HEALTH STATUS OF GREYISH AND DOWNY OAK FOREST OF ROMANIAN PLAIN

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Abstract

Evaluation and health status of greyish oak and pubescent oak forest in the Romanian Plain in 2006 were achieved on a network of 21 'Prodan' sample plots (method of six trees) and the network of permanent surfaces (7 surfaces) located and designed for dendrometric and auxological research, on greyish oak and downy oak trees. The total number of trees evaluated for all species in both monitoring networks (3569 trees), 75.9% were practically healthy (percentage of defoliation ≤ 25 %) and 24.1% of them were damaged trees (percentage of defoliation of the crown > 25%). Xerophytes oak trees (greyish oak + downy oak) have been harmed by a share of 27.4%. In relation to the origin (regeneration mode), trees coming from plantation proved less affected than those from shoots. Thus, the proportion of damaged greyish oak trees shoots was derived from 31.56% to 9.99% for those from plantations and at 36% for pubescent oak trees coming from shoots and 2.25% for those coming from plantations. Also proved that the health of the trees is significantly correlated with their Kraft classes and quality classes for trees from the shoots, which proved less in case of plantations.

Keywords: *greyish oak, downy oak,* defoliation, health status**.**

INTRODUCTION

Xerophytes oaks problem, namely the *greyish oak* and *downy oak*, requires a special concern for maintaining the forest continuity in these fragile areas, from climate and social point of view (Giurgiu, 2005).

In case of *greyish oak* and *downy oak* trees damages, the symptoms are reduced in height and diameter growth, crown thinning due to abnormal increase of the phenomenon of drying buds and stems, discoloration and yellowing, decreasing the size and grouping the remaining leaves at the terminal end the stalks, the appearance of greedy shoots, partial necrosis of bark and bills etc. (Hartmann et al., 1995,Schlag,1995). The damage may comprise only a portion of crown or the entire tree. The phenomenon of decline can affect individual trees or groups of trees within a stand, parts of stand and rarely, the entire stands (Schlag, 1994). Insects of roots, stems, buds or leaves, xylophages insects, parasite plants and different species of mammals have contributed to an extent of the current status of *greyish oak* and *downy oak* forests (Simionescu et al., 2000).The *greyish oak* and *pubescent oak* forest decline was determined by anthropogenic and climatic factors which led to an increased ecological imbalance of forest ecosystems

(Alexe,1985). Against this background of ecological imbalance acted decisively drought, defoliation by insects, followed by attacks of mildew. The defoliations, previously considered the main cause of decline (Marcu et al., 1966), are a consequence of ecological imbalance (Giurgiu, 2004) .

Analyzing the multi-annual results on the health of *greyish oak* and *downy oak* forests, assessed by forest monitoring system applied in Romania in the period 1990-2006 (Badea, Neagu, 2007), we can see that they differ more or less from year to year within the analyzed period . The percentage of damaged *greyish oak* and *downy oak* damaged trees in 2006 (defoliation classes 2-4) was 24.2% (Badea, Neagu, 2007).

The purpose of this research paper is to characterize the health status of *greyish oak* and *downy oak* stands of the Romanian Plain with dendrometrical fundaments.

The main objectives of this research work are: health knowledge of greyish oak and *downy oak* forests through a network of permanent and temporary plots and correlation of different dendrometrical features (Kraft classes, grade) with the health of trees across the research network, including their influence on the percentage of defoliation of tree crowns.

MATERIALS AND METHODS

To determine the dynamics of the health statuse of *greyish oak* and *pubescent oak* forests, were placed 21 Prodan plots (84 groups of six trees) and 7 permanent plots in the network area (Table 1 and Table 2).

Table 1

Identifiers network Prodan polls

Current number	Survey name	Range forest	Management unit	Parcel	Age	Regeneration
1	Punghina	Vânju Mare	IV	56 A	79	LT*
2	Întorsura	Perişor	III	57 A	63	LT
3	Panaghia	Segarcea	IV	22 A	54	P**
4	Deveselu	Caracal	VIII	52 G	56	LT
5	Comoara	Alexandria	V	53 A	70	LT
6	Ruica Buciumeni	Giurgiu	V	55 B	64	LT
7	Buturugaru	Giurgiu	IV	129 B	59	LT
8	Măgura	Comana	VII	16	45	P
9	Negoeşti	Mitreni	VII	57 A	62	LT
10	Tatina	Mitreni	VIII	61 A	62	LT
11	Ciornuleasa	Mitreni	VIII	29	62	LT
12	Pasărea	Brăneşti	II	83 D	65	LT
13	Blidaru	Snagov	VII	5 A	79	LT
14	Balamuceanca	Snagov	VII	95 A	91	LT
15	Groasa	Urziceni	I	39 A	48	LT
16	Sineşti	Urziceni	II	3 A	78	LT
17	Tămădău Mare	Lehliu	I	2 A	77	LT
18	Călăreţi	Lehliu	II	4 B	57	P
19	Bazarghideanu	Lehliu	III	77 A	49	LT
20	Ciunga	Feteşti	II	57 A	43	P
21	Chirana	Slobozia	V	23 C	32	P

Table 2

Identifiers network of permanent survey

Current number	Survey name	Range forest	Management unit	Parcel	Age	Regeneration
1	Govora	Caracal	VIII	43 B	78	LT
2	Dandara	Alexandria	V	14	60	LT
3	Zoicaru	Brăneşti	II	24 H	86	LT
4	Baba Chira	Brăneşti	II	35 B	78	LT
5	Bărăgan	Bărăgan	I	49	58	P
6	Bărăgan	Bărăgan	I	50	58	P
7	Bărăgan	Bărăgan	I	81	57	P

* LT = shoots; **P = plantations (seed).

The permanent sample areas for forest health monitoring of *greyish oak* and *pubescent oak* in the Romanian Plain, were selected predominant trees, dominant trees and co-dominant trees (Kraft classes I, II and III), and in case off Prodan plots, the first six closest trees (which accomplish these conditions off Kraft classes). Taking-up this criterion for choosing the sample trees, it has been considered that the canopy of these trees are almost equally exposed to environmental damaged (such as pollution, sun exposure, wind, snow, hail, etc.) and their potential for accumulation of biomass and competition are similar favorable.

However, to ensure the comparability of information at European level, this criterion has been adopted by all member countries of the ICP. Forests (ICP-Forests Manual, 2004).

Defoliation is one of the most important parameters and expresses the loss of leaves or needles in the tree canopy, compared with another unit whose foliage is complete (as reference tree). This process is estimated by visual assesment using as a reference a tree of the same species with full foliage, in the vicinity of the batch of sample (survey) or photo images applicable to species from our country. Given the relative estimation, the registration is in percentage, by rounding to the nearest amount divisible with 5.The intensity of tree damage after the percentage of defoliation to his canopy, was determined by the methodology adopted at European level (Badea et al., 2008).

RESULTS AND DISCUSSION

To analyze the health of *greyish* and *downy oak* forests in the Romanian Plain were considered as sample the Prodan plots and the permanent plots and thus settled as the percentage of defoliation by species and total species (Table 3).

Table 3

Percentage of healthy and damaged trees by species and total species in Prodan network surveys and permanent plots

Species	basically healthy trees (defoliation classes 0-1)		damaged trees (defoliation classes 2-4)		Total trees
	number of trees	%	number of trees	%	
Greyish oak	1355	76,90	407	23,10	1762
Downy oak	809	66,47	408	33,53	1217
Turkey oak	118	97,52	3	2,48	121
Hungarian oak	16	57,14	12	42,86	28
Common oak	11	100,00	0	0,00	11
Locust	12	66,67	6	33,33	18
Ash	7	100,00	0	0,00	7
Pennsylvania ash	7	100,00	0	0,00	7
Flowering ash	6	60,00	4	40,00	10
Field elm	104	89,70	12	10,40	116
Hedge maple	238	99,17	2	0,83	240
Wild crab	1	100,00	0	0,00	1
Wild pear	10	66,67	5	33,33	15
Norway maple	16	100,00	0	0,00	16
Total	2710	75,93	859	24,07	3569

Analyzing the health status of the two main trees species, we can see that the *downy oak* are more affected than *greyish oak* trees, defoliation percentage being 33.53% for downy oak, respectively 23.10% for *greyish oak*.

Adding the two species, namely *greyish oak* and *downy oak*, from both surveys (type Prodan and permanent) 27.36% of the trees that are damaged (defoliation classes 2-4) and 72, 64% are basically healthy (defoliation classes 0-1) (Table 4).

Table 4

Percentage of healthy and damaged greyish oak and dawny oak trees in permanent and Prodan networks, in 2006.

Species	basically healthy trees (defoliation classes 0-1)		damaged trees (defoliation classes 2-4)		Total trees
	number of trees	%	number of trees	%	
Greyish oak + Downy oak	2164	72,64	815	27,36	2979

It has also been assessed the health of trees depending on the trees regeneration (seed and sprouts). Therefore it was found, that form the *greyish oak* trees number, 691 trees derived from seed evaluated respectively Kraft classes I, II and III, 90.01% (622 trees) were classified as basically healthy trees (defoliation classes 0-1) and 9.99% (69 trees) were classified as unhealthy trees (defoliation classes 2-4). For *downy oak*, from 89 trees evaluated, 97.75% (87 trees) were classified basically healthy and only 2.25% (2 trees) were damaged trees (Table 5).

For stands from the shoots, the *greyish oak*, 1071 trees evaluated, 68.44% were situated in the basically healthy tree category and 31.56% (338 trees) were classified as damaged. Regarding the *downy oak* tree, from 1128

of trees evaluated, 64% (722 trees) were classified healthy and 36% (406 trees) were damaged trees (Table 6).

Table 5

Percentage oh healthy and damaged trees, from greyish and downy oak trees, coming from plantations

Species	healthy trees (defoliation classes 0-1)		damaged trees (defoliation classes 2-4)		Total trees
	number of trees	%	number of trees	%	
Greyish oak	622	90,01	69	9,99	691
Downy oak	87	97,75	2	2,25	89

Table 6

Percentage oh healthy and damaged trees, from greyish and downy oak trees, coming from sprouts

Species	healthy trees (defoliation classes 0-1)		damaged trees (defoliation classes 2-4)		Total trees
	number of trees	%	number of trees	%	
Greyish oak	733	68,44	370	31,56	1200
Downy oak	722	64,00	406	36,00	1128

Based on positional relationship between the classes of trees and lots of evidence of their health by the degree of defoliation of the tree foliage were combined the network plots Prodan and network permanent plots, resulting in defoliation intensity of the *greyish oak* Kraft class (Figure 1) and *downy oak* (Figure 2).Based on information provided by the two combined surveys (Prodan and permanent) and on analysis between positional classes of trees and their health by the degree of defoliation of the tree foliage, was established the defoliation situation on Kraft classes for *greyish oak* (Figure 1) and *downy oak* (Figure 2).

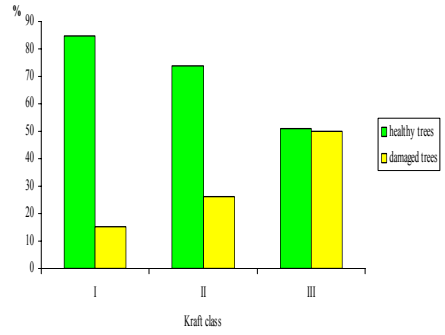

Fig.1. Percentage of defoliation on Kraft classes at *greyish oak* - network surveys

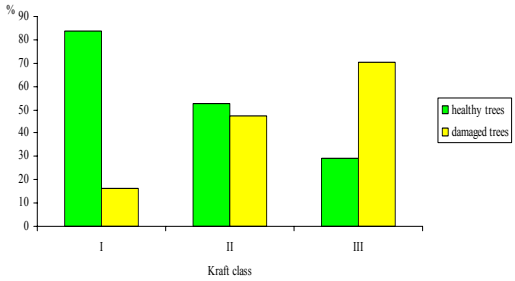

Fig.2. Percentage of defoliation on Kraft classes at *downy oak* - network surveys

In permanent plots was analyzed the relation between quality classes of trees and their health status after defoliation of trees foliage. The share values assigned by groups of trees of defoliation and quality classes are given in figures 3 and 4.

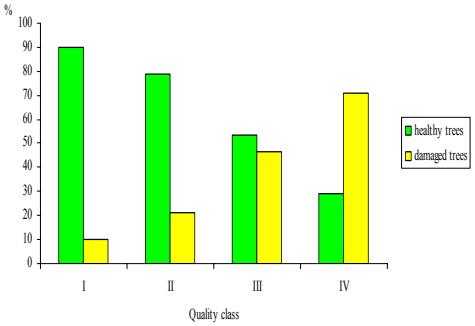

Fig.3. Percentage of defoliation on quality classes at *greyish oak*- permanent plots

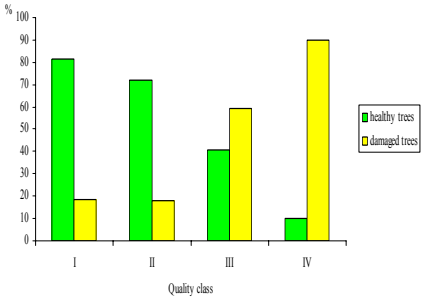

Fig.4. Percentage of defoliation on quality classes at *downy oak* trees- permanent plots

To establish the relation between the positional classes, quality classes of trees and their health status, the independence criterion was applied (test of independence). Thus, the permanent sample plots, trees were grouped according to positional classes (I, II, III), quality classes (I,II,III,IV) and percentage of defoliation of the canopy. Having determined the respective frequencies of these three characteristics, contingency tables werw determined for sample studied areas. Dependence (or independence) groups and Kraft classes on defoliation classes and quality classes on defoliation classes was determined by the criterion χ^2, which allows highlighting the presence or absence of a relation (Table 7).

Table 7

χ^2 values calculated by applying the test of independence

Survey name	Relationship	Regeneration	χ^2_{exp}	$\chi^2_{0,05}$	Signification
Dandara	Kraft classes-defoliation classes	shoots	113,1	5,99	significant
Bărăgan I	Kraft classes-defoliation classes	plantations	0,01	3,84	insignificant
Dandara	Quality classes-defoliation classes	shoots	8,45	5,99	significant
Bărăgan I	Quality classes-defoliation classes	plantations	1,81	3,84	insignificant

In case of the sample areas where the trees accrue are sprouts (eg. Table 6) we note that their value $\chi^2_{exp} > \chi^2_{0,05}$ is significant, the null hypothesis is rejected. It follows that the ratio of downy oak harmed trees and the relatively healthy (trees derived from sprouts) positional class is influenced by the stand of trees, since χ^2_{exp} is greater than $\chi^2_{0,05}$.

For areas where the trees are from plantations, analyzing the experimental statistics χ^2_{exp}, compared with the theoretical, for a transgression probability of 5%, the null hypothesis is rejected. It follows that in case of the Bărăgan I sample surface, the ratio of damaged *greyish oak* trees and the relatively healthy, positional class is not influenced by the

health status of trees, that there is no significant relationship between positional classes (I, II, III) proportion of injured trees (defoliation classes 2-4). The appropriate frequencies of these two characteristics were established, resulting contingency tables of areas under study.

The value of $\chi^2_{exp} > \chi^2_{0,05}$ is significant, the null hypothesis is rejected. It follows that the ratio of pubescent oak trees harmed and the relatively healthy grade is influenced by the quality class of trees in the stand, that exists a significant relationship between quality classes (I, II, III, IV) and the proportion of damaged trees (defoliation classes 2-4). The corresponding relation could not be demonstrated statistically in case of stands from plantations. For stands from the plantations, the ratio of relatively healthy trees and those damaged is not influenced by the quality class of trees in stands, that there is no significant relationship between quality classes (I, II, III, IV) and the proportion of damaged trees .

The value of $\chi^2_{exp} < \chi^2_{0,05}$ is insignificant, the null hypothesis is rejected. It follows that the ratio of damaged and relatively healthy *greyish oak* trees are unaffected by the quality class of trees in the stand, that there is no significant relationship between quality classes (I, II, III, IV) and the proportion of injured trees (defoliation classes 2-4).

Analyzing the health status of the two main species of trees in the permanent and Prodan plots, we note that the *downy oak* trees are more affected than *greyish oak* trees, defoliation percentage being 33.53% for *pubescent oak*, respectively 23.10% for *greyish oak*.

Analyzing the health status of *greyish oak* and *downy oak* trees depending on the regeneration of trees (seed and shoots) was found that the proportion of damaged trees coming from shoots, is higher than the proportion of the trees derived from seed, the sprout trees being more affected, leading to stubs degradation and soil depletion, reduce productivity and degradation of forest stands, with an increasingly weak state of vegetation.

Analyzing the positional relationship between the classes of trees and their health status by the degree of defoliation, it has been found an increase in the percentage values of the damaged trees superior for the lower Kraft classes.To those above mentioned, the statistical finding that the social position in the forest stand significantly influence the health of the trees, decreasing from the upper classes Kraft, explained by the existing competition at trees crowns level.

Analyzing the percentage of damaged trees (defoliation classes 2-4) on quality classes it was noticed an increase in its values, the higher quality classes to those of lower quality classes. This confirms the truth that the trees of the superior wood quality classes (I and II), recorded higher growth

and vitality. Thus, the effects of internal and external damages, physical, especially biotic and abiotic factors, combined with other stress factors (climatic, anthropogenic etc.), directly influences the quality of trees and their health status.

CONCLUSIONS

Based on the results and their analysis the following conclusions can be drawn:

- the *greyish oak* and *downy oak* stands from the shoots are more affected than those from seed, the latter share being reduced, the intensity of damage is influenced by the relatively poor health status of those from shoots;
- trees characteristics : Kraft classes, quality classes, provenance trees along the main factors, particularly drought, significantly affect the health of the xerophytes oaks, this being highlighted by statistical and mathematical processes;
- permanent degradation of *greyish oak* and *downy oak* forests of southern and south-east of our country can lead to the disappearance of the last living borders against the extending of Eurasian steppe over the European continent.

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