ABSTRACT

Key words: forest nurseries, forest plantations, damage insects

The doctoral thesis ***"Research regarding pests from forest nurseries and young forestry plantations from northeastern of Moldavia"*** is based on a series of investigations conducted between 2009 - 2011/2012 in nurseries from northeast of Moldovia, belonging to the forest districts of the Forest Directorates Iaşi, Botoşani and Suceava, and some forest plantations of the state. The paper is structured in seven chapters and includes a number of important conclusions and recommendations for the protection of plants, with special reference to forest pest in forest nurseries.

The first chapter presents the current state of forests and the need to produce seedlings in forest nurseries, the purpose being to emphasize the importance of protecting plants and seedlings production and a correct implementation of integrated pest management system.

To understand correctly the current situation of forests is necessary that this problematic to be considered under two aspects, a "micro" level of territorial administrative units (municipalities, cities, counties) and economic development regions of the country, and one "macro" at the level of major geographic regions of the world, continents and countries components.

Thus, reduction of forest areas in some countries, and regions began to diminish in comparison with the alarming rhythm until a few decades ago. In the past 10 years, nearly 13 million hectares of forest have been lost annually due to their transformation into agricultural lands or for other uses, or have been destroyed by natural disasters caused by various factors compared to the loss of 16 million hectares of forest per year in the 1990s.

Due to afforestation and natural regeneration of forest areas in some countries and regions have succeeded significantly reducing the loss areas of forests. The rate of loss of forested areas was from 2000 - 2010 estimated at 5.2 million hectares per year, compared to 8.3 million hectares per year as recorded in the period from 1990 to 2000.

Although the last two decades, the European Union reported an increase in forest area, between 1990 - 2000 about 7.3 million hectares, 2600 hectares from 2000 to 2005 and 2523 hectares between 2005 to 2010, the current situation of forests in Romania is far from being considered favorable. In 1800 our country had an area of approximately 8.5 million hectares of

forest, or 36% of the territory surface decreased continuously, so that was reached at a percentage of 27.3% of the country and 6.519 million ha. This percentage of forest fund place our country at the bottom of the ranking compared to other European countries, and well below the European Union average that is about 36%.

In the current area of forests of Romania, producing seedlings and afforestation works has at least three strong arguments, namely:

- increasing the surface area covered by forests which is currently at a very low level compared to optimum in our country;
- reconstruction of areas and regions through afforestation of degraded lands and those affected by desertification process;
- Climate change mitigation is a priority.

Due to these reasons, for ensuring seedlings in national afforestation program and in making artificial regenerations exploited forest areas, National Forest, the main forest manager in our country is achieving investment priority growth and modernization forest nursery areas and research for the development of effective pest control methods both in terms of effectiveness, and economy.

Thus, the proposed research topic in the thesis is justified and necessary.

Chapter II presents the current state of knowledge of pests of forest nurseries and forest plantations. In this chapter is presented a brief history of entomological research both from Romania and from abroad, and a brief history of entomological research conducted in north-eastern Moldavia. There are also presented in this chapter and certain papers leading to research on pests of forest nurseries and plantations. There are presented harmful factors of forest nurseries and young forest plantations, and harmful insects, pathogens complex, harmful mammals and abiotic factors.

This chapter presents information on integrated pest management strategies of forest. Integrated pest management includes a combination of management strategies and tactics that reduce economic losses caused by pests at tolerable levels with minimal effects on the environment. An important key to forestry is prevention, which is planned since the establishment of plantations. Establishing economic thresholds and monitoring of pests are more difficult due to high costs.

After Clarke A.R. (1995) the key for IPM program is to identify economic damage (the quantity of damge, justifying artificial control measures) to determine the economic level of

damage (the low population density that causes economic damage) and determine the economic threshold (density at which control measures should be initiated to prevent possible harm to population growth and economic). Forest managers should obtain information and tools to provide damage pest populations, the impact on growth of trees, wood quality and growth trees, provide efficiency and cost of various control options. Finalization of economic level of damage trees is not simple, because economic and biological provisions are made in decades. The factors to be estimated include future population dynamics of pest damage that can be caused by infestation, present and future effectiveness of control measures, increases attack rate and value of production at harvest (**R. Wylie, 2000**).

Chapter III presents the purpose and its objectives which leads to it and the research methodology used to accomplish the experimental protocol. Thus, this paper aimed at determining of common pests causing damages in forest nurseries and young forest plantations, determine the structure and dynamics for improving the detection, prognosis and control. To achieve all objectives were needed more activities consisted of observations made in the field, collecting biological material (insects in various stages of development, seedlings attacked or parts of these), studying the biology of pests in the literature for knowledge pest biological cycle of the study area, in close correlation with ecological factors (abiotic and biotic) data collection and forecasting of pests detection and control methods applied to forest protection officers of the Forestry Departments in which the research was realized, comparative analyzes between them, testing insecticides used by those responsible for forest protection in the forestry departments in nurseries and plantations, as well as proposing new methods of combat.

To cover the whole area north-east of Moldovia, investigations were conducted in three experimental areas (forest nurseries) within the Forest Departments Iasi, Botosani and Suceava, while collecting the data periodically from other 56 forest nurseries within these sylvic directorates.

In **Chapter IV** are presented the natural environment conditions investigated, both for the entire area north-east of Moldavia, as well as forest nurseries and forest plantations where have been conducted investigations: Galata forest nursery in Forest District Ciurea, Cotu forest nursery in Botoşani, forest nursery in Prisaca Dornei, U.P. Argestru VII forest plantation of the Silva Forest Bucovina. Also in this section have been described and analyzed climatic conditions of the years of research.

Chapter V presents the results on the structure, dynamics and degree of pest damage in forest nurseries analyzed. It is known that damage factors may be biotic (insects, plant and mammalian pests) and abiotic (temperature, precipitation, wind, snow, hail, floods, etc..), out of which the biotic factors represents the highest percentage (90%). From them the biotics at the level of forest nurseries, insects cause the most damage of economic importance. Therefore, after the affected areab and after the economic value of damage, pests have to be analyzed, known and kept under control with the lowest cost and most environmentally friendly measures.

Knowing the elements that contribute to the increase of insects becomes very useful thus being able to intervene to prevent and halt their development. Causes that contribute to the formation and development of pest outbreaks are multiple, of which the most important are the internal features of each group of insects taken in part the influence of environment and climate, and the nature and structure of forest vegetation.

To determine the structure, dynamics and degree of attack of the main pests of forest nurseries in northeastern Moldova analyzed data were provided by specialized security and protection of forests within Forest Departments Iaşi, Botoşani and Suceava for the period 2009 - 2011, which were compared with similar data from the period 2005 to 2009.

During 2009 - 2011 the average area for seedlings production was 178.35 ha of which 46.9 ha in Iaşi (of the total 9.5 ha was planted with species of ornamental saplings), 13.45 ha in Botoşani and Suceava 118 ha (30 ha cultivated ornamental species seedlings). Areas affected by the attack of insect species was 9.44 ha in Iaşi. 10.11 ha and 25.65 ha in Botoşani, Suceava, representing on average about 46.8% of the total area under forest species.

In Forest Department of Iaşi, the structure analysis of nuisance factors shows that insects have the largest proportion of attacked areas, its average being 67.60% against plant pests that represents an average of 12.93% of harmful mammals with a share of 11.79%. Abiotic factors represents only 7.68% of all harmful factors, the highest value being registered in 2009 (15.63%) when there were droughts for long periods of time. The surface most affected by insects was recorded in 2010 (71.56%) and the most affected by plant parasites was recorded in 2011 (15.86%).

In Botoşani Forest Department in the years 2009 - 2011, insect pests held the largest share (53.69%) of nuisance factors, the next category of factors being represented by plant parasites (31.15%) and abiotic factors (12.47%). Harmful mammals represented only 2.69% of all harmful factors. From other forest directorates, they had an average of a much higher value

being registered in 2009 and 2010, 14.48% and 16.38%. In Suceava Forestry Department, insects share is superior to other factors (74.28%), a higher percentage being registered both in 2009 (77.50%) and in 2011 (76.19 %). Plant parasites had a share of only 8.92%, values below this average being registered in 2009 and 2011. Harmful mammals represented around 10% and 6.45% of the total abiotic factors pests.

Knowledge of the percentage of participation in pests structure for each category can help to establish the most effective ways to prevent and combat them and leads to taking better decisions in relation to integrated management of forest pests, especially those in nurseries .

The centralized data in the 56 forest nurseries were statistically analyzed by analysis of variance calculation, depending on the degree of harm for each nursery in part, highlighting the significance of differences between the years of research.

Chapter VI presents measures to prevent and combat forest nurseries applied in northeastern Moldova during the research, and the effectiveness of treatments applied against pests of forest nurseries Galata, Cotu and Prisaca Dornei. Effectiveness of forest nurseries chemical treatment was determined by the method of comparing larval density Melolontha melolontha determined by sampling before treatment larval density remained alive after soil treatment.

For forest nurseries Galata, Cotu and Prisaca Dornei within forest districts, respectively Ciurea, Botoşani and Vama, the system tracking and forecasting pest is similar, being organized by the internal rules of the National Forest. Data regarding the presence of insects, plant parasites, mammals rodents and abiotic factors were collected and recorded throughout each year, helping to develop annual statistics for each pest or groups of pests in part. Its purpose is to allow at time, the limitation and combating pests, but mostly to keep them under control (below the threshold of the damage).

In this chapter we present experiments conducted at Silva Forest-Bucovina in UP VII, Argestru in plantations of 8 planing units totaling an area of 22.7 ha to evaluate measures to combat Hylobius abietis, applied in coniferous crops in relation to the degree of damage of seedlings and the success of artificial regeneration.

The last chapter of the thesis presents the conclusions resulted and recommendations on the research conducted in the field.