



Population dynamics, spatiotemporal distribution of the olive psyllid *Euphyllura olivina*, (Costa, 1839) (Hemiptera: Psyllidae) on the Chemlal variety in the Oasis of Boussaâda

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Abstract

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The study conducted on the population dynamics of the olive psyllid *Euphyllura olivina*, (Costa, 1839), on the variety Chemlal in the oases of Boussaâda, during the first half of the year 2021, showed that the first numbers of the different biological stages of the insect are recorded in mid-March 2021, where all directions of the tree are infested while the northern and western directions are the most exposed to attacks of the pest.

The first numbers of adults of *E. olivina* are recorded in mid-April, while mortality according to the directions of the tree is recorded on all cardinal directions of the tree, with a rate of about 39% on the northern direction.

1. INTRODUCTION

Agriculture in Algeria, constitutes an extremely important sector of the Fruit growing is very diversified in Algeria, consisting mainly of olive, fig, vine, and citrus, which are the most important species in economic and social terms. Currently, there is a massive introduction of rosaceous varieties (pear, apple, apricot, peach, cherry, almond, pomegranate, medlar). Other fruit species, local neglected or exotic such as pecan, chestnut, walnut, pistachio, prickly pear, wall tree and banana, have been introduced as botanical species since 1881 (INRAA, 2006).national economy, it covers a large part of the national territory (FAO, 2016).

Fruit growing is very diversified in Algeria, consisting mainly of olive, fig, vine, and citrus, which are the most important species in economic and social terms. Currently, there is a massive introduction of rosaceous varieties (pear, apple, apricot, peach, cherry, almond,

pomegranate, medlar). Other fruit species, local neglected or exotic such as pecan, chestnut, walnut, pistachio, prickly pear, wall tree and banana, have been introduced as botanical species since 1881 (INRAA, 2006).

The culture of the olive tree occupies a privileged place in Algerian agriculture at the level of agricultural production, it is placed in the 7th rank with a production that exceeds 400 000 tons. The olive groves cover an area of 412,000 hectares with 47 million trees, or more than 50% of the national olive heritage (MADR, 2017).

The phytosanitary problems of the olive tree are the main factor of the low productivity of this crop, it can be strongly attacked by the olive fly (*Bactrocera oleae*) which is its main pest, and the olive moth (*Prays oleae*), the olive psyllid (*Euphyllura olivina*) and the black scale (*Saissetia oleae*). These animal pests attack all the organs of the olive tree (leaves, flowers, branches and fruits); Several works have been carried out on

the pests of the olive tree are very important like those of Al Ahmed and Al Hamidi (1984), Alford (1994), Guarino and La Notte (1997), Alvarado (1999), Duriez (2001) and Coutin (2003).

2. MATERIALS AND METHODS

2.1. Study

Boussaâda region is located at 69 km south-west of M'sila city at 461m altitude. It is located between the mountains of Jebel Kerdada and Jebel Azzedine; it is crossed by a perennial flow namely Valley of Bousaâda that irrigates the garden area of the city and its palm grove. The total area is 255Km². It is limited to the North, by the Ouled Sidi Brahim region, in the North-East, by the Maarif region, in the East, by EI-Houamed region, in the West, by Temsa region, in the South-East, by the municipality of Oultem and in the South-West by El-Hamel region (Bennaceur&Benderradji, 2016) (Fig.1).

Boussaâda, it has been noted that the month of May is characterized by the highest relative humidity (77%), against the lowest monthly average that was recorded during July with 30.7%. The annual average is 55.78% (Table 1).

2.3. Characteristics of the study area

The study orchard is characterized by its clay soil, with a heavy structure and poor in organic matter, the farmer proceeds to permanent work of the plot with the different cultural techniques (Ploughing, fertilization, irrigation and pruning), the characteristics of the olive orchard where our work is carried out are represented in Table 2 below.

2.4. Methodology

The study carried out during the period from January to June of the year 2021, on an olive grove of the variety Chemlal, in the Oases of Boussaâda, consists in making exits every fifteen



Fig. 1. Location of study area

2.2. Climatic conditions region

In this region, the climatic parameters such as the rainfall and relative humidity (Table 1) have acts on the density of the populations by causing a decrease in the number of individuals when the hygrometric conditions are unfavorable on the organisms (Dajoz, 1971). In the region of

days on the ground, in order to carry out samplings by taking a branch of each direction of the tree, on the 10 trees chosen randomly, based on the simple method used by Vasseur and Schvester (1957), Benassy (1961) and Fabres (1979).

The cutting of the branches is done, using a

Table 1. Average monthly rainfall (mm) and relative humidity (%) in Boussaâda region for the year 2021

Months	J	F	M	A	M	J	J	A	S	O	N	D	Year
Rainfall (mm)	3,2	3,0	19	4,6	129	14	0	26,2	19	1,0	14,8	0,8	234,6 (Total)
Relative Humidity (%)	69	70,1	74	71	77	31	30,7	29,8	31,8	51	68	66	55,78 (Average)

Table 2. Characteristics of the study area

Orchard area	1,5 Ha
Number of tree	200
Number of trees	12year
Plantation density	2,25m ²
Irrigation	Once /10Days
Phytosanitary treatments	Absent

pruning shears, for the variety studied, as well as strikes within the trees are made to recover the adults; then the samples are put in labeled plastic bags, bearing the date of exit and the direction of the tree.

In the laboratory, observations under a binocular magnifying glass are made in order to count the different biological stages of the insect, eggs, larvae and adults in the different cardinal directions of the tree.

The results obtained were subjected to statistical analysis and analysis of variance by the software "SYSTAT vers. 12, SPSS 2009 and Excel TM".

3. RESULTS AND DISCUSSION

3.1. Population dynamics as a function of time

The first numbers of eggs of *Euphyllura olivina*, are recorded at the beginning of April, then the numbers progress to reach a peak in May 2021; the distribution of *E. olivina* larvae according to time, shows that the larvae are present at the beginning of spring, with maximum peaks in April for the second, third and fifth larval stage, while, for the fourth larval stage, they are present at the end of May. The evolution of the number of *E. olivina* larvae as a function of time, shows that the larvae are present at the beginning of spring, with maximum peaks in April for the second, third and fifth instar larvae, while for the fourth instar larvae, the numbers are important in May and then the numbers decrease to stabilize during the months of May and June; for the adults, the first numbers are recorded in mid-April 2021 (Fig. 2).

According to Hmimina (2009), temperatures higher than 27°C or lower than 12°C, accompanied by a low hygrometry (50%) can reduce 2/3 the reproductive potential of a female,

moreover in winter the oviposition is very reduced and the adults are immobile.

Indeed, Coutin (2003), notes that adults of *E. olivina* overwinter and spring egg-laying occurs in March-April on the underside of the leaves of terminal shoots. Indeed, Coutin (2003), notes that adults of *E. olivina* overwinter and spring egg-laying occurs in March-April on the underside of the leaves of terminal shoots.

Bechiche (2018), notes that, the first numbers of eggs of *Euphyllura olivina* on the variety Siguoise, are recorded in mid-December 2017, with a number of six eggs, as well as, for the larvae of *E. olivina* high numbers are recorded in the second half of March 2018, while, for the adults, the first numbers are recorded at the beginning of December 2017 with 12 individual, in the region of Magra in the east of the wilaya of Msila.

Balboul and Bouchaiba (2020) note that, in the region of Boukhmissa, wilaya of Msila, the first numbers of eggs of *E. olivina*, are recorded at the beginning of February 2020 with a number of 10 eggs, during winter, then increase to wait for 50 eggs in March 2020. *E. olivina*, are recorded at the beginning of February 2020 with a number of 10 eggs, during the winter, then increase to wait for 50 eggs in March 2020. This period coincides with the progression of temperatures and the decrease of Humidity. Concerning the larvae, the numbers are low for the L2, L3 and L5 at the beginning of February, whereas, for L1 and L4 the numbers are high at the same period, for adults, record 11 individuals at the beginning of February 2020, then the numbers increase at the end of February 2020 with a peak of 37 individuals.

In Eastern Algeria, in the region of Mostaganem, Khobzi (2019) confirmed the absence of the olive

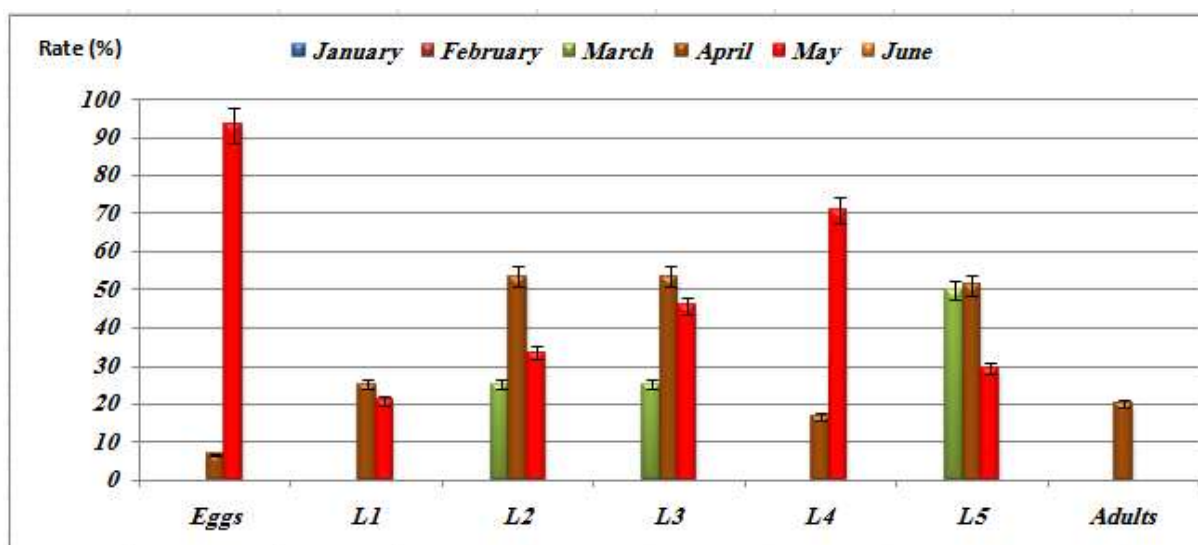


Fig. 2. Distribution of the different life stages of *Euphyllura olivina* as a function of time.

psyllid *E. olivina* during the winter season.

3.2. Population dynamics according to the cardinal directions of the tree

The Fig.3 shows that, the eggs are present on the West direction with a rate of 60%, then the East direction with 27%. Concerning the larvae, all the directions of the tree are affected but the East and West are the most affected, with rates of 34.88% and 30.23% respectively. As well as, the fourth larval stage is recorded with a high rate on the West direction. However, the fifth larval stage is present with a high rate on the South direction of the tree. For the adults, the southern direction records the highest rate followed by the eastern and southern directions with the same rate.

with high rates on the East directions with 33,33%, then the South direction with 27,53%, the West direction with 20,28% and the North direction with 18,84%.

Guessab *et al.* (2021), in the region of Mascara, in the west of Algeria, noted that the number of eggs is important in the northern direction and then the center and east of the tree, with respectively 63, 53 and 20 eggs, while the first larval stage (L1) is present in large numbers in the southern direction with 11 larvae, the second larval stage (L2) is present in the east direction with 19 individuals, and 16 individuals in the south direction. For the third larval stage (L3), a number of 30 individuals recorded in the northern direction, the fourth larval stage is recorded in the central and northern directions

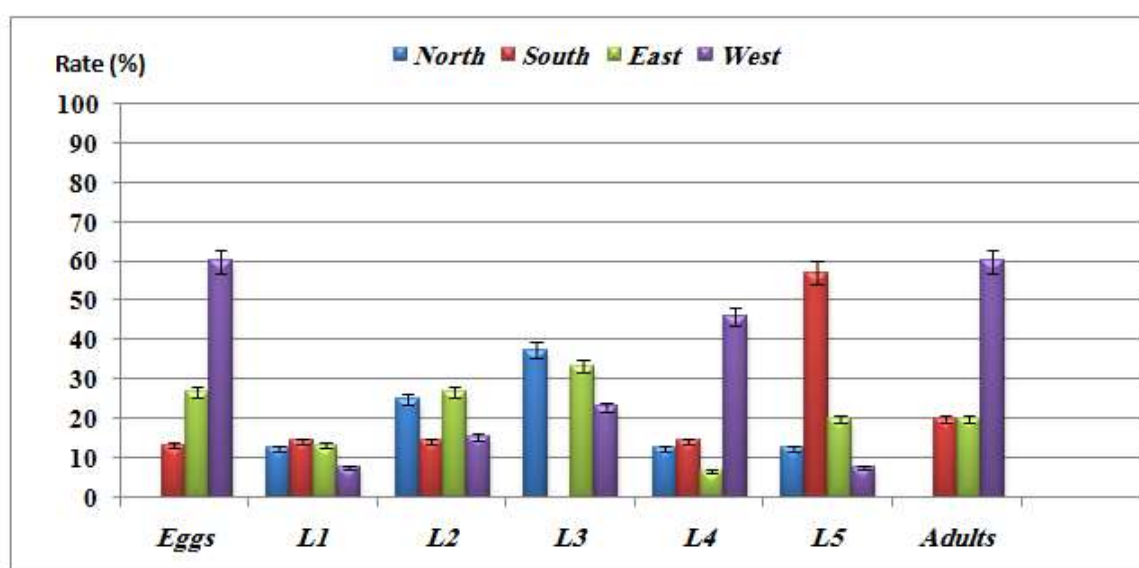


Fig. 3. Distribution of the different life stages of *Euphyllura olivina* according to the cardinal directions of the tree.

Balboul and Bouchaiba (2020) noted that, in the region of Boukhmissa, wilaya of Msila, eggs were present in all directions of the tree, with high numbers in the southern direction with 34 eggs, while in the northern, eastern and western directions, the numbers were 29, 29 and 21 individuals respectively. While, for the larvae, all the directions of the tree are affected by *E. olivina*, with high numbers recorded on the North direction, the larvae of the first stage with 21 individuals and the third stage with 09 individuals. Then, the East direction with 16 individuals of the first stage and the third stage with 14 individuals, the West and South directions record rather low numbers, for the different larval stages. Concerning the adults, they are present on all the directions of the tree,

with numbers of 24 and 20 individuals respectively, then the fifth larval stage is recorded in the western and central directions with 11 and 10 individuals respectively, while, for the adults the southern direction records the large number of individuals with 35 individuals. Belhamdounia (1993) noted the preference of southern orientation for larvae in spring, and southern and western orientation for adults.

3.3. Population dynamics of the olive psyllid (*Euphyllura olivina*) through analysis of variance

The G.L.M. (Global Linear Model) model applied to the distribution of the different life stages of *E. olivina* according to months (January, February, March, April, May, and June) and directions (North, South, East, and West) in The study area

shows highly significant differences between the study months ($p=0,000$; $p\leq 0.05$) and significant differences between the four directions ($p=0.045$; $p\leq 0.05$). However, non-significant differences are recorded between the life stages of *E. olivina* with a probability of $p=0.775$; $P>0.05$ (Fig. 4).

The Fig. 4, allows us to deduce that the numbers of *E. olivina* are more important in May and April. However, these numbers vary significantly depending on the direction, with the highest densities recorded in the eastern and western directions.

3.4. Mortality

3.4. 1.As a function of time

The Fig. 5 shows that, mortality started in the month of March with 17.86%, then the rate increases to reach 46.43% in the month of May, in June no mortality is recorded.

Ksantini (1986) and Chermiti (1989) observed

that high temperatures in association with low relative humidity caused high mortality of eggs and larvae, and spawning even stopped in females of *E. olivina*. Because of the high temperatures and the slower vegetative growth of the tree, second generation adults entered summer rest from June. The insect exhibited polycyclic dynamics, showing its stability to survive from one generation to the next.

Atwal et al. (1970) suggested that both high and low temperatures were detrimental to the psyllid population.

3.4. 2. According to the cardinal directions of the tree

Concerning the mortality, according to the directions of the tree, we record mortalities on all the cardinal directions of the tree, with a rate approaching 39% on the North direction, and 28,57% on the West direction (Fig. 6).

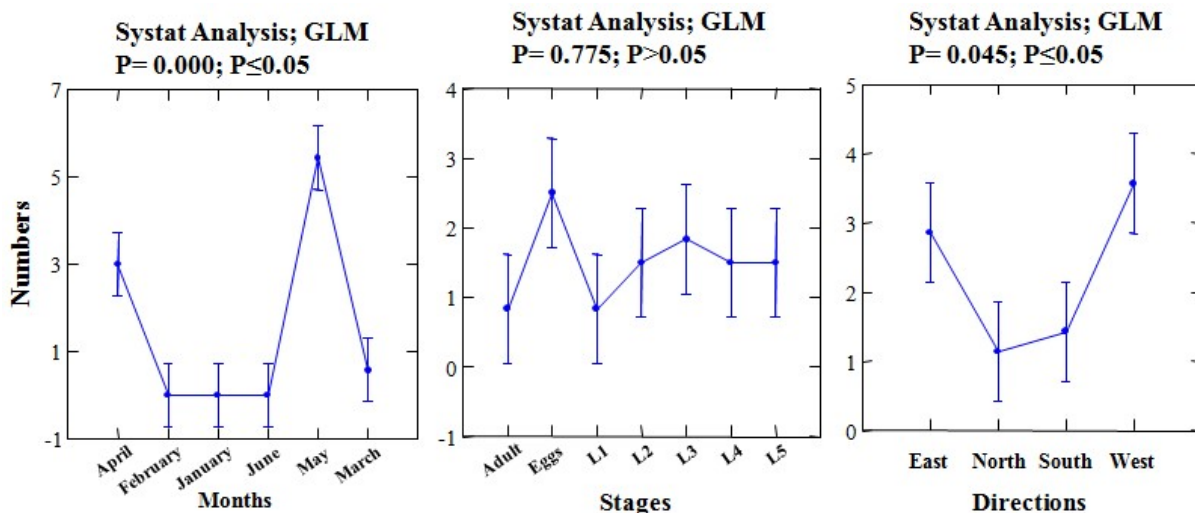


Fig. 4. Distribution of the different life stages of *E. olivina* according to months and direction through analysis of variance (GLM).

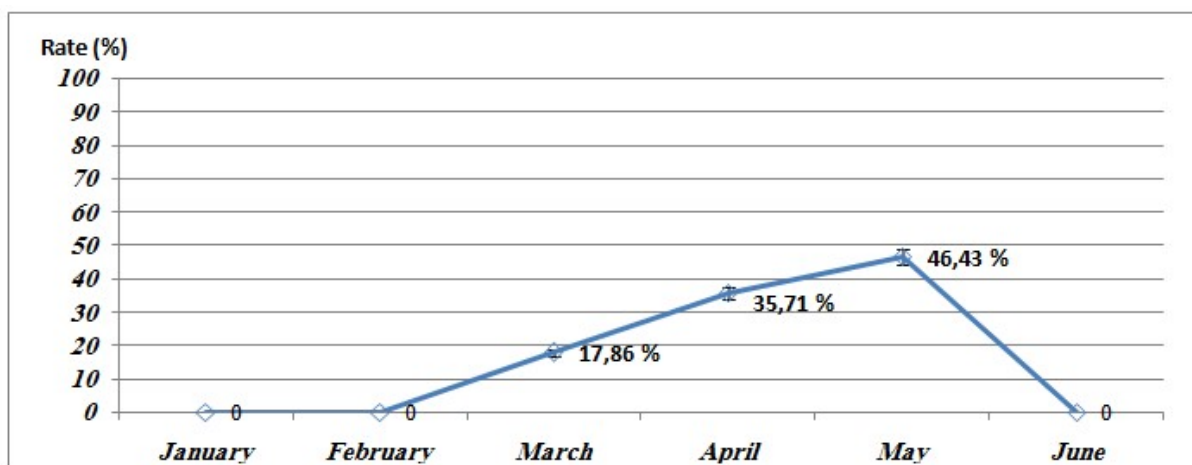


Fig. 5. Mortality of *E. olivina* as a function of time.

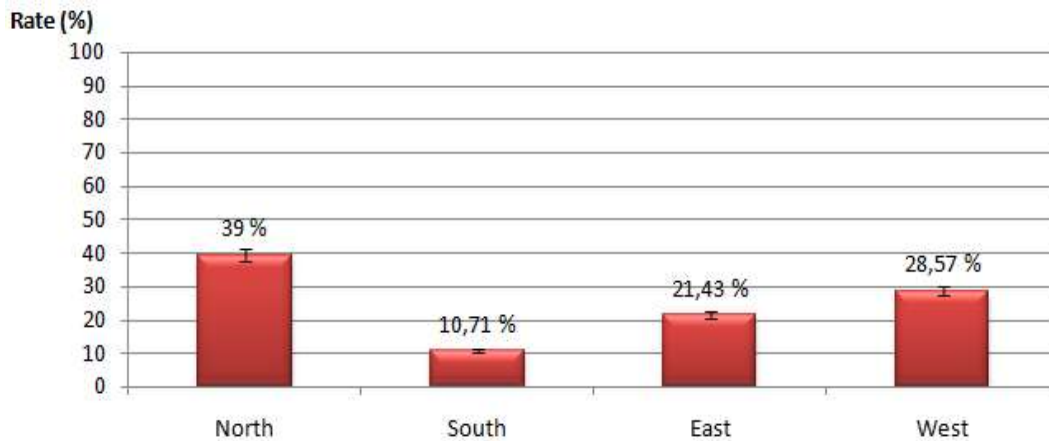


Fig. 6. Mortality of *E. olivina* according to the cardinal directions of the tree

Hmimina (2009), reports that climatic conditions, to some extent, the diversity of olive varieties appear to be the main factors, acting on the development of *E. olivina* and on its evolutionary cycle. Balboul and Bouchaiba (2020), in the region of Boukhmissa, wilaya of Msila, record mortality rates of 53.84% in the southern direction, then come in second place the eastern direction with 30.78%, then the northern direction records a low rate of 15.38%.

3. CONCLUSION

The olive tree is a crop that occupies an important place in the national economy, by its various products that enter the human food, for that, the monitoring of the various pests that it attacks is essential.

The study conducted on the population dynamics of one of the pests of the olive tree which is *Euphyllura olivina*, in the oases of Boussâada, wilaya of Msila, on the variety Chemlal, shows that the first numbers of eggs of *E. olivina*, are recorded at the beginning of April 2021 and the western direction, is the preferred for the laying of females.

Regarding the distribution of *E. olivina* larvae, as a function of time, are present at the beginning of spring 2021, with maximum peaks in the month of April, then the numbers regress to stabilize during the months of May and June 2021, the East and West directions are the most affected, with rates of 34.88% and 30.23% respectively.

The first numbers of adolescents of *E. olivina* are recorded in mid-April 2021 where the western direction records a high rate of 60%.

Mortality, all cardinal directions of the tree are affected, with a rate approaching 39% on the North direction.

The results obtained, allows us to control the outbreaks of the pest, after knowing the moments

of its appearance, the points of oviposition attracted by the females as well as, the preferred part of its installation; the follow-up of the pest on other varieties of olive tree is interesting and even the age of the tree, even to compare the one targeted; it is interesting to follow the evolution of *E. olivina* in different bioclimatic stages, to see the influence of climatic conditions on the evolution of the pest, and also the effect of altitude on its spread.

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