Nursery						

Treatment variant	*Experimental differences between the efficiency of the used fungicides*						
	V3	V4	V5	v2	v6	V7	V1
average	56.82	54.82	54.19	51.90	51.52	50.21	48.47
V3	-	2.00	2.63	**4.92***	**5.30***	**6.61****	**8.35****
V4	-	-	0.63	2.92	3.30	**4.61***	**6.35****
V5	-	-	-	2.29	2.67	3.98	5.72
V2	-	-	-	-	0.38	1.69	3.43
V6	-	-	-	-	-	1.31	3.05
V7	-	-	-	-	-	-	1.74
V1	-	-	-	-	-	-	-

V1- untreated control plant; V2- Tyophanate-methyl 500g/l; V3- Prothioconazole 250 g/l + Tebuconazole 150 g/l; V4-Fenhexamid 500 g/l; V5- Boscalid 50%; V6- acetylsalycilic acid 0.21 g/l; V7- aqueous extract. Juglone 15%.

$Ds_{5\%}$ =3.76-4.28; $Ds_{1\%}$ = 5.07-5.71;

According to the data of Table 5, it resulted that the success of the best was the variant treated with Prothioconazole 250 g/l + Tebuconazole 150 g/l, and the lowest in untreated variant, acorns of oak proved more strongly influenced by the attack pathogens than acorn sky. Analyzing the significance of differences observed between treatment options with Prothioconazole 250 g/l + Tebuconazole 150 g/l there are significant differences compared to the control and one with biopreparation extract from mesocarp black walnut and significant differences between treatment Fenhexamid 500 g/l and at the biopreparation of black walnut. Among other treatment options differences are not statistically.

From the data it can be observed that the springing up percentage in the case of sowing without rigorous sorting is strongly influenced by the application of chemical treatments before sowing. The chemically treated variants had a springing up percentage higher by 10-14% than the control plants or those treated by bioproducts based on dilution of aspirin or aqueous solution from the mesocarp of black walnut. From the chemical substances used, the product with *Fenhexamid 500 g/l*shown the best results.

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Table 6. ***The springed-up percentage of common oak (Quercus robur) treated before planting acorn***

Treatment variant		V1	V2	V3	V4	V5	V6	V7
repetition		***Pădurea Mare Nursery. Satu Mare F.D***						
R1	no	204	215	233	238	217	216	202
	%	58.29	61.43	66.57	68.00	62.00	61.71	57.71
R2	no	198	247	261	245	228	223	188
	%	56.57	70.57	74.57	70.00	65.14	63.71	53.71
R3	no	197	234	254	274	246	196	207
	%	56.29	66.86	72.57	78.29	70.29	56.00	59.14
Average	no	199.67	232.00	249.33	252.33	230.33	211.67	199.00
	%	57.05	66.29	71.24	72.10	65.81	60.48	56.86

V1- untreated control plant; V2- Tyophanate-methyl 500g/l; V3- Prothioconazole 250 g/l + Tebuconazole 150 g/l; V4- Fenhexamid 500 g/l; V5- Boscalid 50%; V6- acetylsalycilic acid 0.21 g/l; V7- aqueous extract. Juglone 15%.

Table 7. ***The variance analysis and the determination of springed-up percentage of common oak (Quercus robur) treated and unselected before planting acorn according to Duncan test***

variability source	SPA	GL	S^2	Fc	Ft0.05	Ft0.01
(SPAt) *total*	364.00	20	-	3.04	2.85	4.46
(SPAvar) *between treatment variants*	205.80	6	34.30			
(SPA rep) *between repetition-Error*	158.20	14	11.30			

Treatment variant	*Experimental differences between the efficiency of the used fungicides*						
	a) **Pădurea Mare Nursery. F. D. Satu Mare**						
	V3	V4	V5	v6	v2	V7	V1
average	57.6	55.77	54.55	54.24	51.06	49.06	48.93
V3	-	1.83	**3.05***	**3.36***	**6.54****	**8.54****	**8.67****
V4	-	-	1.22	1.53	4.71	**6.71****	**6.84****
V2	-	-	-	0.31	**3.49***	**5.49****	**5.62****
V6	-	-	-	-	**3.18***	**5.18****	**5.31****
V5	-	-	-	-	-	2.00	2.13
V7	-	-	-	-	-	-	0.13
V1	-	-	-	-	-	-	-

V1- untreated control plant; V2- Tyophanate-methyl 500g/l; V3- Prothioconazole 250 g/l + Tebuconazole 150 g/l; V4- Fenhexamid 500 g/l; V5- Boscalid 50%; V6- acetylsalycilic acid 0.21 g/l; V7- aqueous extract. Juglone 15%.
$Ds_{5\%}$ =2.56-2.87; $Ds_{1\%}$ = 3.55-3.97;

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By comparing the effects of the seven experimental variants (table 7) it appears that in the case of sowings with unsorted acorns and having an infestation potential, the variants treated with *Prothioconazole 250 g/l + Tebuconazole 150 g/l* and *Fenhexamid 500 g/l* provide a significantly distinct increase of springing up ratio than the variants treated with *Tyophanate-methyl 500g/l* or with *Acetylsalycilic acid 0.21 g/l* dilution, and significantly distinct with respect to the other variants.

4. CONCLUSIONS

- acorns harvested in 2014 and 2015 has a high degree of damage; the attack of seed eating pests, that facilitate the installation and proliferation of specific pathogens, predominates.
- in stands - seed reservations, taking into account the high percentage of attacked acorns by pests (*Balaninus sp., Carpocapsa sp., Andricus sp.*). at the first massive fall of acorns, when the majority are affected – are taken into consideration either an insecticide treatment that attacks larvae when they come out of the acorns but before getting into ground, either harvesting and destroying this quantity.
- the optimal harvest period is at the half of November because the first fructification wave in September is more heavily affected and. after harvesting, because usually optimal storage conditions cannot be provided, sowing as fast as possible is recommended.
- an improper storage for more than 10 days causes a decrease of natural humidity from 80% to 60-65%, which creates conditions for the development of pathogens and infestation of the whole batch.
- fungicides did not have the statistically effects when they were applied preventively on healthy and thermally treated acorns; however, a significant increase in the springing up percentage is observed when they are applied curatively on diseased samples.
- the largest differences between treatment variants were obtained in the case of sowings with unsorted acorns and having an infestation potential. the variants treated with *Prothioconazole 250 g/l + Tebuconazole 150 g/l. Fenhexamid 500 g/l and Tyophanate-methyl 500g/l* provide a significantly increase of springing up ratio than the variants treated with *Boscalid 50%* or with *Acetylsalycilic acid 0.21 g/l* dilution, and significantly distinct with respect to the other variants for the performed experiment.
- more resistant to pathogen attack was proven to be the red oak acorn, where only 20-28% of the harvested batch had damage or attack marks; this determined a high springing up percentage in all treated variants and also in the untreated control variant.
- the aspirin dilution treatment had significant differences with respect to the untreated control variant only in this case, which denotes the limited, strictly specialized potential of this product.
- the bioproduct of aqueous extract of *Juglone 15*% did not had statistically ensured differences with respect to the control variant in none of the analyzed cases.

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