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POPULATION DYNAMICS OF DATE MOTH ADULTS IN DATE PALM GROVES IN SIDI OKBABISKRA; (SAHARA – ALGERIA)

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ABSTRACT

The date moth *Ectomyelois ceratoniae* (Zeller) (Lepidoptera: Pyralidae) can cause total production losses and is considered a key pest of date palm in Algeria. This research aimed to evaluate the adult dynamic of *E. ceratoniae* in date palm grove throughout one year (2016). Two high flight periods were recorded in the spring and autumn. The first adult emergence was in 6th of Feburary 2016. Also, results showed that climatic factors have a significant influence on the date moth which could only develop over a limited range of temperatures and relative humidity.

Keywords: *Ectomyelois ceratoniae*; Population dynamics; *Phoenix dactylifera*; sexual pheromone traps; climatic parameters.

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1. INTRODUCTION

The date palm, *Phoenix dactylifera* L. (Arecales: Arecaceae) is subject to damage by numerous arthropod pests [1] has established a list containing 112 species of mite and insect pests associated with date palm distributed among 10 orders and 42 different families.

The date moth (DM) *Ectomyelois ceratoniae* (Zeller), also known as carob moth, is an important pest attacking fruit trees and nut crops throughout the world [2]. Its presence in Ziban oasis was mentioned by many researchers [3, 4, 5]. It cans causes important damages that can reach 20 to 30% of the date production in the Mediterranean [6].

In Algeria, although, we're using two major parasitoids to control this pest (*Phanerotoma flavitestacea* Fisherand *Bracon hebetor* Say) [7], the study of other mechanisms which control insect populations is crucial [8].

Indeed, the basic climate parameters like temperature and humidity influence insects in many ways like the activity of larvae and adults and insects dispersal in the environment [9].

The objective of this research was to identify the first adult emergence, adult population dynamics, the periods of outbreak pic and its duration depending on four climatic factors (minimum, maximum and average temperatures and relative humidity) to support the establishment of control strategies against this pest in order to reduce consequently damages on fruits by choosing adequate moments to intervene.

2. MATERIAL AND METHODS

2.1. Site of study

The present study was carried during 2016 from January to December, in an organic palm grove situated in Sidi Okba in Biskra (34°72' 59. 82" N, 5°91'56.42" E and 72 meters above sea level) belonging to a Saharan climatic stage. The date palm grove occupied approximately 2 hectares with palms aged between 15-20 years and spaced from one another by by 6 m and 12 m between rows totalling around 120 palms per hectare. The survey was conducted every week corresponding to 52 captures of date moth to assess population fluctuation of this pest.

2.2. Populationdynamicof date moth

The sexual pheromone traps were used to detect the adult population change of date moth.Two traps was placed, hanged at man height of the palm trees, and controlled weekly. In each control oncethe number of captured moths was recorded. The pheromone capsules of traps were changed every 4-5 weeks

2.3. Climatic parameters data

The climatic parameters considered in this study were recorded in Sidi Okba by thermo-hygro recorder placed inside the grove hanged on date palm. The raw climate data represented daily observations of minimum, maximum and average temperatures (°C) and relative humidity (%). These climatic parameters were calculated based on the daily data of 12 months.

2.4. Statistical analysis

The effects of climate parameters on the flight activity of DM were analyzed by Poisson regression, using a generalized linear model (GzLM) between the DM numbers weekly captures oand the values of four climatic parameters corresponding. Computations and statistical modelling were conducted using SPSS Statistics software 20.

3. RESULTS

The results of pheromone traps weekly captures during 2016showed that date moth was always present throughout the year except in January and August. In fact, adults were caught for the first time in 6th of Feburary. The total number of captures during this month was 6 (Figure 1). Average temperature during this month was 15.63 °C while relative humidity was 47.01% (Figure 2). This number kept increasing during March and April with 14 and 33 adults captured respectively. In the spring, temperatures and relative humidity are optimal for the development of the date moth.

Captured adults number felt sharply from May until August reaching 0 with a constant increase in average temperature and a decrease in relative humidity. The maximum temperature recorded, in summer, exceeds 37.70 °C with a relative humidity less than 35 % which explains the very low number of adults caught.

The highest number of adult captured was in September (39). In October, we captured 31

adults, 11 in November and finally 3 in December. Besides, results showed the presence of two high flight periods: the first was in spring and the second during autumn (Figure 1).

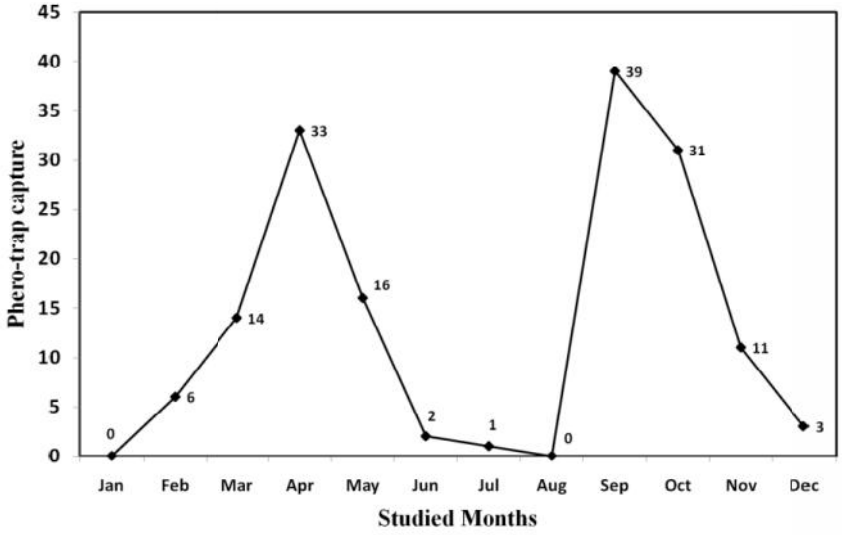

Fig.1. Population dynamics of *Ectomyelois ceratoniae* date palm groveat Sidi Okba region (Biskra, Algeria) during the study period (2016)

During 2016, minimum temperature varied between 3.7 and 27.9°C while the maximum temperature fluctuated from 15.2 to 40.9 °C, with average temperature fixed between 10.95and 34.4°C whereas Humidity in the palm grove varied between 28.2 and 83.85% during the year of study.

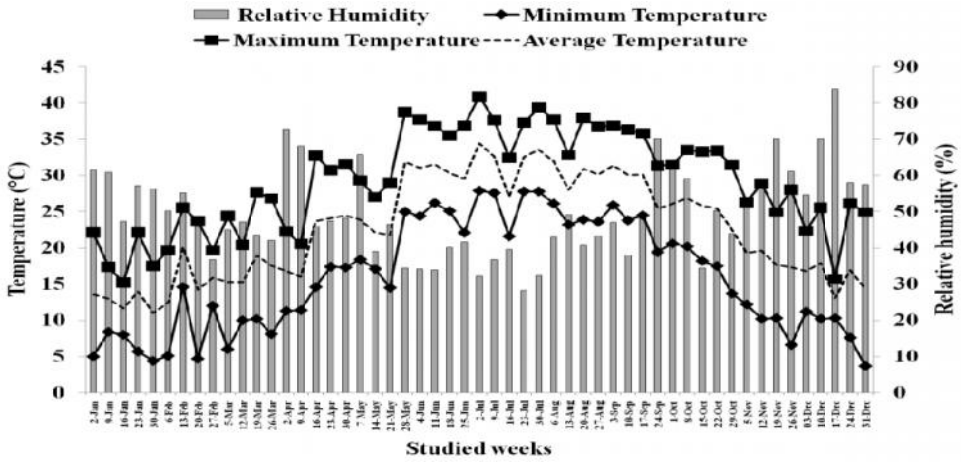

Fig.2. Weekly variation of minimum, maximum and average temperatures, and relative humidity at Sidi Okba region (Biskra, Algeria) during the study period (2016)

Statistical analysis of the results showed thatmaximum temperature, average temperature and relative humidity affected carob moth dynamic with a significant value. In fact, the **Omnibus Test** table shows via a likelihood ratio test that all the independent variables collectively improve the model over the intercept-only model (**P** = 0.000) (Table 1).

Table 1. Omnibus Test of independent variables (minimum, maximum and average temperatures (°C) and relative humidity (%))

Likelihood Ratio Chi-Square	***df***	***P***
38,726	3	0.00

In fact, a GzLM was run to predict carob moth dynamic from temperatures and relative humidity. The results showed that climatic factors having a significant influence on the capture of DM ($p < 0.00$) while the minimum temperature had not any significant effect on this studied parameter ($p > 0.5$) (Table 2).

Table 2. Parameter estimates evaluating the effect of independent variables (minimum, maximum and average temperatures (°C) and relative humidity (%)) on DM captures.

Source	***df***	***Wald χ2***	***P***
Intercept	1	15.852	0.00
Minimum Temperature	1	0.382	0.537
Maximum Temperature	1	8.73	0.003
Average Temperature	1	8.73	0.003
Relative Humidity	1	37.118	0.00

4. DISCUSSION

[10] indicated that adults of date moth showed a permanent flight throughout the year with two important frequencies corresponding to two generations: the first one is spring generation and the second is autumnal generation which corroborate with our findings. *E. Ceratoniae* is active in Jordan valley from first April to May whereas studies conducted in Iran and Turkey mentioned that the first adults of *E. ceratoniae* existed in May [11, 12].Similarly, [13]

reported that the first generation beginsFrom March until May, it is derived from the larvae of dates stored in the palm grove. According to [14], temperature and humidity affect the insect biological activities by influencing on reproduction and development. During some parts of the year the insect is more abundant due to the favourable conditions of temperature and humidity for reproduction**.** Temperature is particularly important as a factor that limits insect's activity. Average temperature changes are interrelated with changes within insect phenology [9]. In the spring, temperatures and relative humidity are optimal for the development of the date moth. According to [3] and [15], the emergence of the first generation of adults takes place when the average temperature exceeds 15 °C often between the last days of March and April 15th while [4] has fixed the optimum temperature for the emergence of the adult moth beyond 24 °C.An increasein temperatures to the thermal optimalthreshold causes acceleration of the insect metabolism. Hence, it directly influences its activity increase [9].

The average temperature and relative humidity during September and October appear favourable for population growth of *E. ceratoniae*. While low temperatures during November and December seem to play an important role in the reducing of moth number. Indeed, the development cycle takes 54 days at a temperature of 27 ± 1 °C under controlled conditions [16] while [17] situated the development cycle of the date moth at 70% relative humidity averaged 48 days at 20 °C, 30 days at 25 °C and 23 days at 30 °C.During the summer, high temperatures and low humidity seem to have a negative impact on the abundance of the *E. ceratoniae* population, resulting in a significant decrease in the number of individual captured. Indeed, high temperatures can exacerbate sensitivity to low humidity by increasing rates of water loss during gas exchange. Mortality and weight loss increased as humidity levels decreased [18]. [15] argued that date moth does not survive above 35 °C. In our palm grove, the maximum temperature recorded, in summer, exceeds 37.70 °C with a relative humidity less than 35 % which explains the very low number of adult caught.The average temperature and relative humidity during September and October appearfavourable for population growth of *E. ceratoniae*. While low temperatures during November and December seem to play an important role in the reducing of moth number. According to [4], the larvae remain active but their development is very slow during this period. In fact, [17] concluded that diapause in

fully grown larvae of *Ectomyelois ceratoniae* was induced by low temperature and also short photoperiods[3] also mentioned that a few individuals complete their transformation into animago in storage places and have the chance to return to palm grove which explains the sporadic captures during unfavourable conditions. Temperature and relative humidity appear to be the main factor responsible of *E. ceratoniae* fluctuations. Thus, date moth can only develop over a limited range of temperatures and relative humidity. Precisely, the development of third generation coincides with the maturity stage of the fruit which causes important damages and yield losses.

5. CONCLUSION

Climatic factors (temperature and humidity) directly affect population dynamics of the date moth. The close relationship between climatic conditions and population dynamics seems to be the major factor influencing the activity of this pest in the palm grove. According to these results, it is recommended to establish a program of monitoring and prevention to protect the date production from the damages caused by this dreadful enemy.

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6. REFERENCES

[1] El-Shafie HAF. 2012. Review : List of arthropod pests and their natural enemies identified worldwide on date palm, *Phoenix dactylifera* L. Agriculture and Biology Journal of North America, 3(12); 516–24.

[2] Norouzi A, Talebi A, Fathipour Y. 2008. Development and Demographic Parameters of the Carob Moth *Apomyelois ceratoniae* on Four Diet Regimes. Bulletin of Insectology, 61(2); 291–97.

[3] Wertheimer M. 1958. Un des principaux parasites du palmier dattier algérien : le myelois

décolore. Fruits, 13(8) ; 109–23.

[4] Doumandji S. 1981. Biologie et écologie de la pyrale des caroubes en l'Algérie *Ectomyelois ceratonia*Zeller (Lepidoptera, Pyralidae). Pierre et Marie Curie. Paris VI (In French).

[5] Deghiche-Diab N, Deghiche L, Belhamra M. 2015. Inventory of arthropods in an agro-ecosystem Ziban oasis, Ain Ben Noui, Biskra, Algeria. Journal of Entomology and Zoology Studies, 3(34); 229–234.

[6] Abdelmoutaleb M. 2008. La campagne intensive de vulgarisation (civ) pour la lutte contre le ver ou myelois la pyrale des dattes dans les wilayas de Biskra et d'El Oued. Agriculture & développement, communication Vulgarisation ; 7–10.

[7] Bensalah MK, Ouakid ML. 2015. Test for biological control of the moth dates Apomyelois ceratoniae Zeller, 1839 (Lepidoptera: Pyralidae) by the use of Phanerotoma flavitestacea Fisher (Hymenoptera: Braconidae) And Braconhebetor Say (Hymenoptera: Braconidae) in controlled conditions. Courrier du Savoir, ,20; 1–6 (In French).

[8] Alyokhin A, Drummond AF, Sewell G, Storch RH. 2011. Differential effects of weather and natural enemies on coexisting aphid populations. Environmental Entomology, 40 (3); 570–80.

[9] Jaworski T, Hilszczański J. 2013. The Effect of Temperature and Humidity Changes on Insects Development and Their Impact on Forest Ecosystems in the Context of Expected Climate Change. Forest Research Papers, 74 (4); 345–55.

[10] Mehaoua MS, Hadjeb A, Belhamra M, Ouakid ML. 2015. Influence of Temperature on Seasonal Abundance of *Ectomyelois ceratoniae*Zeller, 1839 (Lepidoptera, Pyralidae) in Tolga Palm Grove. Courrier du savoir, 20; 167–73.

[11] Kashkuli A, Eghtedar E. 1976. Biology and Ecology of *Spectrobates ceratoniae* (Zell.) (Lep.: Pyralidae) in the Province of Fars. Entomologie et Phytopathologie Appliquées, 41; 21–32.

[12] Mart C, Kılınçer N.1993. Güneydoğu Anadolu Bölgesi Narlarında Zararlı Harnup Güvesi, *Ectomyelois ceratoniae* (Zell.) (Lep.: Pyralidae)'nin Popülasyon Değişimi ve Döl Sayısı.Türk Entomoloji Dergisi, 17(4) ; 209–16 (In Turkish).

[13] Khireddine R, Fekieh A. 2011. Etude du niveau d'infestation et influence de la température sur lafluctuation du vol d'*Ectomyelois ceratoniae* Zeller, 1839 (Lepidoptera, Pyralidae) dans la palmeraie de Tolga. Mohamed Khider, Biskra (In French).

[14] Al-Digail Saleh A, Assagaf AI, Mahyoub JA. 2017. Effect of temperature and humidity on the population abundance of spotted oriental cucumber beetle*Epilachna chrysomelina* (F .) (Coccinellidae : Coleoptera) In Al-Qunfudah Western Saudi Arabia.Current World Environment, (1); 7–12.

[15] Le Berre M. 1978. Mise au point sur le problème du ver de la datte, *Myelois ceratoniae* Zell. Bull. Agr. Sahar, 1(4) ; 1–35 (In French).

[16] Naidji T, Kebici H. 2009. Etude de quelques aspects bioécologique de la pyrale des dattes*Ectomyelois ceratoniae* Zeller., 1839 (Lepidoptera, Pyralidae) et essai de lutte biologique par le spinosad dans les conditions contrôlées. Mohamed Khider, Biskra (In French).

[17] Cox PD. 1979. The influence of photoperiod on the life cycle of *Ectomyelois ceratoniae* (Zeller) Lepidoptera : Pyralidae).J. stored Prod. Res, 15; 111–15.

[18] Johnson JA. 2010. Effect of Relative Humidity and Product Moisture on Response of Diapausing and Nondiapausing Indianmeal Moth (Lepidoptera: Pyralidae) Larvae to Low Pressure Treatments. Journal of Economic Entomology, 103(3); 612–18.

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