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Study of population dynamics of the white scale (*Parlatoria blanchardi* targ, 1868) in the date palm of the Biskra région

Hana Chebaani[1*], Nacer Tarai[1], Nabila Souilah[2], Billal Nia[3]

[1] Laboratory of Diversity of Ecosystems and Dynamics of Agricultural Production Systems in Arid Zones, Department of Agronomy, Faculty of Nature and Life Science, Biskra University, Algeria

[2] Laboratory for Optimizing Agricultural Production in Sub-Humid Zones, Department of Agronomy, Skikda University, Algeria

[3] Center for Scientific and Technical Research on Arid Regions (CRSTRA), Mohamed Khider University Campus, Biskra, Algeria

Abstract
The white scale *Parlatoria blanchardi* is one of the main pests of the date palm. The objective of this work is to study the population dynamics of *Parlatoria blanchardi* during one year in the variety of Deglet Nour in the region of Biskra. Monitoring over one year made it possible to know the evolution the larvae, and of the adults of the white scale.

During the study period we note the presence of 3 annual generations, spring, summer and fall. The study of the abundance of *Parlatoria blanchardi* according to orientations shows that the white scale prefers the south and west orientation of date palm, with proportions ranging from 28.42% and 27.5%. She prefers places protected from sunstroke to thrive. The abiotic factor such as temperature plays a key role in the proliferation of white scale.

Keywords: parlatoria blanchardi, dynamics, date palm, Biskra, generation

Introduction

The date palm is the backbone of the oasis ecosystem in the Saharan regions (Munier, 1973) [27]. The Algerian palm date is mainly located in the areas of the south-eastern part of the country. It covers an area of 128,800 ha with around 14,605,030 palm trees, of which 9,641,680 constitute the productive potential, ie 66%. Production is estimated at 492,217 tonnes including 244,636 tonnes (50%) of semi-soft dates (Deglet Nour), 164,453 tonnes (33%) of dry dates (Degla Beida) and 83,128 tonnes or 17% of soft dates (Ghars) (Felliachi, 2005) [19]. The Ziban region is one of the most important phoenicultural regions in Algeria. According to Biskra's phoenicultural heritage consists of 4.28 million palm trees. The total phoenicultural heritage is experiencing strong growth, rising from nearly 2 million trees in 1990 to 4.28 million palm trees in 2015, an increase of 22.8% (Benziouche, 2016) [14]. The total production of Deglet Nour during the 2018/2019 campaign is estimated at 3,070,000 qx for 2,756,137 productive palms. Belguedj (2002) [8], Sidi-Okba among the main date-producing communes mainly produces an excellent variety of Deglet Nour. The commune of Sidi Okba has more than 218,586 palm trees with a production equal to 215,500 qx (DSA, 2020) [18].

Several constraints, particularly of a phytosanitary order which affect the Algerian phoenicultural heritage thus affecting the quantity and quality of production by attacking certain pests such as the date worm (*Ectomyelois ceratoniae* Zeller), Boufaroua (*Oligonychus afrasiaticus*), *Apate monachus* and white cochineal (*Parlatoria blanchardi*) (Belhout 2012; Benameur-Saggou *et al* 2015) [9,12]. In Algeria, there is no phoenix region free from the attack of *Parlatoria blanchardi* (Idder, 1991) [21]. According to Allam (2016) [5], the Deglet Nour variety which presents a great sensitivity to the attacks of the cochineal. As a sucking stinging insect, the strong attacks of the cochineal cause the weakening of the tree by taking up the sap, reducing the surface available for photosynthesis, which hinders the process of chlorophyll assimilation by their crowding, thus causing a reduction yield and commercial quality of dates (Chiboub, 2003) [16].

The objective of this work is to study the dynamics of the white cochineal in the Biskra region for one year.

Materials and methods

Presentation of the study area experimental protocol

Our work was carried out on the private farm of Mr. B. Chebaani in the Sidi Okba Commune, located at 18 km east of the town of Biskra (northeast of the Algerian Sahara). This covers an area of 5 ha of which 2,5 ha is the area planted by the date palm with 289 palm trees of the Deglet Nour, Mich Degla, Ghars varieties and 2,5 ha for fruit growing (fig, olive, pomegranate, lemon and apricot). Our experimental work was carried out in a 1, 5 ha plot, it includes 180 palm trees of Deglet Nour varieties.

Plant biological material

We have chosen the date variety Deglet Nour (*Phoenix dactylifera* L., Arecaceae), because it is the variety most infested with white scale (*Parlatoria blanchardi* Targ.) compared to other date varieties, in view of its richness in sucrose sugar which promotes the development of *P. blanchardi*. The palm samples are homogeneous and undergo the same climatic and edaphic conditions.

Animal biological material

Our study was carried out on a hemiptera as the white

cochineal *Parlatoria blanchardi* which is one of the most formidable insect pests of the date palm.

Sampling To carry out this study we adopted the method of Vasseur and Schester in 1957 [30], which consists of periodically, and randomly taking samples using pruners from three palm trees chosen at random. Each week, using a secateurs, four leaflets from the four orientations (North, South, East, and West) are removed from the outer crown which is the most infested (Iperti, 1970) [24]. In total at each sampling, we took 12 leaflets (4 leaflets/palm tree × 3 palm trees). The present work started on 2 January 2017 and end on 23 December 2018. Each leaflet is placed in a Kraft paper bag on which is indicated the number of the palm tree (P1, P2, P3) and the orientation of the palm.

Counting

In the laboratory and under the binocular magnifying glass at x 40 magnification, we carried out a count of the dead and alive individuals of Parlatoria blanchardi on the leaflet, we choose 3 places of 1 cm^2. We count larvae, adults.

At the end of each count, the results are reported in summary tables.

Results and discussion

Evolution of white scale populations over time

At the beginning of January, the number of larvae of the white scale reaches 237 larvae which increase to 395 larvae on 26 January. The period between 19 February and 9 March shows a decline in the number of larvae, which expresses the passage of larvae to the adult state. From of July, the number of larvae of the white scale reaches different values; 546 larvae on 11 July, 570 larvae on 16 September, 343 larvae on 18 October, 283 larvae on 19 November, 201 larvae on 19 December.

Finally, the number of adults reached 389 adults as of 27 February. During the spring period, the number of adults increases with a maximum value reaching 1158 individuals / cm2 on 30 March. The period between 8 June and 11 July, the number of adults remains decreasing due to climatic conditions. From 22 July, the workforce increases to reach different values; 348 to 16 September and 221 adults to 9 December.

The results of the study of the population dynamics of the white scale during the year of experimentation (2017) show that there are three generations in the Biskra region; a spring generation, a summer generation, and a fall generation.

Number of generations

According to the results obtained in the study plot, the white scale in the Biskra region evolved in three generations divided as follows:

Spring generation: runs from March 9 to May 29.

Summer generation: runs from July 2 to September 5.

Fall generation: runs from September 5 to December 30.

The number of generations and the length of the life cycle of the white mealybug vary from one region to another and also within the same region depending on climatic conditions. Our results confirm the work obtained by Maatallah (2010) [25], Djoudi (1992) [17], Nadji (2011) [15] in the region of Biskra found three generations for one year. Idder (2011) [22] in Ouargla found 3 annual generations. According to Achoura (2013) [1] in the El kantara region, Bakry (2014) [6] and El-Said (2000) [19] in Egypt, stated that there are 4 generations. Idder-Ighili *et al*., (2015) [22], the weekly monitoring of *P. blanchardi* revealed the existence of four generations per year which partially overlap (winter, spring, summer, and fall). Also, Al-Antary *et al*., (2015) [2], have four to five overlapping generations in Jordan. Belkhiri (2018) [10] in the region of Biskra, Allam (2008) [4] in Touggourt, the white scale evolved two generations per year. During our study, climatic conditions particularly temperature affect the mortality of the white scale population.

Mortality rate of white scale

During the winter period, we note that the low mortality of the populations of the white scale. During the spring period, larval mortality is estimated at 1.69% as of 24 April, that of adults with 4.37% as of 30 March. The highest larval mortality rates were recorded during the summer with a percentage of 11.18% on 24 August and 5.06% for adults on 19 June. From 19 September, we note that a decrease in the mortality rate of the larvae which reaches 0.21% on 29 November and 1.34% on 28 October for the adults of the white scale. During the winter period, we note that the low mortality of the populations of the white scale. The mortality rate in the spring period of larvae is estimated at 1.69% on 24 April, that of adults at 4.37% on 30 March. The highest larval mortality rates were recorded during the summer with 11.18% on August 24 and 5.06% for adults on 19 June. From 19 September, we notice a decrease in larval mortality rate which reached 0.21% on 29 November and 1.34% on 28 October for adults of the white scale.

According to Djoudi (1992) [17], the summer period is characterized by high natural mortality. Bensaid (2011) [13] reported that the highest mortality rate of orange scale larvae is recorded during the summer season with 62.57%, that of adults with 36.98% is recorded in August.

Belkhiri (2010) [10] found that the highest adult mortality rate for white scale insects in June with 39.80%. On the other hand, Boussaid and Maache (2001) [15] recorded that winter and spring mortality are the most important, with 83.33% in January and 70.97% in May. According to Mehaoua (2006) [26]; Gherbi (2006) [20], females naturally die just after the expulsion of the eggs.

Effect of temperature on the numbers of *Parlatoria blanchardi*

From the result obtained in fig 3, we note that there is a positive correlation (r^2 = 0.1144) between the daily temperature and the number of the population of *Parlatoria blanchardi*, the same for b on the regression line is positive.

Distribution of white scale according to orientations

From Table 01, we note that the distribution of the white scale is varied depending on orientation. The white scale prefers to locate in the South with a rate of 28.42%, followed by the West orientation with 27.5%, then the East orientation with 24.01%, and finally the North is the least infested 20.05%.

We found that the south orientation is most populated by white scale insects. Our results confirm the work obtained by Achoura (2013) [17] found that the infestation rate of the Southern orientation is 26.21% followed by the East with a rate of 25.21%. Al - Hafidi (2006) [3] in Iraq, found that the South most infested by the white scale. Bakry *et al*., (2015) [7], showed that the numbers of the white scale are highest in the eastern direction (94.03 to 102.8 individuals/leaf).

Saighi and *al* (2015) [29] indicated that the orientations most infested by the white scale are the East with a rate of 26.02% and the North with 25.50%. Allam (2008) [4] reported that the highest white scale infestations are observed in the eastern direction with a density of 26.94 scale / cm^2.

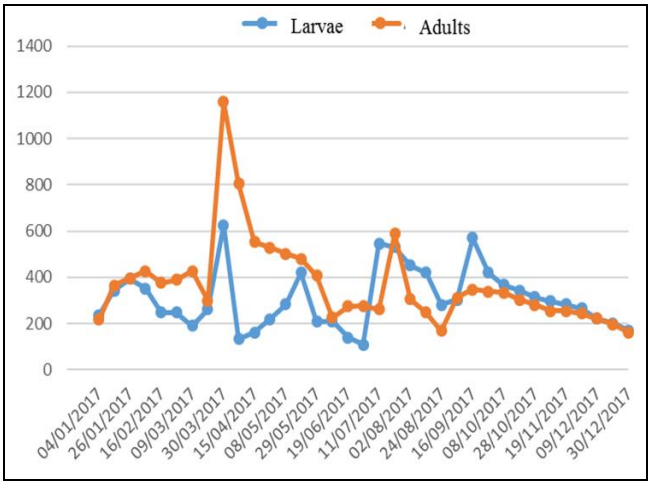

Fig 1: Evolution of the populations of the white scale during the year

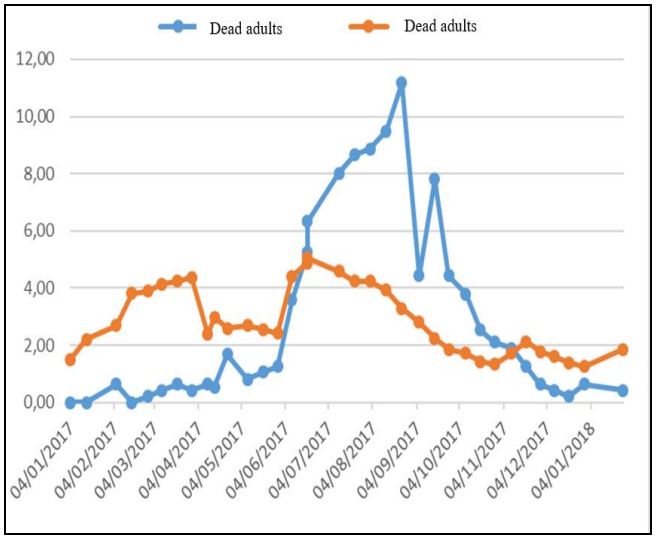

Fig 2: Mortality rate of white scale

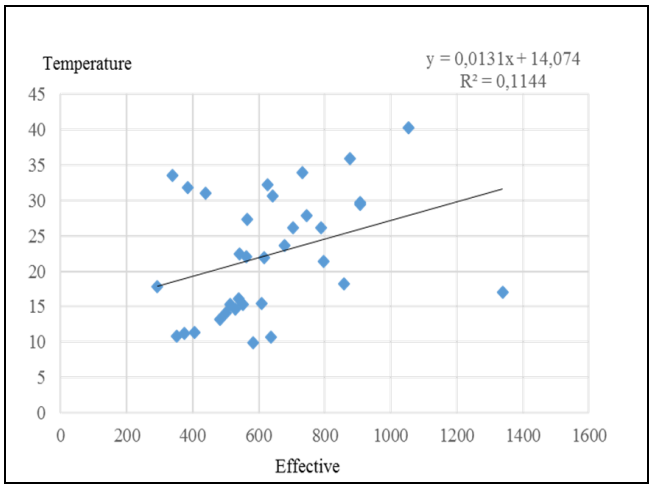

Fig 3: Correlation between the daily temperature and the population size of the white scale

Table 1: Evolution of white scale populations according to orientations

Orientation	Number of Individuals	Percentage
Nord	4999	20,05
Sud	7086	28,42
Est	5985	24,01
Ouest	6857	27,5
Total	24927	100%

Conclusion

Through the results obtained, we found that the white scale is the most feared enemy in the date palm of the Biskra region. Our work on the dynamics of *Parlatoria blanchardi*, allowed us to obtain results relating to the number of generations and their succession during a year of counting and observations and the effect of climatic conditions on the fluctuation of this pest. In the Biskra region, we were able to determine 3 generations of the white scale: a first spring generation, a second summer generation, and a third autumn generation. We have found that the Southern orientation is more infested than the other directions. So *Parlatoria blanchardi* chooses sheltered places where conditions are favourable for its development.

Finally, this study allowed us to consider future possibilities for deepening our knowledge of the dynamics of the white scale and their relationship with the environment, to limit the proliferation of this pest by a reasoned application of the method integrated pest management.

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