Volume 16(4), 10-15, 2012
JOURNAL of Horticulture, Forestry and Biotechnology
www.journal-hfb.usab-tm.ro

The dynamics of the damage caused by *hylobius abietis* (l.) in the first two years after the spurce plantations establishment in relation to the control measures applied

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Abstract The large pine weevil, *Hylobius abietis*, can cause significant damages, unless efficient protective measures are applied and which most of the times must to have a prevention character. That's why, it is necessary to evaluate these measures in order to improve them both from an economical and ecological point of view. The results of this study shows that in the spurce plantations set up after 3 years from the cutting area exploitation, the damages caused by the *Hylobius abietis* pest in the first two years are held under control through the protective measures applied, the success index of artificially regeneration being placed between the accepted limits of at least 85% for the mountain and pre-mountain area. Even though, the damage index determined for the first year since the setting up of the plantation shows that *Hylobius abietis* causes significantly bigger damages, the share of the losses due to this pest being over 80 % out of the total losses.

Key words

large pine weevil, *Hylobius abietis*, artificially regeneration, spurce plantations

Young conifers cultures in our country are often significantly damaged, especially in their first years, because of the *Hylobius abietis* attack, which continues to be the main pest of these cultures. In the absence of a method to predict the damages, the apllied protection measures have a prevention role, which implies a series of expenses and ecological risks even when there aren't notified any damages that can cause significant loss. This is the reason why protective measures of pest control have to be closely analysed and improved (ameliorated) both from an ecological and economical point of view (1). Considering previous researches which shows that into one year old cutting areas there are generally little extent of the pest gnaws which usually take place on spring, caused by the old chafers, that stayed in that areas since the last year an that are feeding themselves actively before the migration toward the fresh cutting areas or before the beginning of the oviposition in the cutting areas they live (Olenici, 2003), new researchers are needed to see the damage dynamics caused by this pest in 2-3 years old cutting areas. This study shows the results of a research in the period 2011- 2012 meant to evaluate the means of pest control especially in the case of *Hylobius abietis* applied at present in the conifer cultures in comparison with the seedling damage degree and the success of the artificial regeneration. The experiments took place at the Forestry Silva – Bucovina, in UP VII, Argestru, in plantations from 8 forest plannings totalizing an area off 22,7 ha.

Material and Method

In order to present the dynamics and the intensity of the damages caused by *Hylobius abietis*, observations were made in several plantations belonging to the Forestry District Silva-Bucovina. The observations were systematically made during 2010, 2011 and 2012, starting in the first year of the establishment plantations studied.

For evaluation the protective measures of pest control applied in the case of the *Hylobius abietis* and to determine the success index of regeneration success, there were marked 3-5 testing areas per hectare each with 100 s.m. for the plantations under 3 hectares and 1-3 testing areas each having 200 s.m. in the case of over 3 hectares plantations, depending on the microstational conditions diversity, where all the existant planted seedlings were counted and checked. This way the number of valid seedlings was determined out of the total number of planted seedlings, and also their damage degree, considering the frequency and the intensity of the attack. Regarding the intensity it was realized a 5 classes classification where it was possible to illustrate simultaneously both the frequency and the intensity of the damage, determining a damage value (I_v) (2):

$$\mathbf{I_v = 1p_1 + 2p_2 + 3p_3 + 4p_4 + 5p_5,}$$

where $p_i = N_i N_t^{-1}$, N_i representing the number of the seedlings from "i" class I and N_t the total number of seedlings inventoried on the testing area. The class 0 includes undamaged seedlings, class 1 – low damaged seedlings with 1-20 mm^2 gnawed bark, class 2 – moderately damaged seedlings with 21-100 mm^2 gnawed bark, class 3 – highly damaged seedlings with 101-200 mm^2 gnawed bark, class 4 – very highly damaged seedlings with over 200 mm^2 gnawed bark and class 5 where there were included the dead or nearly dead seedlings caused by *Hylobius* gnaws. The seedling losses due to other factors are shown in a different place.

Field data collection was made with the assistance of qualified sylvic personnel in charge with the forests protection in Forestry District Silva-Bucovina and the titular forester for that area. The data were processed using the Microsoft Excel program, graphic comparisions and interpretations being made for the whole testing area.

Results and Discussions

Initially, in the experiments it was analyzed the success index of the cultures, and meanwhile the type of loss registered in each plantation. The observations were done after the middle of September of each of the first two years after the creation of the plantation, after this period the gnaws of the *Hylobius abietis* are considered to become sporadically, and the damages unsignificant.

The protective measures of pest used in the analyzed plantations had mainly a prevention character, the culture settlement being made in the 3rd year, after the cutting area exploitation taking into account the fact that the population and damage level can't be predicted yet and that the attack risk is maximum in the first 2-3 years after cutting down the forest. Before being planted the seedlings were treated, bathed, in an emulsion of Fastac 1% and Nu-Film 1%. Another way of controlling *Hylobius abietis* was the installing toxic barks treated with Mospilan 20SG having a consuming rate of 0,3g/bark.

The number of installed toxic barks varies from one plantation to the other, depending on the microstational conditions and on the infestation intensity. The barks were installed, at the middle of June 2010, at the end of May 2011 and at the beginning of June 2012. Previously, in order to establish the pest's presence and the intensity of the attack, there were installed 20-30 toxic barks/ha uniformly distributed on the surface of plantations, which helped to determine the number of the weevils per 100 seedlings, counting the captured weevils and the observed ones at 50 seedlings around them.

Based on the number of weevils captured, in the first two weeks it was possible to establish, in an orientativ way, the intensity of the infestation, according to the following scale: low intensity 1-12 weevils, middle 13-25 weevils, high 26-50 weevils and very high intensity over 50 weevils (*fig. 1*).

The success index of regeneration was estimated in percentage for each plantation for the first year of existence, as well and for the second. Thus, in the first year the success index of regeneration, was in average of 85,6%, and in the second year its average value was 90,8% (*fig. 2*).

Determining the success index of regeneration it was possible to count the seedlings losses registred in the first two years since the creation of the plantations, the average value in the first year was 14,37% and in the second year – 9,12%. Estimating the damage index for each surfaces analyzed presented in *figure 3*, were evidenced the dead seedlings or the ones partially damaged because of the *Hylobius abietis* attack and also the seedlings which were killed because of other reasons or even unexistant ones.

The number of damaged seedlings due to *Hylobius abietis* which were declared as losses were included in classes 4 and 5 when determining the damage index and they were those whose bark was gnawed on a surface of over 200 mm^2 or were already dead or almost dead because of the gnaws. The number of these seedlings was related to the total number of seedlings declared as losses, this way obtaining the loss percentage caused by the pest *Hylobius abietis* attack. (*fig. 4, fig. 5*).

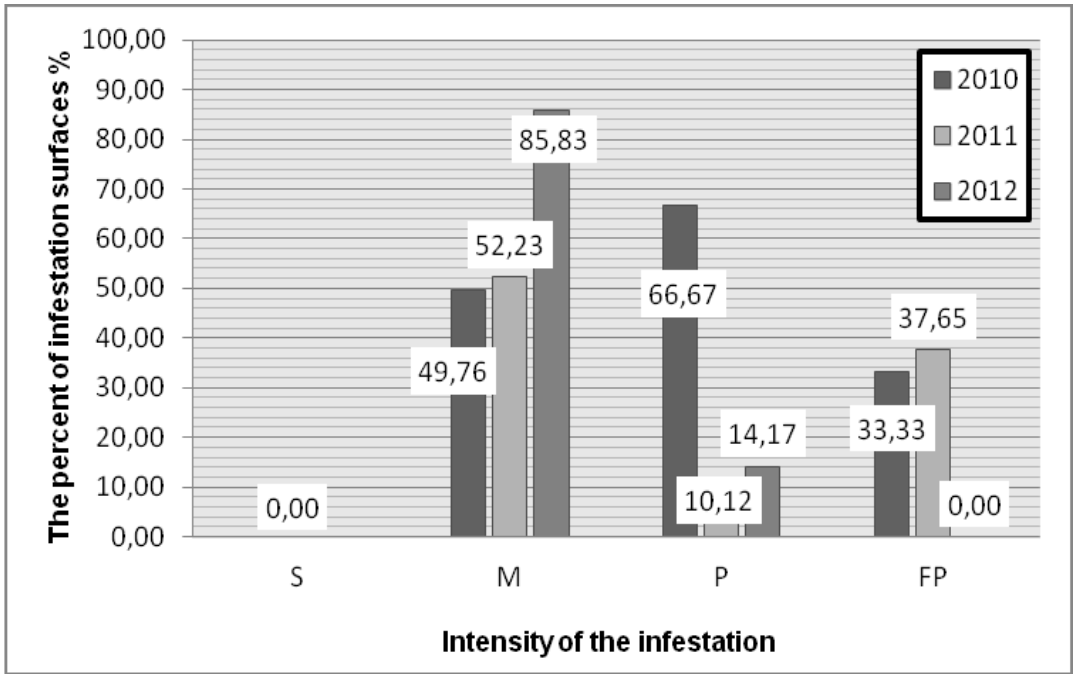

Fig. 1. The intensity of the *Hylobius abietis* infestation

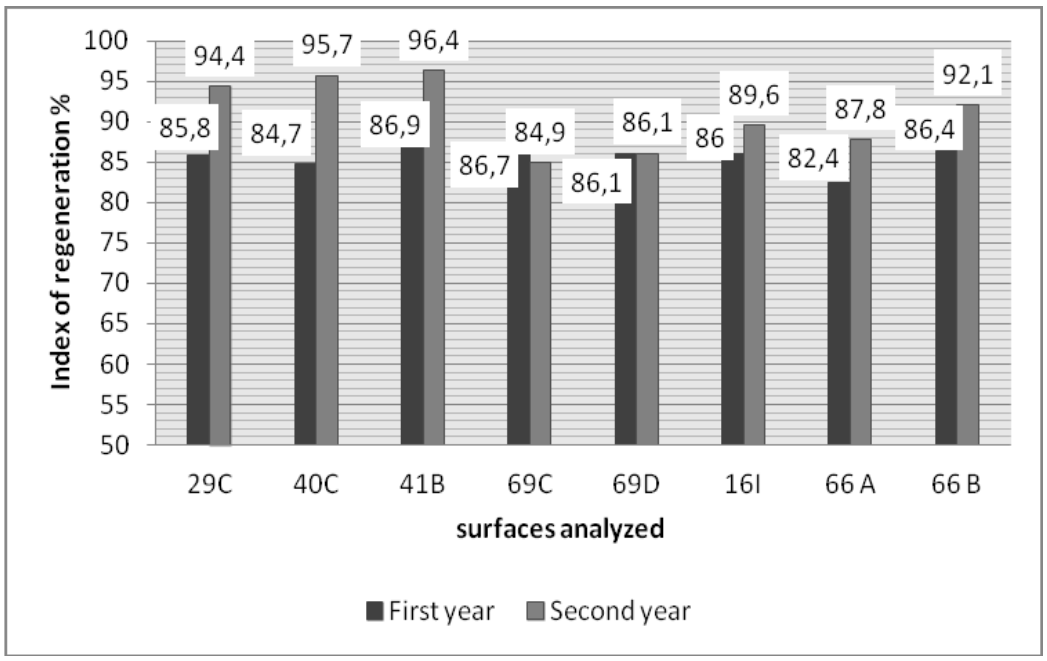

Fig. 2. The success index of regeneration

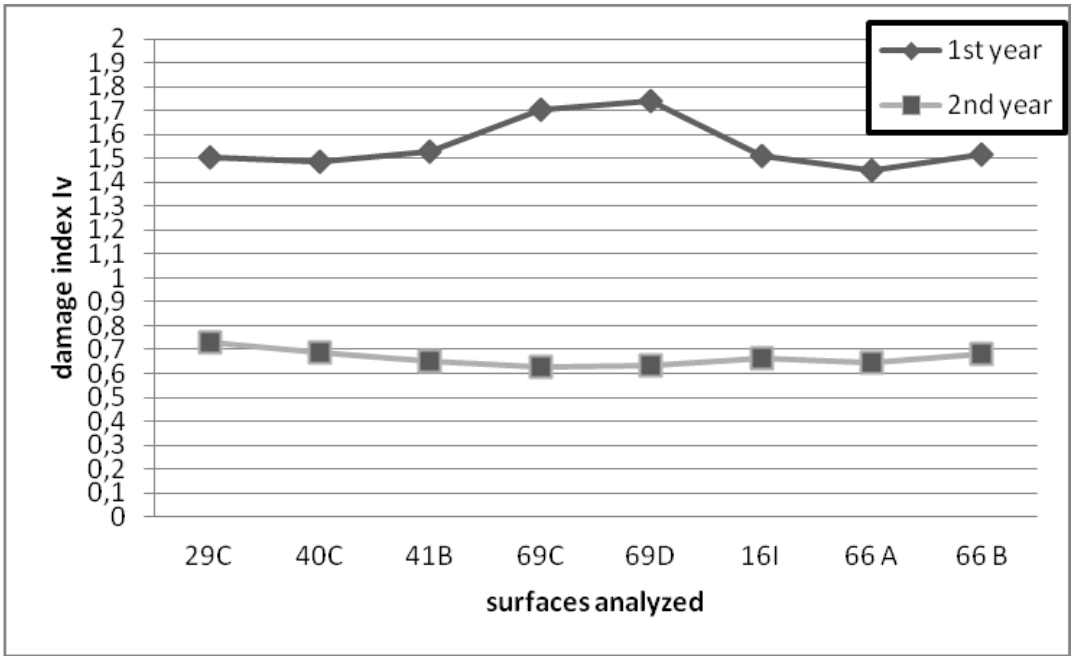

Fig. 3. Representation of damage index for surfaces analyzed

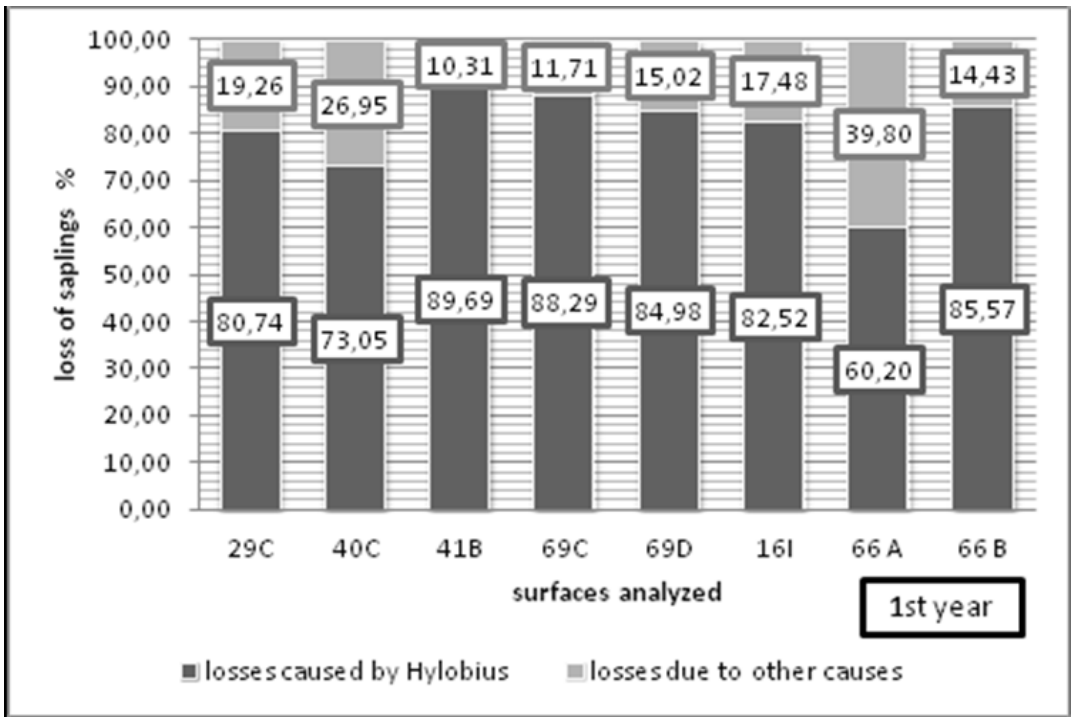

Fig. 4. Representation of the loss percentage caused by the *Hylobius abietis* attack in 1st year

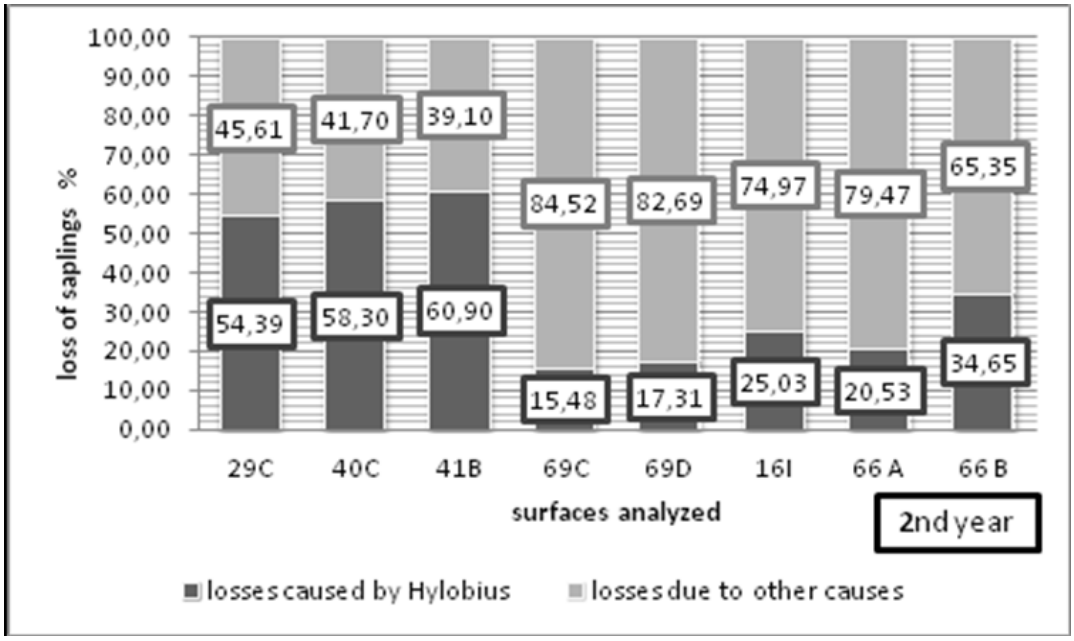

Fig. 5. Representation of the loss percentage caused by the *Hylobius abietis* attack in 2nd year

It can be observed that during the first year since the creation of the plantation the average percentage of the seedlings losses is significantly higher than the second year because of the damage made by *Hylobius* is, meaning 80,6 % in the first year compared to 35,8 % in the second year.

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This is mainly due to the high interest of the pest for the young seedlings, most of the gnaws taking place during summer (July-August) especially in the plantations facing the sun and during (August – September) in the North or North-West plantations. Summer to autumn gnaws are also justified by the fact that the researches were mainly made in over 1000 m altitude plantations, where as shown in other previous researches (2) the period of a generation development is of 2-3 years, and the appearance of the young weevils usually happens at the end of July – beginning of September. The exact share of the two generations depends on the stational conditions (altitude, exposure), on the oviposition moment, on the weather forecast during the development of the larvas and on the sublayer quality where larvas develop. In the second year after the plantation creation, the gnaws will take place mainly in April-May, due to the fact that it is possible that some weevils to come out at the end of the previous sezon or the beginning of the current one, but they will have a relatively low intensity.

Due to the applied protective measures both preventive and effective through placing a toxic bark and treating the seedlings before planting, the total percentage of loss is between the accepted limits - up to 25% for the mountain and premountain area, according to the technic standards on the performing of the annual control on regeneration from 2000, developed by the Ministry of Waters, Forests and Environmental Protection. Although, in all analyzed plantations was necessary to perform additions, after the first year and the second year, the minimum percentage of regeneration success should have been of 95% in order to avoid this to happen.

Conclusions

Due to the stational conditions (altitude, exposure) where the researches took place, it was observed that the development period of a generation could be 2-3 years, more exactly: 2 years for the lower limits of the plantations and 3 years for the upper limits and especially with northern exposures.

Out of the total number of seedlings losses in the first two years since the creation of the plantation, only in the first year the average percentage is over

80% due to the *Hylobius abietis* damages, in the second year the percentage is 35 % only.

The applied protective measures conducted to a good control over the *Hylobius abietis* populations, so that the success index of regeneration to be placed between the accepted limits of at least 85%, and the seedlings supplimentations starting with the second year to be under 10 %. It is noticeable that, in addition to the chemical protective measures, the sylvicultural measures have a major role in pest control in the conifer cultures and for the year of the plantation creation the control measures have to be more efficient so that the losses caused by the large pine weevil to be significantly smaller.

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