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SEASONAL ABUNDANCE OF POPLAR LACE BUG, *MONOSTEIRA UNICOSTATA* MULS. & REY. (HETEROPTERA – TINGIDAE) IN THE FOREST GARDENS OF TURKEY

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Abstract

Field study were conducted at Istanbul province to evaluate the effect of poplar species on population density of insect and susceptibility of three poplar trees, *Populus deltoids* Bartr., white poplar, *Poplar alba* L. and black poplar, *Populus nigra* L. to the infestation of the poplar lace bug, *Monosteira unicostata* Muls. and Rey. (Hemiptera:Tingdae). Adults appeared in the beginning June and their numbers increased until disappeared in the middle of October in the forestry gardens- Istanbul during season 2019. The results of the ecological study indicated that the population density of insects under field conditions reaching its number peak in July on the poplar host during the period of experimental. Results indicated that eastern cottonwood poplar trees, *Populus deltoides* Bartr. was the most susceptible species to infestation followed *Populus nigra* L., whereas the white poplar, *Populus alba* L. was the least susceptible.
***Keywords*:** *Monosteira unicostata*, Poplar, Infestation, Population.

Introduction

Populus spp. is considered as important economic trees belongs to the family Salicaceae. Poplar play a significant role in rehabilitation of degraded forests and fragile ecosystem. Poplar wood is consumed by different sectors as rural uses (constructional round wood-fuel wood) and industrial uses, construction-furniture-packing-fiberboard, particleboard-pulp and paper and others (Qasir, 1990). According to the latest statistics, forest area in Turkey covers up to 22.7 million hectare (FAO, 2018). It has been observed that many broad leaved and coniferous forest tree species in a forest area of this size have formed a wide geographical variation according to their natural distribution inclinations in different ecological conditions (Urgenc, 1982; Tunctaner, 2007). Poplars have a place in many areas of landscape planning and design work, including amenity plantings in parks, along roads and in residential gardens, public areas and green spaces, as well as in landscape restoration work and for wind screens and noise reduction (Eroglu and Cengiz, 2018). Poplar lace bug, *Monosteira unicostata* Muls. & Rey., is one of the most economically important sucking pests of Poplar and Willow (Onder and Lodos, 1983; Moleas,1987; Ozey, 1997; Al-Maroof *et al*., 1981; Mustafa, 2000). Researchers in the different parts of the world reported that genus, *Monosteira* spp. were founded on the poplar and almond trees (Abdullah *et al*., 1980; Awad & Amin, 1983; Moleas, 1985, 1987; Atieh, 1996; Mustafa & Al-Maroof, 2003; Babolmorad *et al*., 2006; Ozey, 1997; Ozlem & Halil, 2007). The economic important of lace bug is attack all species of poplar trees and may lead to their death or decline in quantity and quality of their timbers. This insect produces pale spots on upper side and small black points on underside leaves of poplar and willow host species (Ozey, 1997; Adabi, 2013; Mustafa *et al*., 2014). Many references indicate that it also it affects pears, apples, peaches, apricots, almonds and other (Ibrahim and Nayef, 1986; Hariri, 1981; Hosseini, 1966; Ozlem & Halil, 2007; Roze *et al*., 2012). Babmorad *et al*. (2010) and Ahadiyat *et al*. (2010) who studied in Iran, susceptibility and resistance of poplar species and clones against the *Monosteira unicostata* Muls. & Rey. Onder and Lodos (1983) who studied population density and environment of the insect on the willow trees in the Turkey. In addition, several studies have been carried out on resistance and susceptibility of poplar species and clones against poplar pests and diseases (Modir-Rhmati *et al*., 1997; Augustin *et al*., 2000; Han and Fang, 2000; McNabb *et al*., 2000; Meilan *et al*., 2000; Mustafa, 2000; Singh, 2000; Villar *et al*., 2000; Yan *et al*., 2000; Singh and Pandey, 2002; Sadeghi, 2004; Nordman *et al*., 2005; Sadeghi *et al*., 2006; Sadeghi *et al*., 2007; Hannon *et al*., 2008; Nikdel and Dordaei, 2008; Ahadiyat *et al*., 2010; Babmorad *et al*., 2010; Pahlevan-Yali *et al*., 2010; Peaeson *et al*., 2010). Ozlem and Halil (2007) also studied the fatty acid compositions of predator *Luridus piocoris* agents their host *Monosteira unicostata* on almond trees in Turkey. The present study deals with occurrence, densities, food preferences and the number of generations add to feeding behavior and the nature of damage caused by the insects in order to plan a suitable control measures.

Materials and Methods

The field study was carried out on Salicaceae trees grown at gardens forestry, Istanbul, Turkey, to determine the impact of poplar host species of lace bug and their susceptibility with infestation insects. In this study 5 trees of each species, Eastern cottonwood poplar, *Populus deltoides* Bartr., white poplar, *Poplar alba* L. and black poplar, *Populus nigra* L. (Dawood, 1979) and a random weekly samples have been taken from studied species from the beginning of June month until to the October during season 2019 was chosen five trees of each species and stains of 4 leaves from each tree to represent the leaves of the four directions of the tree (North, South, East, west) to become the size of the sample (20) leaf of each poplar species and estimated the population density of insects on poplar leaves infestation each species through weekly readings so that each sheet of these papers are immediately counted from the nymphs using a hand lens in the laboratory of entomology and Protection, Faculty of Forestry, Istanbul University, but the adults were longer without the use of a hand lens due to their large size according to the Atieh (1996). The statistical

analysis design of randomized complete sectors used (SAS, 2000) for comparing to the preparation of the weekly insects for Poplar species.

Results and Discussion

Table 1 show that the adults of lace bugs showed at the beginning of June on the poplar species, Eastern cottonwood, *Populus deltoides* Bartr. with infestation reached 15, 3 and 8 insect, respectively. Number of insects increased gradually from mid-June for poplar species, aspen poplar, white *poplar* and black poplar with infestation were 83, 6, and 58 % respectively. In this study, all species of tree were infested and reached the peak of infestation at the beginning and middle of the month of July and August months with average reached 79.3 and 170.0;175.6 and 52.3 insect, respectively, while the numbers of Poplar lace bug were decreased at the beginning of October month and its hibernate beneath the bark of trees or under fallen leaves at the middle of October with average of temperature and relative humidity ranged (20.10 C^0 and 62.35 %), respectively, these results are disagree with Abbasi (2010) who found that the hibernation of poplar lace bug, *Monosteira buccata,* were at mid-September and the adult on modern leaves have been observed in early April when the temperature and relative humidity (17.27 m and 57.35%), respectively. AL-Maroof and Mustafa (2004) who mentioned that the rate of decrease for population density by lace bug insects were 92.66 bug on a black poplar trees clone IRQ45 with nutrients of leaves were 3.33, 5.22 and 1.79 for nitrogen, Phosphorus and potassium, respectively. These results obtained were in agreement with those of Al-Maroof *et al*. (1981) and Mustafa (2000) they found that *Monosteira unicostata* M. R. were one of the most insects pests on poplar trees, on the other hand, in addition to the different trees, poplar strains within species (clones) *Populs nigra*, we concluded that the increase in the numerical density of the insect lead to increased infection rates may be attributed contrast to the differing proportions of the key elements in vegetable juices and to morphological characteristics leaves for each type, we concluded from the results of this study that providing the temperatures and relative humidity and host feedings has played a role in determining the length of the hibernation, and it cleared from this study and previous studies that the early delays in the appointment of appearances adult depends on the climatic conditions in the study area, particularly temperature and relative humidity during the months year. In general results of this research indicate that variations in the susceptibility of poplar trees may be due to variation according to the food preferences of poplar species, topography, altitude, and environmental conditions (Ateih, 1996; Shaheen *et al.*, 2012).

Table 1: Weekly Population density of lace bug, *Monosteira unicostata* on poplar species during season 2019.

Date of sample	*Populus deltoides*	*P. alba*	*P. nigra*	Average / week
1 / 6	15	3	8	8.6 f *
15 / 6	83	6	58	49.0 cd
1 / 7	73	72	93	79.3 b
15 /7	220	105	185	170.0 a
1 / 8	184	130	213	175.6 a
15 / 8	56	62	39	52.3 c
1 / 9	61	-	42	34.3 de
15 / 9	27	-	22	16.3 e
1 / 10	19	-	-	6.3 f
15 / 10	-	-	-	-

*Averages of similar letters not differ significantly at 5% probability.

Table (2) refers to prepare aggregates bugs on species in conjunction with the insect-month period in which existed during the study season to prove the impact of food allergy and the host of the insect and the degree of preference with them to determine the months in which the insect also increased, it has been observed that the numbers of lace bug reached high infestation 249.3 and 228.0 insect during July and August months, respectively, at temperatures of 26.15 and 28.10 ºC and a relative humidity of 50.10 and 52.82 % respectively, these results agreed according with many of the researchers that studies have agreed on that the density numerical insect peaked in the summer in July and August in some areas of the world (Moleas, 1987; Mustafa, 2000 and Mahdi *et al*., 2018). Generally, it was noted that the averages of infestation for normal white poplar, *Populus alba* were least and its reached 75.6 insect compared Aspen poplar, *Populus deltoides* 147.6 insect and black poplar, *Populus nigra,* 132.6 insect, this variation in infestation average and its susceptibility trees as a result to the difference in the nutritional value and may be due to some morphological characteristics and physiological and genetic of these trees, which makes this species of poplars non preferences by the lace bug as a result of content of nutrients variation. These results confirmed by some researches such as studies of Ahadiyat *et al*. (2010), Sadeghi (2004), Babmorad *et al*. (2010) and Sadeghi *et al*. (2006). Ahadiyat *et al*. (2010) observed highest density of *M. unicostata* on *Populous nigra* and *P. alba* and the lowest on *P. euramericana* and *P. deltoids* on the other hand, the results of this study disagree with the obtained by Al-Maroof (1977) who mentioned that higher infestation was on the black poplar Shaqlawa, *Populus nigra* with infestation percent 74 and 84%, and less infestation on Poplar White *Populus alba,* while Mustafa (2000) who showed susceptibility of poplar trees for that the highest infestation was *Populus deltoids* clone 702/8 with infestation reached 83.5% and the least of the black poplar *Populus nigra* Tr. 75/56 and likely variation in infestation percent divergent species of *Populs* spp.

Table 2 : Monthly population density for tiger lace bug, *Monosteira unicostata*, with averages of temperature and relative humidity during 2019.

Months	Population density of poplar lace beg / Month			Temperature C^0	Relative humidity %	Average / month
	Populus deltoides	*P.alba*	*P. nigra*			
June	98	9	66	22.70	53.12	57.6
July	293	177	278	26.15	50.10	249.3
Augusts	240	192	252	28.10	52.82	228.0
September	88	-	64	23.50	55.26	50.6
October	19	-	-	18.84	64.10	6.3
Avg./ type	147.6 a	75.6 c	132.6 b			

*Averages of similar letters not differ significantly at 5% probability.

(Table 3). Results of the statistical analysis showed that aspen poplar was more susceptibility by lace bug compared black poplar and white poplar, this differences are due to the food preferences by insects for poplar species, these results agree with studies researches in the different of world about increase population density of lace bug during August month on the poplar and almond trees (Moleas, 1987; Ateih, 1996 and Mahdi *et al*., 2018). From above mentioned information and through the field visits to forest gardens at Istanbul region , the results of this study showed that the insect infestation were different according to the species of poplar, leaf directions and environmental conditions, generally, the, *Populus deltoides* Bartr., infested mostly by insect pests and highly density followed by *Populus nigra* L., and then, *Populus alba* L., these results of this phenomenon may be due to occurrence of differences in morphological features of tree leaves for poplar species, chemical components and nutrition content (Al-Maroof & Mustafa, 2004; Al-Mallah *et al*., 2008). In addition to the insect infestations were variation between three poplar species s, generally, the results of this research indicate that variations in the susceptibility of poplar trees may be due to variation according to the food preferences of poplar species by poplar lace bug, parts of leaves and differential environmental factors. The results of this study indicated that the correlation value between number of insects with average of temperature and humidity was significantly between temperature and numbers of insect which reached 0.80+ and significant negative with a relative humidity as a value 0.75- on aspen poplar,While the correlation was positive between the average temperature and the numbers of insect reached 0.72+ and significant negative with relative humidity and its value 0.70-, white poplar(Table 3).The correlation value were significant positively with temperature and negative with relative humidity between the average temperature and the number of insects was reached 0.78 + and 0.73 - respectively. We concluded from the results of this study that providing the temperatures and relative humidity and host feedings has played a role in determining the length of the hibernation, and it cleared from this study and previous studies that the early delays in the appointment of appearances adult depends on the climatic conditions in the study region. The results of this research indicate that variations in the susceptibility of poplar trees may be due to variation according to the food preferences of poplar species and differential environmental factors, particularly temperature and relative humidity during the months year .Generally advised to plow fields periodically to bury weeds and fallen leaves so as to eliminate the insect's hibernate them and organize irrigate fields and not to expose it to the thirst during the growing season and hold pruning periodically operations to secure good ventilation of the axes and the fight against the insect after graduating from the developed wintering to one of systemic herbicide (Al-Mallah and Abdul- Razzaq, 2012) in the case of the intensification in the month of July can be made extra combat operation with the aim of eradicating the insect before it enters in the process of wintering and decrease of infestation percent in the following year (Mustafa, 2011).

Table 3 : Linked value and coefficient of certainty for relationship between numbers of poplar lace bug and average of temperature and relative humidity.

Species of Poplar	English name (poplar trees)	linked value and coefficient of certainty			
		temperature		relative humidity	
		R	R^2	r	R^2
Populus deltoides	eastern cottonwood poplar	0.80+*	0.64	0.75-*	0.56
Populus alba	white poplar	0.72+*	0.51	0.70-*	0.49
Populus nigra	black poplar	* 0.78+	0.60	0.73-*	0.53

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