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SPATIOTEMPORAL DISTRIBUTION OF THE OLIVE PSYLLID *EUPHYLLURA OLIVINA* COSTA, 1839 (HEMIPTERA: PSYLLIDAE) ON THE CHEMLAL VARIETY IN THE MOUNTAINS OF KABYLIE – ALGERIA

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Abstract

The study conducted on the population dynamics and the spatiotemporal distribution of the olive psyllid Euphyllura olivina on two olive groves, of the Chemlal variety, in the Kabylie Mountains, one is located in the wilaya of Bouira (Station Mchedallah) and the other in the wilaya of Tizi Ouzou (Station ITMAS Boukhalfa), revealed that the first numbers of the different biological stages appeared in February 2022. The first numbers of eggs of E. olivina, are recorded in mid-February 2022 for the station of Mchedallah, with a low number, while, for the station of Boukhalfa, the first numbers are recorded in mid-April 2022 and then progress to reach a peak of 56 eggs on May 22, 2022. The numbers of larvae, are high for the different larval stages of the psyllid, during the spring period of the year 2022 in both study stations. The high mortality rate is about 29.07% on the North direction, then the other directions the rates are close to 24% in the station of Mchedallah and in the station of Boukhalfa the South direction records the highest rate with 37.35% followed by the North direction with 32.53 %.

Key words: Psylle, Bouira, Boukhalfa, Larvae, effective, Chemlal, ITMAS

INTRODUCTION

The lifestyle of the olive tree occupies a privileged region in the algerian agriculture at the extent of the rural manufacturing, it is placed on the seventh rank with a production which exceeds 400 000 heaps. The olive groves cowl a place of 412,000 hectares with forty seven million bushes, or extra than 50% of the national olive heritage (MADR, 2017).

The olive tree presents a remarkable hardiness and plasticity allowing it to produce in difficult conditions (adaptation to a wide range of soil and water insufficiency), but its productivity is still limited by several biotic and abiotic factors.

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 psyllid (*Euphyllura olivina*) and the black scale (*Saissetia oleae*). These animal pests attack all organs of the olive tree: leaves, flowers, branches and fruits (El Hadrami and Nezha, 2001).

Euphyllura olivina is native to southern Europe, growing on *Olea europea* L (Debo et al., 2011; Triapitsyn et al., 2014), then it developed on other *Oleaceae* such as *Phillyrea angustifolia* and *P. latifolia*. This species

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had subsequently a wide distribution air, pellucid in Algeria, France, Germany, Great Britain, Iran, Italy, Portugal, Palestine, Tunisia and Yugoslavia, then it is introduced in the United States of America in California. It is reported for the first time in Algeria by Arambourg and Chermiti, 1986.

E. olivina, is a species that causes significant damage to olive crops with two to three generations per year (Chemseddine, 1988; Tajnari, 1992). It should be noted that the culture of the olive tree in Algeria is ancestral. An entomofauna of olive tree pests has long been established in this agrosystem. The richness and abundance of these entomophagous are favored by the mode of conduct of the Algerian olive cultivation based on the limited use of pesticides.

Several works have been carried out on olive pests, such as those of Al Ahmed and Al Hamidi, 1984; Alford, 1994; Guario and La Notte, 1997; Alvarado, 1999; Duriez, 2001 and Coutin, 2003. In order to study the role that, pests exert on the olive crop and their effects, that our study is conducted on one of the important pests such as the olive psyllid *Euphyllura olivina.*

MATERIAL AND METHOD

1. The study sites

Our work is carried out in the localities of Mchedallah wilaya of BOUIRA and the Institute of Medium Agricultural Specialized Technology (ITMAS), in the locality of Bouhkalfa wilaya of TIZI OUZOU.

The site of Mchedallah, located 43 km east of the chief town of the wilaya of Bouira, at 440 m altitude with an area of 57 km^2, located on the southern slope of the chain of Djurdjura covering part of the valley of Sahel (which extends from Tazmalet to Lakhdaria), with the geographical coordinates: 36° 21' 55" North, 4° 16' 15" East, the orchard is an area of 3Ha with 250 trees aged of 30 years.

The ITMAS of Tizi-Ouzou is located in the locality of Boukhalfa situated in a mountainous zone of approximately 300 m of altitude, at five kilometers in the North-West of the city center of Tizi Ouzou, with the geographical coordinates: 36° 43' 44" North, 4° 01' 05" East, the orchard of study is of a surface of 7 Ha, with 500 trees old of more than 40 years (Fig. 1).

2. Methodology

The study carried out during the period from January to June of the year 2022, on two olive groves of the variety Chemlal, in the localities of Mchedallah and ITMAS Boukhalfa. The study consists in making field trips every fifteen days, for each station, in order to carry out sampling by taking a branch from each direction of the tree, on 10 randomly chosen trees, based

on the simple method used by Vasseur and Schvester, 1957; Benassy, 1961 and Fabres, 1979.

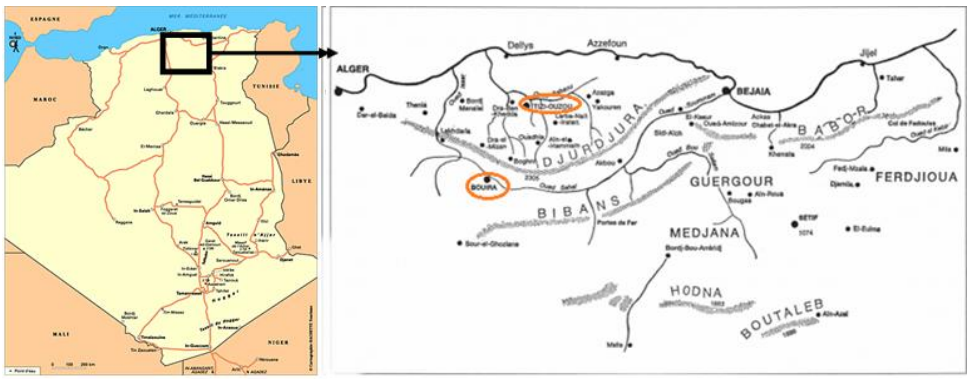

Fig. 1. Location of the study sites

The cutting of the branches is done, using a pruning shears, for the variety studied, as well as knocking within the trees to recover the adults; then the samples are put in labeled plastic bags, bearing the date of exit and the direction of the tree as well as the station.

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

3. Data analysis

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

RESULTS AND DISCUSSION

1. Population Dynamics

The Figure 2 shows that, the first numbers of eggs of *E. olivina*, are recorded in mid-February 2022 for the station of Mchedallah, with a low number of eggs, to reach a peak in mid-April with 256 eggs, while, for the station of Boukhalfa, the first numbers are recorded in mid-April 2022 and then progress to reach a peak of 56 eggs on 22 May 2022; then the numbers regress in both stations, during the month of June, period of absence of the laying period of summer rest of the psyllid (Chermiti, 1983; Ksantini, 1983; Chemseddine, 1988; Tâjnari, 1992).

Chermiti, 1983, explains that the absence of psyllid eggs during the summer season is not always due to the absence of receptive vegetative organs but to high temperatures. He also states that E. olivina does not exhibit diapause at any stage of its development. Chermiti and Arambourg, 1986,

also evoke the term of summer rest without specifying the type of this stop of oviposition.

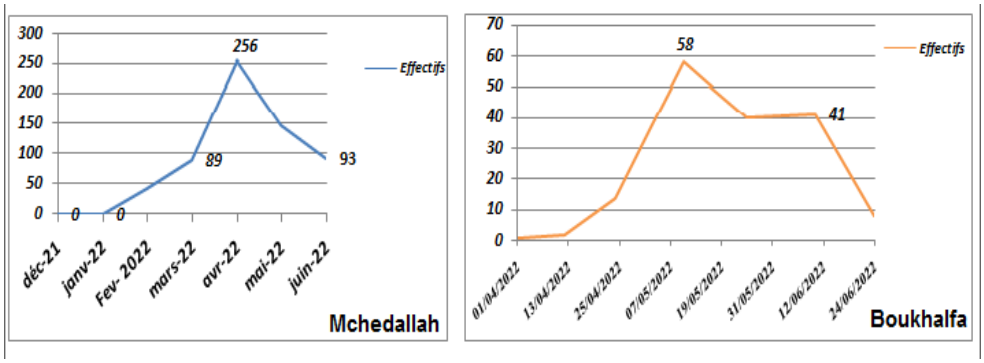

Fig. 2. Egg counts of *Euphyllura olivina* as a function of time at the Mchedallah and Boukhalfa stations

Indeed, Coutin, 2003, notes that the adults of *E. olivina* overwinter and the spring eggs are deposited in March-April on the underside of the leaves of terminal shoots.

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.

Bechiche, 2018, notes that the first numbers of eggs of *Euphyllura olivina* on Siguoise, are recorded in mid-December 2017, with a number of six eggs in the region of Magra east of Msila.

Bouchiaba and Balboul, 2020**,** note that in the region of Boukhmissa, wilaya of MSila, the first numbers of eggs of *E. olivina*, are recorded in early February 2020 with a number of 10 eggs, during the winter, it has subsequently begun to increase to reach 50 eggs in March 2020. This period coincides with the increase in temperature and decrease in humidity.

2. Spatial distribution of the different life stages of *E. olivina* according to the orientations of the tree

The Figure 3 below shows that, all life stages of *E. olivina* are present in the different directions of the tree, in the two study sites, with different numbers, where we record a number of 177 eggs in the southern direction, followed by the northern direction with 155 eggs, at the station Mchedallah, while for the larval stages, the East direction records a number of 110 individuals, for the fourth larval stage (L4) and 110 individuals of the first stage larvae (L1), then comes the South direction with 83 individuals for the fourth larval stage (L4) then the North direction with 79 individuals, for the first larval stage (L1).

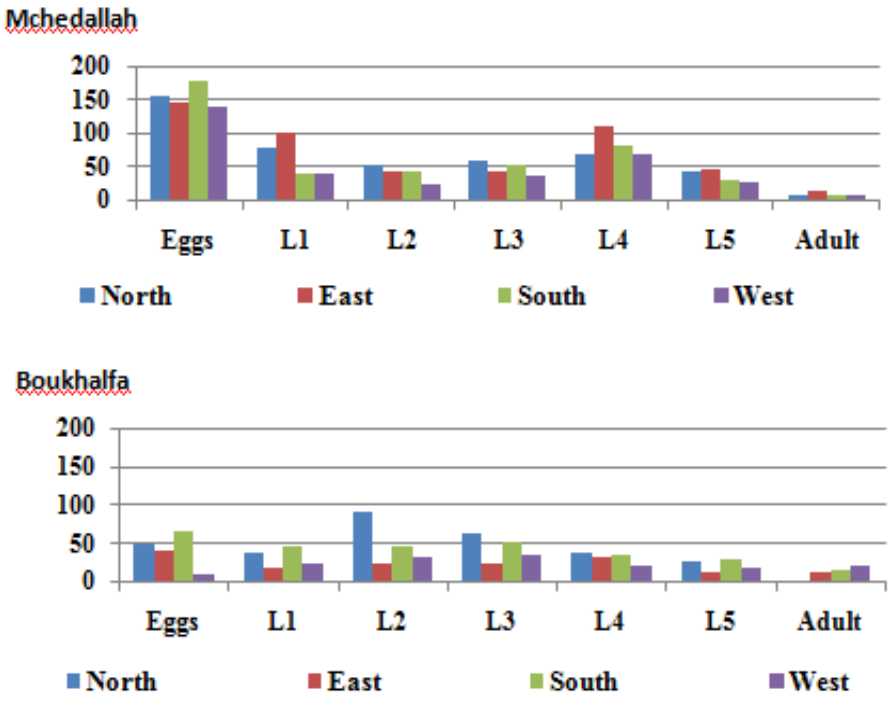

Fig. 3. Distribution of the different life stages of *Euphyllura olivina* according to the cardinal directions of the tree

While for the site of Boukhalfa, the southern direction records a number of 66 eggs, the northern direction records a number of 90 second stage larvae (L2) and 62 third stage larvae (L3), while the fifth stage larvae (L5) is recorded with a low number of 14 individuals in the eastern direction.

Guessab et al., 2021, in the region of Mascara, in the west of Algeria, noted that the number of eggs of *E. olivina* 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 eastern direction with 19 individuals, and 16 individuals in the southern 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 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 south orientation for larvae in the spring, and south and west orientation for adults.

3. Monthly distribution of the different life stages of *E. olivina* according to the orientations of the tree

According to Figure 4 below, we notice an absence of numbers in winter, for the region of Boukhalfa, while the first numbers are recorded in April of the year 2022, with 76 individuals of the third larval stage (L3), for the eggs a peak is recorded in May with 98 eggs.

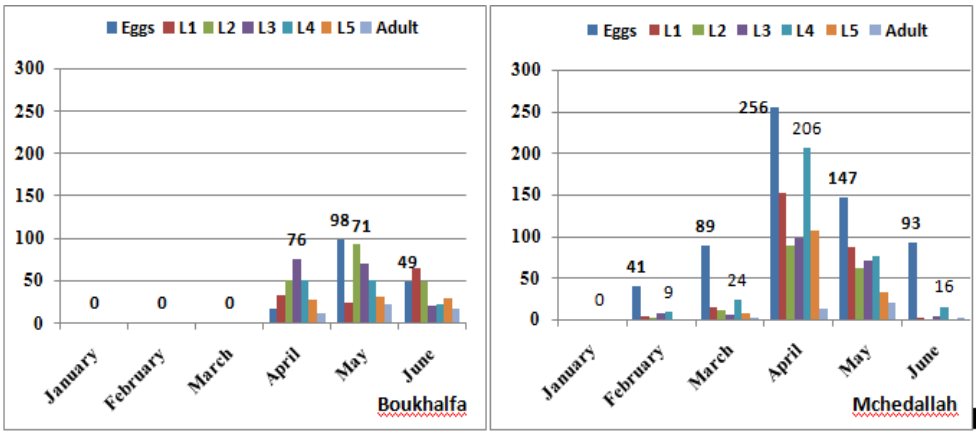

Fig. 4. Distribution of the different life stages of *Euphyllura olivina* according to the months in the sites of Mchedallah and Boukhalfa

Concerning the site of Mchedallah, the first numbers, are recorded in February 2022, with 41 eggs, then the numbers progress, to reach 256 eggs in April, as we also note that, the site of Mchedallah is more infested than that of Boukhalfa in terms of numbers, this is due to climatic conditions characterizing the region.

In Eastern Algeria, in the region of Mostaganem Khobzi, 2019, confirmed the absence of the olive psyllid *Euphyllura olivina* during the winter season.

The G.L.M. (Global Linear Model) applied to the distribution of the different life stages of E. olivina according to the months (January, February, March, April, May and June) and directions (north, south, east and west) in the Boukhalfa site shows highly significant differences between the months of study ($p=0.000$; $p<0.05$) and significant differences between the life stages of E. olivina and the four directions, whose probabilities are respectively, $p=0.032$ and $p=0.018$; $p<0.05$ (see Figure 5). olivina and the four directions, whose probabilities are respectively, $p=0.032$ and $p=0.018$; $p<0.05$ (Fig. 5).

The Figure 5, allows us to deduce that the numbers of L2, L3 and eggs are more important in May then June and April. However, these numbers vary significantly depending on the direction, with the highest densities recorded in the North and South directions.

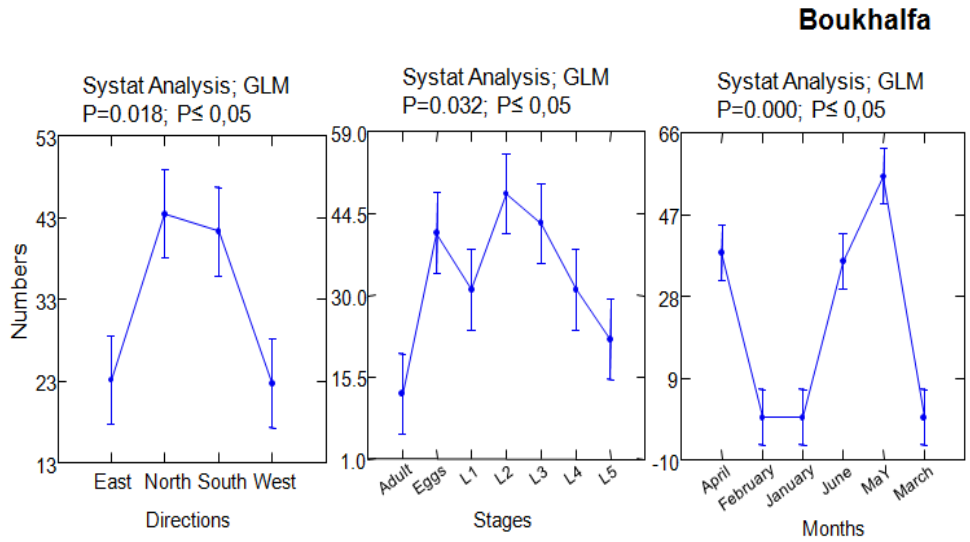

Fig. 5. Distribution of different life stages of *Euphyllura olivina* according to months and direction through analysis of variance (GLM) in the Boukhalfa site

The G.L.M. model applied to the distribution of the different life stages of *E. olivina* according to the months (January, February, March, April, May and June) and directions (north, south, east and west) in the Mchedallah site shows highly significant differences between the life stages of E. olivina and the months of study ($p=0.000$; $p<0.05$) and significant differences between and among the four directions ($p=0.044$; $p<0.05$) (Fig. 6).

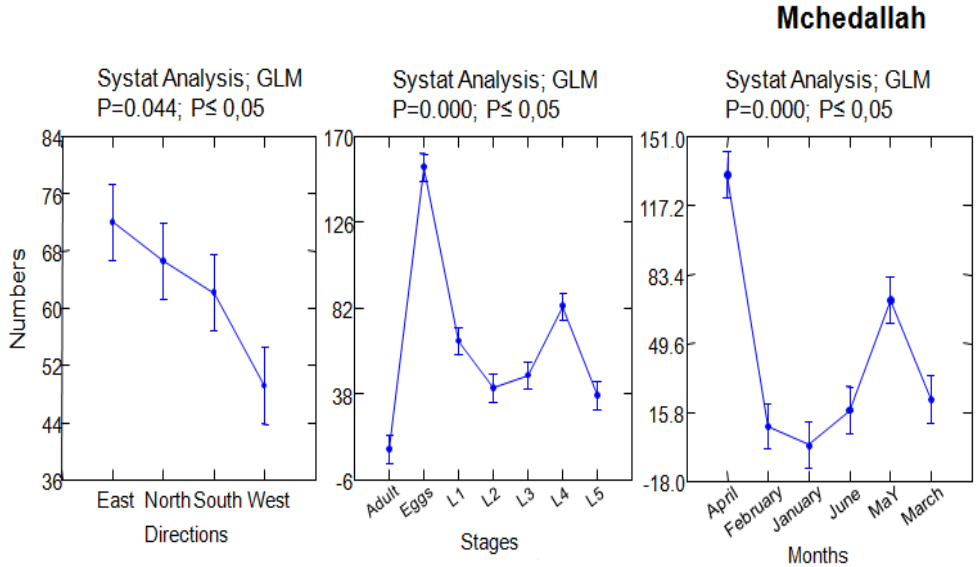

Fig. 6. Distribution of different life stages of *Euphyllura olivina* according to months and direction through analysis of variance (GLM) in Mchedallah site

The Figure 6, allows us to deduce that the number of eggs is more important in May and April. However, these numbers vary significantly by direction, with the highest densities recorded in the western and northern directions.

4. Mortality

The following Figure 7 shows that, the mortality of larvae is recorded at the beginning of March 2022 for the station of Mchedallah with an important peak of 306 individuals recorded in mid-April while, for the station of Boukhalfa, the first numbers of mortality are recorded at the beginning of April 2022, then the numbers progress to reach an important peak of 34 individuals in mid-June 2022 then the numbers regress to disappear at the end of the same month.

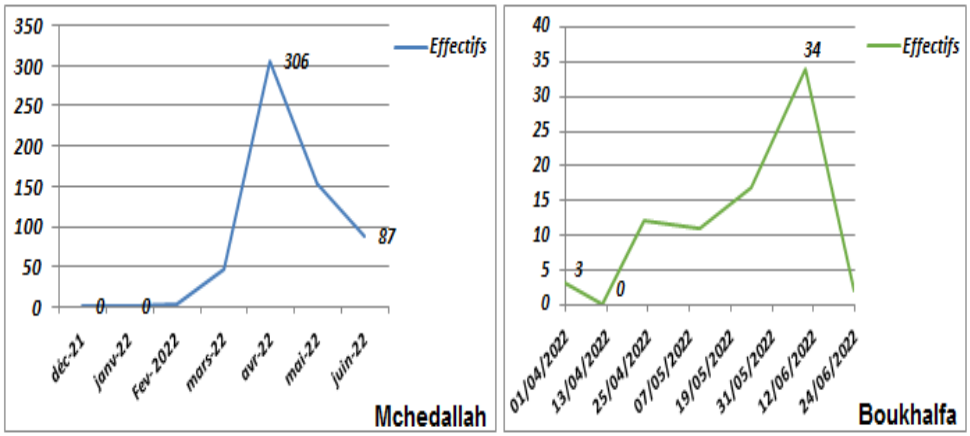

Fig. 7. Mortality of *Euphyllura olivina* as a function of time at the study stations

The Figure 8 below shows that, the high mortality of *E. olivina* rate is about 29.07% on the North direction, then the other directions the rates are close to 24% in the station of Mchedallah and in the station of Boukhalfa the South direction records the highest rate with 37.35% followed by the North direction with 32.53%.

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.

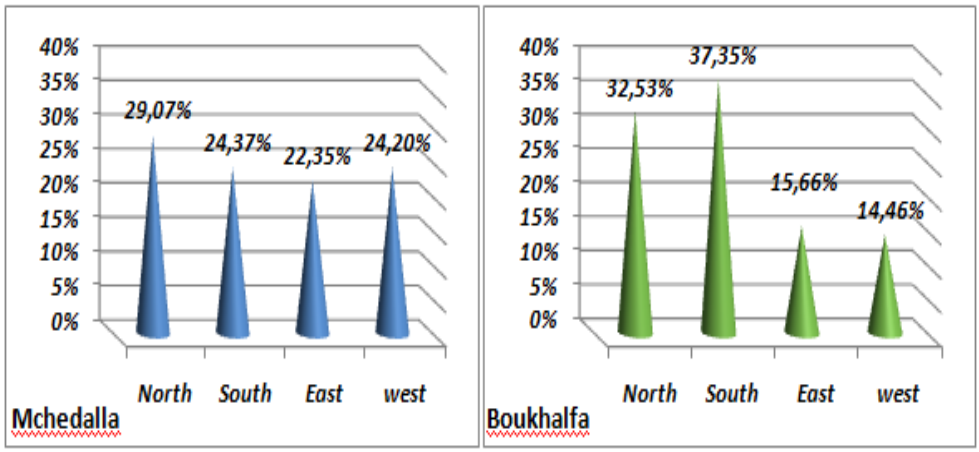

Fig. 8. Mortality of *Euphyllura olivina* as a function of tree directions at the study sites

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

CONCLUSIONS

The study conducted on the population dynamics and spatiotemporal distribution of the olive psyllid *Euphyllura olivina* Costa, on the Chemlal variety in the Kabylie Mountains in Algeria, one located in the wilaya of Bouira (Mchedallah Station) and the other in the wilaya of Tizi Ouzou (ITMAS Boukhalfa Station), during the first semester of the year 2022, allowed us to establish the following notes:

- The first numbers of the different life stages, appeared from the month of February 2022;
- The first numbers of eggs of *E. olivina*, are recorded in mid-February 2022 for the station of Mchedallah, with a low number of eggs, to reach a peak in mid-April with 256 eggs, while, for the station of Boukhalfa, the first numbers are recorded in mid-April 2022 and then progress to reach a peak of 56 eggs on May 22, 2022, and then the number of eggs regresses in both stations in June 2022;
- Larvae numbers are high for the different larval stages of the psyllid during the spring period of 2022 at both study stations;
- The numbers, are high in April for the station of Mchedallah while, the station of Boukhalfa the numbers are high in May 2022, then regress until the beginning of June 2022. This regression is due to high temperatures recorded during the month of May and June of the year of study;
- The different larval stages are present in the two study stations on the different directions, with different rates, where we recorded a

significant rate of 46.88% for the second larval stage in the northern direction in the station of Boukhalfa, and 38.46% for the first larval stage in the eastern direction in the station of Mchedallah;

- The mortality of larvae is recorded at the beginning of March 2022 for the station of Mchedallah with a significant peak of 306 individuals recorded in mid-April while, for the station of Boukhalfa, the first numbers of mortality are recorded at the beginning of April 2022, then the numbers progress to reach a significant peak of 34 individuals in mid-June 2022 then the numbers regress to disappear at the end of the same month;
- Psyllid populations infect young shoots which cause buds and twigs to wither, which are a source of production as well as weaken trees and drop leaves.

Therefore make auxiliary releases is essential to minimize insect pullulation and regulate their populations in olive groves.

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REFERENCES

1. Al Ahmed M., Al Hamidi M., 1984, Le dépérissement de l'olivier dans le Sud Syrien. Revue de la protection des végétaux, no. 2,pp. 70;
2. Alford D.V., 1994, Ravageurs des végétaux d'Ornement -Version française. Ed. INRA, pp. 464;
3. Alvarado M., 1999, Es el olivar un cultivo desequilibrado, Potenciación de otiorrinco (*Otiorrhynchus cribricollis*), gusanos blancos (*Melolontha papposa*), abichado (*Euzophera pinguis*), Cochinilla (*Saissetia oleae*) y acaros (*Aceria oleae*) en las nuevas plantaciones. In Symposium phytoma, pp. 98;
4. Arambourg Y., Chermiti B., 1986, *Euphyllura olivina* Costa (Homoptera: Psyllidae). In: Traité d'Entomologie Oléicole, Espagne: Conseil Oléicole International, (Y. Arambourg, Ed.). Conseil Oleicole International, Madrid, Spain, pp. 163-171;
5. Atwal A.S., Chaudhary J.P., Ramzan M., 1970, Studies on the development and field population of citrus psylla, *Diaphorina citri* Kuwayana (Homoptera: Psyllidae). Journal of Research Punjab Agricultural University, vol. 7, no. 3, pp. 333-338;
6. Bechiche A., 2018, Contribution à l'étude bioécologique du psylle de l'olivier *Euphyllura olivina* (Hemiptera: Psyllidae) sur deux variétés d'olivier à Magra Wilaya de M'Sila. Mémoire de fin d'étude du cycle de spécialisation en agronome, pp. 48;
7. Belhamdounia S., 1993, Contribution à l'étude bioécologique des principaux ravageurs de l'olivier dans la plaine de Tadla. Thesis 3rd cycle, Faculty of Sciences, Marrakech(Maroc), pp. 141;

8. Benassy C., 1961, Les secrétions tégumentaires chez les Coccidés. Annales de Biologie, vol. 37, pp. 165-171;
9. Bouchiaba I., Balboul Z., 2020, Etude bioécologique du psylle de l'olivier *Euphyllura olivina* (*Hemiptera* : *Psyllidae* COSTA, 1839) sur la variété Siguoise dans la région de M'Sila. Mém. Master univ-Msila, pp. 58;
10. Chemseddine M., 1988, Les arthropodes frondicoles de l'oliveraie du Haouz (Maroc): évolution spatio–temporelle des peuplements et bioécologie des espèces dominantes. Doc. Es-sc. Thesis, University of Cadi Ayyad, Morocco, pp. 169;
11. Chermiti B., 1983, Contribution à l'étude bioécologique du Psylle de l'olivier *Euphyllura olivina* Costa (Homoptera: Psyllidae) et de son endoparasite *Psyllaephagus euphyllurae* Silvestri. (Hymenoptera: Encyrtidae). PhD thesis, Université d'Aix–Marseille, France, pp. 34;
12. Chermiti B., 1989, Dynamique des populations du psylle de l'olivier *E. olivina*, en conditions méditerranéennes. Thèse Doctorat Es-Sciences, Université d'Aix-Marseille, France, pp. 224;
13. Chermiti B., Arambourg Y., 1986, Psyllidae. *Euphyllura olivina* COSTA.F.A.O.PNUD, pp. 163-171;
14. Coutin R., 2003, Les insectes de l'olivier. Insectes, vol. 19, no. 3, pp. 130;
15. Debo A., Yangui T., Dhouib A., Ksantini M., Sayadi S., 2011, Efficacy of a hydroxytyrosol– rich preparation from olive mill wastewater for control of olive psyllid, *Euphyllura olivina*, infestations. Crop Protection, vol. 30, no. 12, pp. 1529-1534;
16. Duriez J.M., 2001, Agriculture raisonnée: l'oléiculture française tournée vers la protection sanitaire raisonnée. Olivea, no. 86, pp. 16;
17. El Hadrami I., Nezha Z., 2001, La mouche de l'olive état des connaissances et perspectives de lutte. Défense des Végétaux, vol. 493, pp. 45-48;
18. Fabres G., 1979, Analyse structurelle et fonctionnelle de la biocénose d'un homoptère *Lepidosaphes beckii (*Homoptera: Diaspididae) dans deux habitats agrumicoles de la Nouvelle–Calédonie. Ed. ORSTOM, Paris;
19. Guario A., La Notte F., 1997, La mouche de l'olivier en zone méditerranéenne connaissances actuelles et stratégies de lutte. Phytoma, la défense des végétaux no. 493, pp. 11;
20. Guessab A., Elouissi M., Lazreg F., Elouissi A., 2021, Population dynamics, seasonal fluctuations and spatial distribution of the olive psyllid *Euphyllura olivina* Costa (Homoptera, Psyllidae) in Algeria, Arxius de Miscel·lània Zoològica, vol. 19, pp. 183-196;
21. Hmimina M., 2009, Les principaux ravageurs de l'olivier, la mouche, la teigne, le psylle et la cochenille noire. Bulletin Mensuel D'Infomation et Liaison du PNTTA (Programme National de Transfert de Technologie en Agriculture), vol. 183. Institut Agronomique et Veterinaire Hassan II, Rabat Morocco, pp. 4;
22. Khobzi M., 2019, Etude de la dynamique des populations du psylle d'olivier *Euphyllura olivina* dans la région de Hassi Mamèche «wilaya de Mostaganem». Mémoire Master in Agronomy, University Abdelhamid Ibn Badis, Mostaganem, Algeria, pp. 79;
23. Ksantini M., 1986, Contribution à l'étude de l'influence des températures constantes sur le développement de l'oeuf du psylle de l'olivier *Euphyllura olivina* Costa (Homoptera: Psyllidae). Vème session du réseau de la protection phytosanitaire de l'olivier. Document FAO, pp. 267-276;
24. M.A.D.R., 2017, Bulletin statistiques du Ministère de l'Agriculture et du Développement Rural Algérie, Service Statistiques, pp. 16;

25. Tajnari H., 1992, Etude bio-écologique d'*Euphyllura olivina* Costa (Hom. Psyllidae) dans les régions du Haouz et d'Essaouira: mise en évidence d'un état de diapause ovari. Meknès, Maroc. Thèse de troisième cycle, École nationale d'agriculture, pp. 153;
26. Triapitsyn S.V., Jones J.M.L., Pickett C.H., Buffington M.L., Rugman–Jones P.F., Daane K.M., 2014, Description of the male of *Psyllaephagus euphyllurae* (Masi) (Hymenoptera: Encyrtidae), a parasitoid of the olive psylla, *Euphyllura olivina* (Costa) (Hemiptera: Liviidae), with notes on its reproductive traits and hyperparasitoids. Journal of Entomological and Acarological Research, vol. 46, no. 3, pp. 112-118;
27. Vasseur A., Schvester D., 1957, Biologie et écologie du Pou de San José (*Quadraspidiotus perniciosus*) en France. Annale des Epiphyties et de Phytogénétique. INRA, Paris, vol. 8, pp. 5-161.

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