DETERMINATION OF *MELANOPHILA PICTA* PALL. (COLEOPTERA: BUPRESTIDAE) DAMAGE RATE IN *POPULUS ALBA / MEDICAGO SATIVA* AGROFORESTRY SYSTEM

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ABSTRACT**:** The poplar flat headed borer is one of important pests of poplar trees. This pest, attacks many poplars in physiological weakness condition and causes considerable damage in nurseries, plantation and wood-lots. This survey carried out in 2008 in order to study the effect of distance and planting system on damage rate of *Melanophila picta* in poplar/alfalfa agroforestry system in complete block design with 3 replications and 5 treatments (stand distances) of poplar/ alfalfa include, 3×4, 3×6/7, 3×8, 3×10 meter and poplar 3×4 meter using two methods. The first method: In order to estimate of damage rate, 5 levels of bark infestation were determined and infested trees numerated in each plot as fallow. 0=0% (without infestation), 1= 1%-20% (infestation from tree base up to 10cm stem height), 2= 21%-40% (infestation from tree base up to 50 cm stem height), 3= 41%-60% (infestation from tree base up to 150 cm stem height), 4= 61%-80% (condensed infestation from tree base up to 150 cm stem height), 5= 81%-100% (condensed infestation from tree base up to 150cm stem height including side branches). Then damage rate of each stand in plots was numerated. The second method: the number of holes that made by larvae on the bark of infested stands were counted in each plot. Data analysis conducted with SPSS software showed a significant difference among treatments in two methods, the poplar treatment had the most infestation and the most number of holes and 3×10 treatment had the least infestation and the least number of holes.

KEY WORDS**:** Agroforestry, Alfalfa, Damage, *Melanophila picta*, *Populus*.

Wood is one of the basic materials that has been naturally and abundantly available to mankind. Nowadays the global demand of wood, paper and other wood industries has been increased. So in Iran like other countries the importance of forests has been taken in to consideration more than before (Heidari, 2003), but Iran is classified as countries that have poor forest areas. So poplar plantation has been considered for years as an alternative wood source instead of forest trees.

Alfalfa is as a valuable forage for livestockes. Todays lack of talented areas, pests and diseases and low economical advantage has caused serious challenges to supply wood and adequate forage (Karimi, 1989).

Agroforestry (intercropping of agronomic plants and trees (Nair, 1993)) is a method that can overcoms most of the afore mentioned problems (Heidari, 2003). Its considerable that thirty percent of the total reported poplar planted area was established in agroforestry systems, which also accounted for 40 % of the global poplar wood production (Ball, 2007).

Melanophila picta is one of the most important pests of poplar trees. The adults appeared on poplar trees from May to the end of June. Peak of adults population was observed in early June. After mating the females were frequentely laied their eggs in fissures of the bark of lower parts of the trunk (first 2-2/5 m, especially base of trunk) after the incubation period (7.14±1.21) (Bab Morad, 2008), the larvae penetrate into the trunk immediately where they feed on the bark and sapwood layers, then they constructs tunnel galleries in the wood where they overwinter (Khial, 1984; Behdad, 1988). The first pre-pupa and pupa were observed in pupal chambers from mid April and mid or late April, respectively (Bab Morad, 2008). This insect had 1 generation per year (Bab Morad, 2008; Cavalcaselle, 2008).

Damage is strongly dependent on physiological stresses that caused by dry, unsuitable sites or by bad planting (Cavalcaselle, 2008). Attack on the lower part of the trunk weaken the tree which is then liable to be snapped by wind.

There have been few studies of insect pests in agroforestry systems (Rathore, 1999). This project carried out to study the effect of distance and planting system on damage rate of *Melanophila picta* in various planting distances in poplar/alfalfa agroforestry system.

MATERIAL AND METHODS

This research carried out in West Azarbaijan in Iran in 2008. The stands of poplar *(Populus alba*) were planted by complete randomized design with 5 treatments (stand distance) of *Populus alba*/ *Medicago sativa* include 3×4, 3×6.7, 3×8, 3×10 meter and poplar 3×4 meter (control treatment). So there were totally 15 plots and the size of each plot was 30×40 meter. Sampling was done on July in 2008 using two methods:

First sampling method

In each plot all of trees (without marginal trees) were controled and their damage rate were determined according table 1 (Haghighian, 2006).

Second sampling method

The number of holes that made by larvae were counted for each tree in all plots (without marginal trees).

Statistical analysis

After transforming data, the analysis conducted with SPSS software, and means comparison was done with Duncan test.

RESULTS AND DISCUSSION

According to table 2 and 3 data analysis showed significant difference (P<1%) among treatments (stand distances) and replications (P<1% and P<5%) in gradation of damage rate and counting the number of holes on the trunk methods respectively.

The reason of significant difference in replications is that the terminal sections of the land of experiment get less water, and it was proved that irrigation played an important role in increasing this pest's damage (Radjabi, 1976), so the number of treatments that were in that parts of land showed high rate of damage and more holes on the trunks.

Treatments means comparison showed that the poplar treatment had the most infestation and 3×10m treatment had the least infestation in first method (gradation of damage rate of trees) (fig. 4).

Also Means comparison indicated that the number of holes in poplar treatment was the most and in 3×10m (poplar/alfalfa) treatment was the least (fig. 5), similar to damage rate. The results of previous experiments which are conducted in agroforestry system has shown that the number of holes in poplar treatment is more than others (Heidari, 2003). Two factors can be involved in these obtained results:

1. Tree density:

This factor has direct and indirect effects on insect's population. Indirect effects include microclimate changes, amount of food and adjacency of host plants. Indirect effects include natural enemies changes (pathogens, parasites, predators) and vital power of trees.

In fact all of these agents redound to change of host (plant) vital power and insects growth conditions and play their role in this way. Insects' reactions to these changes are different and so changing in tree density can cause variety results. In this experiment, according to results damage rate of *Melanophila picta* had direct relation with trees density in spite of general suppositions, its might result from lack of shadow effect, that is very important factor in this insect's activity (Radjabi, 1976), because poplar in this study were 4 years trees and didn't have effective shadow.

The experiments for effect of tree density on Carabid beetles in The North Ireland showed that tree density has very positive effect on them, with increasing in trees' density, abundance and diversity of them were increased drastically (Cuthbertson, 1997; McMilian, 1993).

However, other species of insects like *Coleophora laricella, Rhacionia zozona* (Lepidoptera)*, Neodiprion sertife, Fenusa pusilla* (Hymenoptera) and *Pissodes strobi* (Coleoptera), were increased in less host density (DeClerck, 1985; McMilian, 1993).

2. Planting type:

Uniformity in genetic parts of plant is one of the main reasons for increasing pests problem in monocultures. Different experiments which were conducted under different conditions have showed decreasing pests activity in polyculture in comparison with monoculture systems (Khanjani, 2008).

Scientists tried to clarify the ecological mechanisms which includes differences between the phytophagous insect dynamics and their natural enemies in farms with monoculture and mixed cultures (Bach, 1980; Risch, 1980; Root, 1973).

More increasing in rate damage of flat headed borer in poplar treatment proves the observations related to Carabidae (Helenius, 1990), Scarabaeidae (Jonsen, 1997) and Curculionidae (Helenius, 1990), *Chaitophorous populeti* and *Monosteira unicostata* (Hashemi Khabir, 2009) in monoculture and polyculture systems. On the other hand, these results are in contrast with observations related to *Bembidion* spp. (Helenius, 1990) and *Mylabris pustulata* (Jonsen, 1997).

There are some reasons for this result (more increasing in rate damage in poplar treatment): its possible that presence of alfalfa in mixed culture (poplar/alfalfa) made a special microclaimate that caused low temperature that its not proper for this insects' activities (Radjabi, 1976) and maybe there were some biocontrol agents of this pest on alfalfa that controled this pest and decrease rate damage in mixed culture treatments in comparison with poplar treatment. Also its possible that covering the trunk by alfalfa might not allow to insect to lay its eggs in this part.

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Figure 1. larve of *Melanophila picta*.

Figure 2. Poplar treatment.

Figure 3. Poplar / alfalfa treatment.

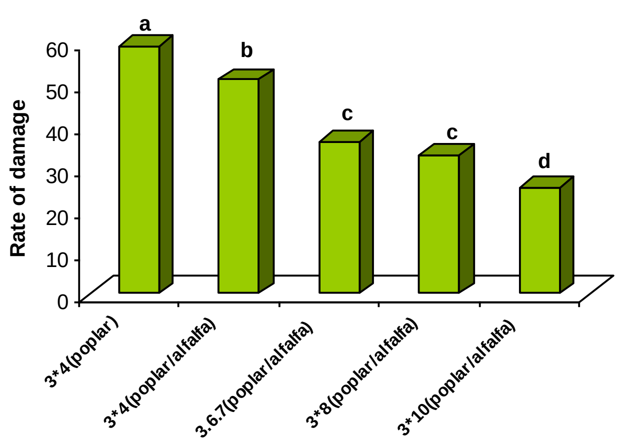

Figure 4. Means comparison of damage rate.

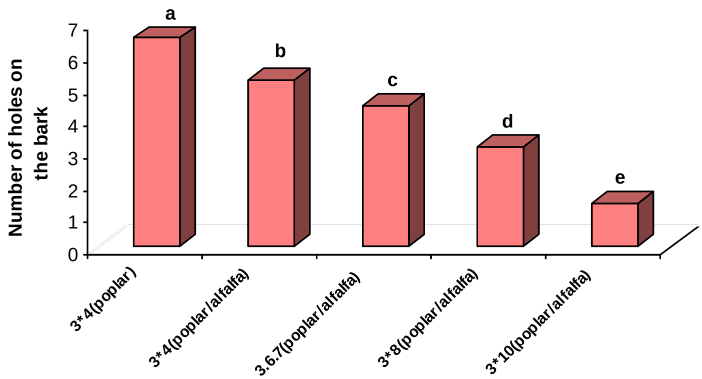

Figure 5. Means comparison of holes number.

Table 1. Gradation of damage rate of *Melanophila picta*.

Gradation	Damage	Rate of damage
0	Without infestation	0
1	infestation from tree base up to 10cm stem height	1-20%
2	infestation from tree base up to 50cm stem height	21-40%
3	infestation from tree base up to 150cm stem height	41-60%
4	Condensed infestation from tree base up to 150cm stem height	61-80%
5	Condensed infestation from tree base up to 150cm stem height including side branches	81-100%

Table 2. Analysis of variance for first method.

Source of variation	df	F	P
Rrepetition	2	7/45 **	0/00
Treatment	4	60/25 **	0/00
Rrepetition × Treatment	8	0/78	0/07
Error	712		

*= significant differences at 5%, **= significant differences at 1%, ns= non significant

Table 3. Analysis of variance for second method.

Source of variation	df	F	P
Rreplication	2	3/84 *	0/022
Treatment	4	65/37 **	0/00
Rrepetition × Treatment	8	1/37 ns	0/20
Error	712		

*= significant differences at 5%, **= significant differences at 1%, ns= non significant