

Short Communication

Survey of Trojan fir seed orchard in Edremit-Gurgendag Region of Turkey

Hamit Ayberk* and Huseyin Cebeci

Department of Forest Entomology and Protection, Faculty of Forestry, Istanbul University, 34473 Bahcekoy, Sariyer, Istanbul-Turkey.

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Abies nordmanniana ssp. Equitrojani, with a limited distribution in Northwestern Anatolia (Kazdaglari Mountain ranges), is one of the four *Abies* taxa naturally grown in Turkey. Regeneration problems are caused when establishing seed orchards for this important conifer. Seed and cone pests are the main problems encountered in orchards. This study was conducted between the years of 2006 and 2008 in Edremit-Gurgendag Seed Orchard located in Balikesir, Turkey. Four pests, *Megastigmus suspectus* Borr. (Hymenoptera, *Torymidae*), *Dasineura abiesemia* (Foote), *Resseliella piceae* Seitn. (Diptera, *Cecidomyiidae*) and *Dioryctria abietella* (Den. and Schiff.) (Lepidoptera, *Pyralidae*) with 1224 individuals, were recorded at the end of the study. An attempt was made to calculate the cone infestation index and the damage rates to cones of each pest.

Key words: Trojan fir, seed orchard, seminiphagous insects, conophagous insects.

INTRODUCTION

Trojan fir (*Abies nordmanniana* ssp. *equitrojani* Aschers. et Sint.) is one of the most endemic species of Turkey in ecological aspects. It lives in Biga Peninsula, Northwestern of Anatolia, on Kazdaglari Mountain ranges. Trojan fir covers an area of 5512 ha and forms mix stands with European black pine (*Pinus nigra*), beech (*Fagus orientalis*), oak (*Quercus* spp.) and chestnut (*Castanea sativa*) trees in the region (Ata, 1975). The regeneration problems of this important conifer cause building of seed production areas, which are seed orchards. Velioglu and his colleagues have started a project aiming to protect the genetic variations of the fir in natural stands in 1999 (Velioglu et al., 1999). In seed orchards, the important pests interrupting germination of seeds are cone and seed insects (Fatzinger et al., 1990).

The most abundant and well-known seed pests of conifers in Turkey are *M. suspectus* Borr. (Hymenoptera, *Torymidae*) and *D. abietella* (Den. and Schiff.) (Lepidoptera, *Pyralidae*) (Defne, 1954; Canakcioglu, 1963, 1969; Bas,

1973; Tosun, 1977; Ozkazanc, 1982; Sekendiz et al., 1996; Can, 2003; Unal and Cilbircioglu, 2008).

MATERIALS AND METHODS

Field and laboratory case studies were conducted between the years of 2006 and 2008 in Edremit-Gurgendag seed orchard located in Balikesir, Turkey.

Three parcels of 209.5 ha each were randomly chosen, within seed orchard area. The elevation of each parcel was 1300 m and they were at southern aspect. In each parcel, a total of 10 sampling trees were chosen randomly. In every year of the study, the sampling parcels were visited from August to September and cones of the sampling trees were collected.

In 2006, a total of 185 cones were collected from 30 sampling trees. Total cone counts were 281 in 2007 and 190 in 2008. After collection in the field, the cones were transported to the laboratory and put into insect rearing boxes. Relative humidity in the laboratory was kept at 60 - 70% and the temperature was 20 - 24°C, which is ideal for insect rearing. The larvae that emerged from the collected cones were recorded and an attempt was made to calculate the infestation indexes of pests. In order to determine the cone infestation index for each pest, the formula anticipated in Skrzypczynska's study was used (Skrzypczynska et al., 2001, 2005). Cone infestation was calculated by dividing the number of individuals of a given species by the number of cones in a sample.

*Corresponding author. E-mail: hayberk@istanbul.edu.tr. Tel: +90 2122261100. Fax: +90 2122261113.

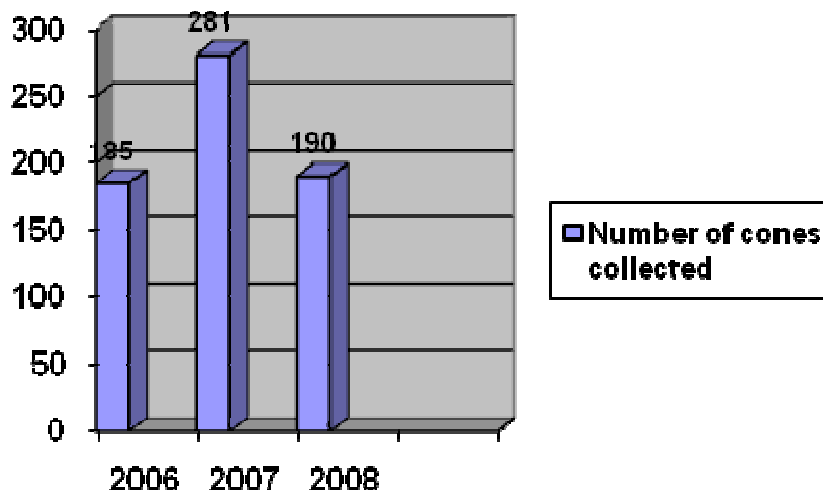


Figure 1. Collected cones per year.

Table 1. Cone infestation indexes.

Year	Cones examined	Number of individuals and cone infestation index for each species				Total insects obtained
		<i>M. suspectus</i>	<i>R. piceae</i>	<i>D. abietella</i>	<i>D. abiesemia</i>	
2006	185	137 (0.740)	29 (0.157)	173 (0.935)	36 (0.195)	375 (2.027)
2007	281	224 (0.797)	46 (0.164)	201 (0.715)	84 (0.299)	555 (1.975)
2008	190	87 (0.458)	12 (0.063)	142 (0.747)	53 (0.279)	294 (1.547)
Total	656					1224

It can be written as follows:

$$\text{Cone infestation index} = \frac{\text{Number of individuals of a given species}}{\text{Number of cones examined}}$$

RESULTS

A total of 656 cones were collected from 30 sampling trees at the end of the study. Cone counts showed similarities in the years of 2006 (185) and 2008 (190). In 2007, 281 cones were obtained from the sampling trees due to the rich cone crop in that year (Figure 1).

The total number of insects that emerged from the cones collected was 1224. 2006 record of pests was 375; the number was increased in 2007 with 555 individuals and 294 in 2008. Three seminiphagous insect species, *M. suspectus* Borr. (Hymenoptera, *Torymidae*), *D. abiesemia* (Foote) and *R. piceae* Seitn. (Diptera, *Cecidomyiidae*) and a conophagous species, *D. abietella* (Den. and Schiff.) (Lepidoptera, *Pyralidae*) were identified as the seed and cone pests of Trojan fir. *D. abietella* emerged to be the most abundant species with 516 specimens (42.2%) out of 1224, following *M. suspectus* with 448 individuals (36.6%), *D. abiesemia* with 173 (14.1%) and *R. piceae* with 87 (7.1%) individuals, resp-

ectively. In Table 1, the cone infestation indexes related to each pest were given.

In 2006, the infestation index of *D. abietella* was calculated as 0.935 (173/185) and this was the highest number detected in that year. In 2007, *M. suspectus* showed the highest value of 0.797 (224/281). In 2008, *D. abietella* once again owned the highest index of 0.747 (142/190). In Table 2, we tried to define the damage rates of each insect to cones. For this objective, the data concern the infected and non-infected collected cones and the number of cones infested by each insect for years was determined.

D. abietella infested 32.4% of the cones examined in 2006. The ratio decreased to 18.9% in 2007 and in 2008 the damage rate to cones was found to have similar value of 34.7%. The percentage of *D. abietella* caused infected cones to vary between 18.0 and 35.0%, averaging 28.7%, in a three year period.

DISCUSSION

Two species, *D. abietella* and *M. suspectus* showed the highest index values and the damage rates to cones when compared with all the obtained species.

Defne (1954) and Canakcioglu (1963) announced that

Table 2. Damage rates of infected and non-infected cones.

Year	Number of and the rate (%) of cones infected by				Number of and the rate (%) of non infected cones	Total cones obtained
	<i>M. suspectus</i>	<i>R. piceae</i>	<i>D. abietella</i>	<i>D. abiesemia</i>		
2006	43 (23.2)	9 (4.9)	60 (32.4)	7 (3.8)	66 (35.7)	185
2007	29 (10.3)	14 (4.9)	53 (18.9)	14 (4.9)	171 (61.0)	281
2008	41 (21.6)	8 (4.2)	66 (34.7)	3 (1.6)	72 (37.9)	190

the rates of *D. abietella* causing damage to *A. nordmanniana* cones varied between 10 and 67% in Turkish forests. This comprehensive study conducted confirmed that the damage rates had been obtained in previous experiments.

M. suspectus is an important pest for conifer seeds in Turkey. The damage rate was recorded as 50% (Defne, 1954), 27% (Canakcioglu, 1963) and 58% (Bas, 1973) on seeds of *A. bornmulleriana* and 31.9% on seeds of *A. cilicica* in Turkey (Ozkazanc, 1982). In the study, seed counts and the number of seeds damaged by seminiphagous insects (*M. suspectus*, *D. abiesemia* and *R. piceae*) were excluded, so the seed damage rates remained uncalculated. But, Bouaziz and Roques (2006) stated in their study that *Megastigmus* spp. destroyed up to 30% of 2-year-old cones and 44% of 3-year-old cones of *Cupressus sempervirens*, 30% of 2-year-old cones of *C. arizonica* and 29.5% of 2-year-old cones of *C. glabra*. In the present study, the percentage of *M. suspectus* infested cones was observed in an average of 18.4% in a three-year period on Trojan fir.

Additionally, *D. abiesemia* and *R. piceae* species are new records for the related fir on Kazdaglari Mountain ranges.

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