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The factors affecting the acorn production of Pedunculate Oak (Republic of Moldova)

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Abstract: The paper presents the evolution of the formation and development of the pedunculate oak acorns during vegetation season. The study was conducted in two variants: variant control and variant flower / acorn isolated. Results showed that only 6.8% of the initial number of flowers have become mature acorns healthy to the control variant. The non-fecundated flowers represented 21%, but 65.2 % felt down in the different stages of the acorns development. From the carpophagus insects, *Curculio glandium* was that attacked 7% of the initial number of flowers.

To the variant flower / acorn isolated, the healthy mature acorns constitute 13.8% of the initial number of flowers. As for the non-fecundated flowers and aborted acorns by the plant, they accounted 26.5% and 59.7%.

Keywords: pedunculate oak tree, carpophagus insects, production, temperature

INTRODUCTION

An important role in natural regeneration of oaks forests plays the periodicity of fructification of these species. The frequency and fructifications abundance, vary with the species, the station conditions and forest stand as well as the vitality of the trees. The pedunculate oaks begin to fructify at the age of 40–50 in the open and at the age of 70–80 years in dense canopies (Martinik et al., 2014). In the open, they fructify nearly every year while in stands, seed years repeat every 3–8 years (Enescu, 1982). Although potential acorn production is genetically controlled, actual production depends on weather, site productivity, insect activity and individual tree characteristics.

MATERIAL AND METHODS

The researches were conducted in oaks stands from the "Codrii" Reserve. The formation and development of acorns were studied in two variants: the control variant and the flowers/acorns isolated variant (Nică et al., 2008). The control variant is to install the baskets on the branches for the collection of flowers and acorns fallen during the vegetation season, but to the variant flowers/acorns isolated were installed bags to collect the flowers and acorns fallen and protect them from carpophagus insects. When installing the baskets and bags were counted the flowers on each branch, then they were collected weekly the flowers/acorns fallen in the bags and baskets installed and the remained on branch. The collected material was analyzed in the laboratory.

Pollen viability was determined by the method of staining with aceto-carmin. The collected pollen from several trees was stained with aceto-carmin, for a better visualization was processed with 3% acetic acid and then was examined under a microscope by calculating the percent viability of the pollen. The aceto-carmin colored in carmin red the grains with cytoplasm but the sterile grains remained uncolored.

The data regarding the temperature, the precipitation, the air and soil humidity, the wind speed were taken from the weather station, located at an altitude of 157 m within the reserve.

RESULTS AND DISCUSSIONS

The flowering period of pedunculate oak was recorded in the second half of April. Pollination of the female flowers depends on climatic conditions. The study conducted by Celac (1996) about specific of the oak flowering and pollination, shows that the optimal conditions for the oak flowering and

pollination are: average air temperature no lower than 15°C, relative air humidity 30-80%, wind speed 1-3 m/s. The pollination quality decreases on rain time especially in torrential rain. Figure 1 shows that, during the oak flowering, both forms, early and late, the average air temperature varied between 7,7°C - 21,2°C, most days recorded the temperatures below 15°C, relative air humidity - 50% - 77%, the wind speed - 0.4 m/s - 1.9 m/s.

The rainfall also acts on pollination quality. So, we can mention that during the flowering period the highest amount of rainfall was recorded in just one day reaching 23.7 mm.

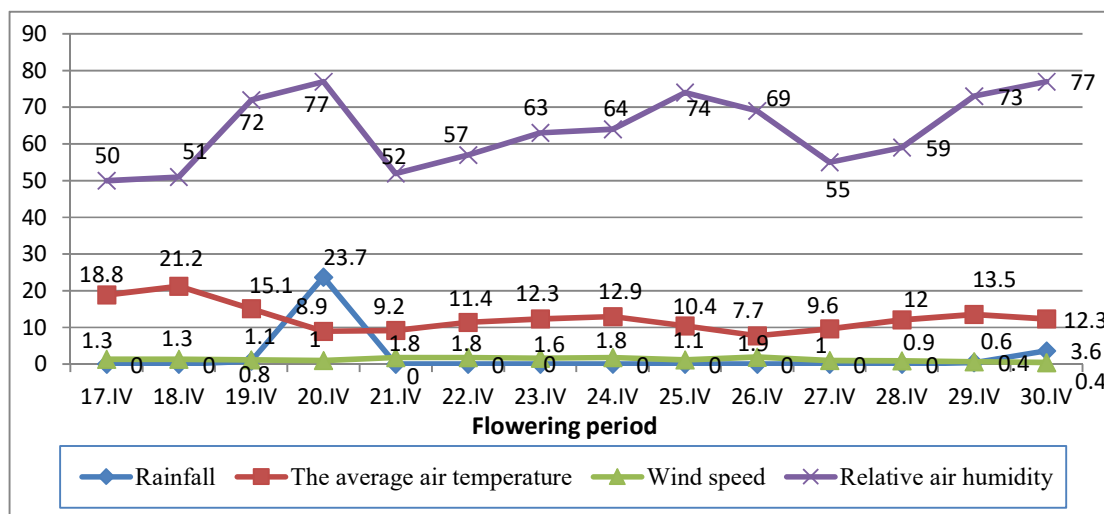


Figure 1. The climatic conditions during flowering

To exclude the cause of the pollen infertility, in the case of decreasing the oak productivity was determined the pollen viability by staining method with aceto-carmin.

Aceto-carmin colored in red-carmin the grains with cytoplasm, but the sterile grains remained uncolored. As a result 98% of formed pollen is fertile (Fig. 2.).

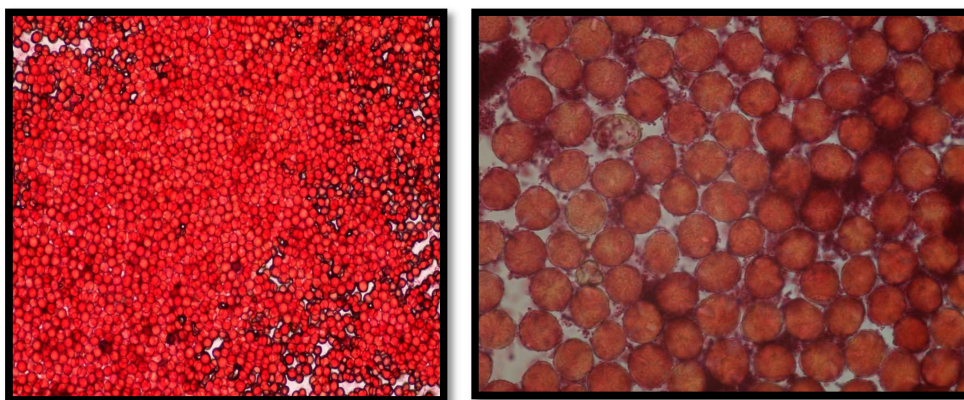


Figure 2. Pollen viability

The research of evolution of the formation, development and premature abscission of the pedunculate oak acorns was performed by installing the baskets and bags to 4 trees (Fig. 3.). Installing the baskets and bags was conducted on April 27th, also it was performed and counting the flowers on each branch (Table 1).

The counting of the remaining acorns on branches and the collecting those who have fallen into baskets and bags was performed at different dates (16.V.2016, 30.V.2016, 7.VI.2016, 17.VI.2016, 24.IV.2016, 01.VII.2016, 08.VII.2016, 15.VII.2016, 22.VII.2016, 29.VII.2016, 08.VIII.2016, 16.VIII.2016, 23.VIII.2016, 1.IX.2016, 09.IX.2016, 20.IX.2016, 28.IX.2016).

The flowers and acorns collected from bags and baskets were cut in laboratory conditions and was analyzed the causes that led to their fall.



Figure 3. Installation of baskets and bags

Table1. The initial number of flowers on each branch

Branch no.	Control variant (flowers)	Isolated flowers/acorns variant (flowers)
1	147	141
2	79	35
3	102	106
4	158	83
Total	646	625

In case of the control variant is observed that only 6.8% of the initial number of flowers became healthy mature acorns. 21% of the number of flowers were unfertilized but the highest percentage of 65.2% although fertilized were aborted by the plant at different stages of acorn development.

From carpophagus insects, *Curculio glandium* attacked 7% of the initial number of acorns (Fig. 4).

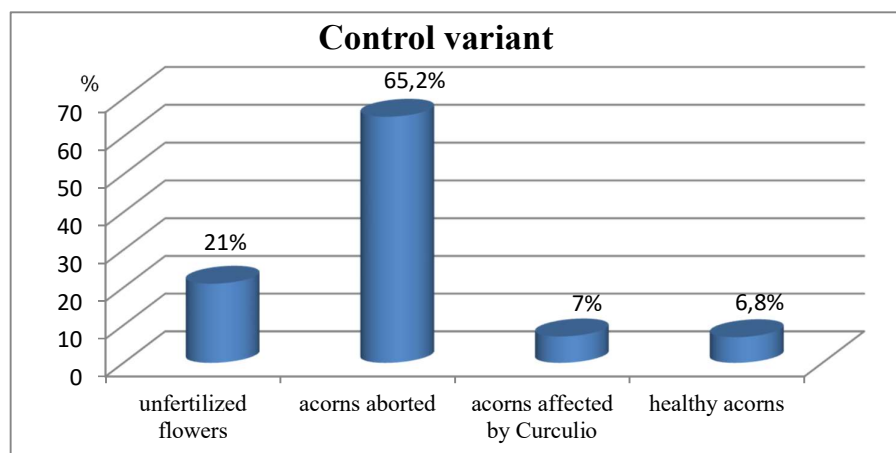


Figure 4. The number of flowers/acorns during the vegetation season

According to the causes which determining the falling of flowers/acorns during the vegetation season, they fall mainly in certain periods of time, so 85.2% of unfertilized flowers have fallen between 16.05-24.06, the rest remained on the branches, on the peduncles which have developed acorns, their fall take place gradually until autumn.

The most acorns were aborted between 17.06-08.08 (64% from total), the rest acorns fall gradually by the end of the vegetation season (Fig. 5). The acorns attacked by *Curculio glandium* start to fall in early august, reaching highs between 23.08-20.09.

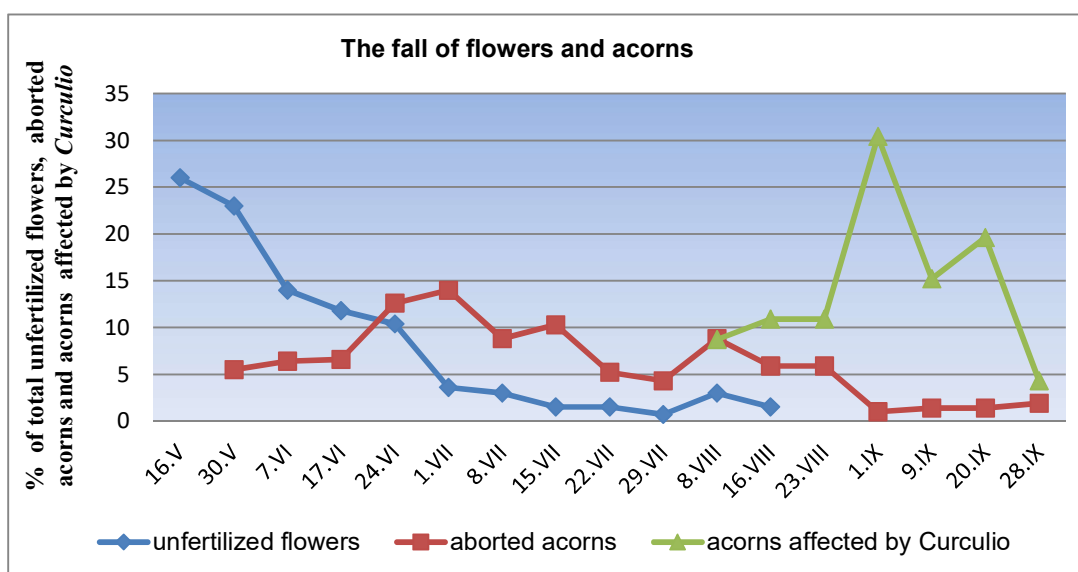


Figure 5. The dynamic of the falling of flowers/acorns during the vegetation season to the control variant

During the vegetation period in the installed baskets registered the presence of *Curculio glandium* – imago form on June 24th and July 29th, larvae and pupa of *Agrotis* sp. – May 16th, larvae of *Lymantria dispar* July 1st. Larvae of *Agrotis* sp. and *Lymantria dispar* do not have the negative action on maintaining acorns on branches (Fig. 6).



Figure 6. a. – *Curculio glandium* (imago form), b. - *Agrotis* sp. (larvae), c. - *Lymantria dispar* (larvae)

In the case of isolated flowers/acorns, healthy mature acorns represent 13.8% of the initial number of flowers, which represents a higher percentage than the control variant (6.8%), (Fig. 7).

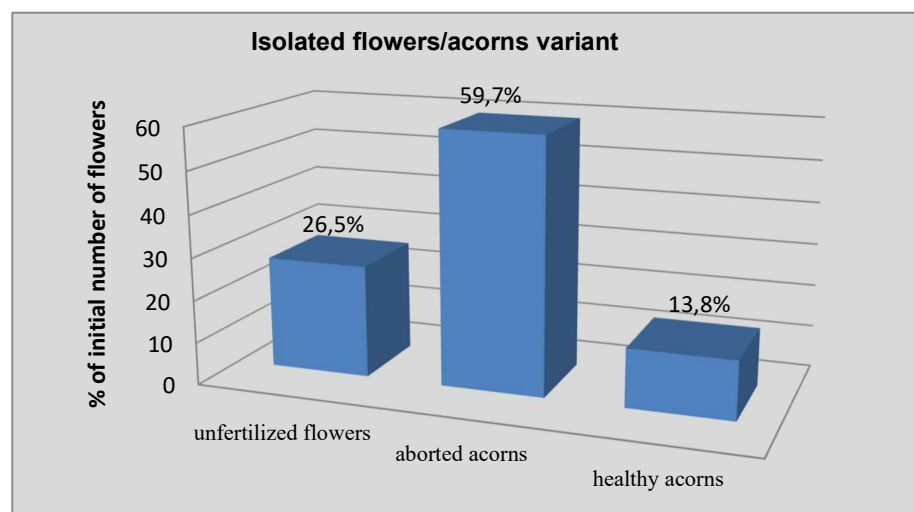


Figure 7. The number of flowers/acorns during the vegetation season

Regarding the fallen unfertilized flowers and aborted acorns by the plant, they accounted for 26.5% and 59.7% of the initial number of flowers respectively. The most part of acorns have fallen in period 16.V-08.VII, when the climatic conditions, especially the soil humidity was favorable (May – 24.14%, June – 23.1%, July – 18.38%), (Fig. 8).

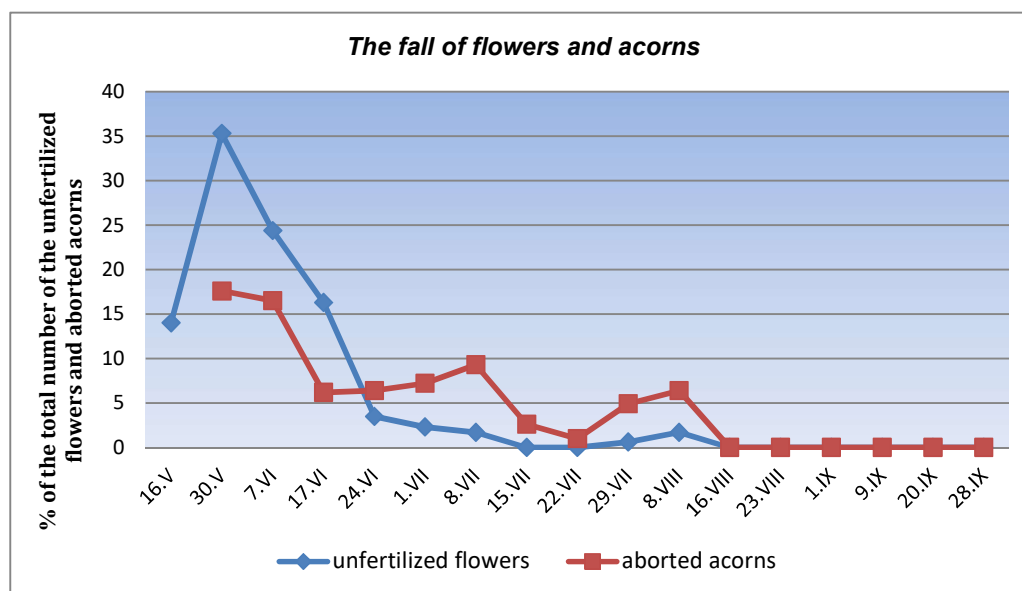


Figure 8. The dynamic of the falling of flowers/acorns during the vegetation season in the case of isolated acorns

The obtain results prove that the flowers/acorns aborted by the plant is in greater number (59,7%-65,2%), than the acorns attacked by insects (7%). Following a study by Pahopol and Celac (1996) is remarked that the abortion of female flowers is due to the anomalies occurring in the macrosporo- and megagametogenesis process, as well as the formation of unilateral ovaries with a single placenta on which no egg develops, being sterile.

CONCLUSIONS

The factors which influence the acorn production are the number of flowers that appear in spring, the pollen viability, the pedo-climatic conditions and the activity of the carpophagus insects. Of the causes that lead to the reduction of final acorn production of pedunculate oak, premature abscission represents one of the most important, 59,7-65,2% of the initial flowers, although acorns were formed, these were aborted by the plant in different stages of development. Whereas this process is mainly determined by the amount of mineral substances that plants can assimilate.

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