Algerian Journal of Biosciences
ISSN: 2716-9375
Journal homepage: http://www.ajbjournal.periodikos.com.br

Original Article

Relationship between biochemical properties of some date varieties and nutritional requirements of *Ectomyelois ceratoniae* Zeller (1839)

KRID Keltoum [a]* and DJELLABI Nesrine[b]

[a] *Department of Agronomy, University Kasdi Merbah, Ouargla, Algeria*
[b] *higher normal school of Ouargla, Algeria*

ARTICLE INFOR

Article history:
Received 09 April 2022
Revised 15 Jun 2022
Accepted 25 Jun 2022

Keywords:
date moth;
date varieties;
infestation;
qualitative characteristics.

ABSTRACT

Ectomyelois ceratoniae Z is one of the most dangerous insects in the world and Algerian phoeniciculture. The survival of this insect is based on the search for the appropriate dates varieties to its nutritional needs. In this paper, an experimental study was performed to determine these nutritional needs. In this study, three susceptible varieties to the moth attack were chosen, the healthy and infested dates were separated to calculate on the one hand the attack rate and to carry out the qualitative analyzes. The results showed that the moth selects the appropriate dates to lay its eggs and feed the larvae based on the consistency of the dates and their high sucrose content. The content of the sucrose is reduced in attacked dates, resulting from their consumption after the enzymatic degradation by Invertase for the synthesis of simpler sugars (fructose and glucose) to be easily used by the larvae. The more the medium is very acidic (infested dates), the more the degradation of sucrose is important. The total sugar is also necessary to produce sufficient energy for the biological activities of the moth (growth).The use of these organic elements by the larvae leads to a reduction in the weight of the date and increases its fragility.

Faculty of Natural Sciences and Life, University of El Oued.

1. Introduction

The quality and quantity of food offered by the host plant are among the major factors that control the population dynamics of phytophagous insects [1]. Thus, nutrition provides the insect with the chemical compounds necessary for its growth, development, reproduction, defense, movements and survival [2]. The host plant, as a food source, plays a determining role in population dynamics with its nutritive components and its allelochemical components [3].

Dates do not become attacked by *Ectomyelois ceratoniae* until they begin to ripen [4, 5]. The larvae of this moth penetrate dates by crawling under the calyx and depreciate the quality and marketing [6].

Cultivar factor plays an important role in the ecology of the date moth and the attacks level [7]

[8] defined the food preferences of the date moth *Ectomyelois ceratoniae* feeding and laying eggs on soft to semi-soft dates (not in relation to their water content but rather in relation to their total sugar / water ratio), slightly acid to neutral with a high sucrose content, in order to ensure the best nutritional conditions for his descendants. The aim of our study is to determine the nutritional requirements of dates, based on the comparison of biochemical and biometric analyzes of invasive and healthy dates. The results we will achieve will allow us to know the nutritional needs of date moth.

2. Material and Methods

2.1. Sample preparation

Three dates varieties were chosen for this study (Deglet Nour, Ghars and Degela Beida), the dates were harvested from the El'Oued region palm groves (south-eastern Algeria).The dates of each variety are harvested randomly from existing date palms. The total number of dates is 120

* *Corresponding author :*…… Tel.: 00000000000000
E-mail address: krid.keltoum@univ-ouargla.dz
Peer review under responsibility of University of El Oued
DOI: https://doi.org/10.57056/ajb.v3i1.53

dates per variety. After that, each variety were puted in kraft paper bags which contain the information of the area, sampling date and the variety.

In the laboratory, the dates were cut in half using a tool to examine their state either healthy or infested according to the existence of an indication of presence of the moth (larva, excrement, silky fibers…etc.), then separate the dates of each variety into two groups: healthy and infested (six groups in total).

Infested dates undergo cleaning using towels and thin brushes to eliminate larvae, eggs, excrement and dust…etc.

2.2. Applied qualitative analysis

The same analysis was manipulated on the healthy and infested dates.

Biometric analysis

The total weight (TW) of the date and its pulp (PW) is measured using an electric balance. The date consistency (Con) is determined as the ratio of the Total sugars / water content. Dates are classified according to the index r in to soft dates (r <2), semi soft (2<r <3.5) or dry (r> 3.5) [7].

Water content (WC %)

The water content in the fruit pulp has been determined as the difference between the weight of fresh fruit (M1) and the weight of dried fruit (M2) after drying at a temperature of 103 ± 2 ° C, until getting a constant weight, using the following formula [8]:

$$wc\% = \frac{M1 - M2}{M2} * 100$$

Date acidity (pH).

The pH is measured in an aqueous solution of crushed date pulp. Once the pH meter has been calibrated, the pH value is noted [9].

Dates Electrical Conductivity (EC)

We use the same aqueous solution to measure the pH, but using a conductimeter.

Ash content

The samples (pulp) burned at 600 ° C in a muffle furnace for five hours until obtaining whitish or gray ashes of constant weight [10].

Sugar content

Total sugars (TS) and reducing sugars (RS) of dates were determined with the Bertrand method. The sucrose (Suc) content is obtained by the difference between the total sugar content and the reducing sugars present in the sample. The value is determined by the following formula:

$$sucrose\% = (TS\% - RS\%) * 0{,}95$$

2.3. Statistical analysis

With SPSS software (IPM 22), infestation rate data was analyzed by single factor ANOVAs. Concerning to the qualitative analysis data, the comparison between the rate of infested and healthy dates (Independent factor) compared to the studied parameters (TW, PW, Con, pH, EC, ash, WC, TS, RS, and Suc) (Independent variable).

.

3. Results and Discussion

3.1. Influence on biometric charateristics

Total weight and pulp weight vary overall from one variety to another and depending on the date phytosanitary status. However, infested fruits by the moth present a total weight and pulp weight lower than healthy fruits. The ANOVAs show a non-significant difference for the TW and the PW parameters of all varieties (p> 0.100) (Tab. 1). The reduction in weight justifies by the date compounds consumption by *Ectomyelois ceratoniae.* According to [11;12], this pest reduces the production quantity and destroys quality. [13] noticed in his experimental study that the moth larvae consume the samples (dates) to feed directly after hatching. The host plant then considered as the source of nutrients for its habitats (carbohydrates, amino acids, proteins, water…) [14].

Infested dates are less consistent than healthy dates whatever the variety. They classified according to r index as semi-soft dates, then healthy dates considered to be semi-dry which is due to the effect of the date moth after using the sugars. Its quantity will be decreased compared to the water content (the more the sugar content is decreased compared to water content the more the dates become soft). Statistically, ANOVA's reveal highly significant results (p<0.000) (Tab.1).

3.2. Influence on bichimical charateristics

Infested dates are more acidic than healthy dates in all varieties, with a pH <5.4 which can be considered as a bad character according to agriculture ministerial standards. ANOVAs of pH show highly significant results (p<0.000) (Tab.1). After the attack of *E. ceratoniae* on dates, holes will appear on the fruit (surrounded by blackish secretions), and in the

Tab.1. Descriptive results (means of 3 repetitions) of the qualitative analysis, accompanied with ANOVAs .

var	TW	PW	Con	pH	EC	Ash%	WC%	TS%	RS%	Suc
DN	9,45±0,24	8,597±0,06	3,64±0,00	5,80±0,02	2,363±0,01	1,68±0,04	17,96±0,03	65,45±0,00	33,24±0,00	30,59±0,00
DN'	8,41±0,51	7,72±0,46	2,72±0,00	5,56±0,00	2,44±0,01	1,39±0,02	17,68±0,02	48,12±0,00	38,62±0,00	9,025±0,00
G	5,67±0,37	4,86±0,4	3,63±0,00	5,79±0,01	1,9±0,01	2,48±0,17	20,21±0,16	73,56±0,00	66± 0,00	7,182±0,00
G'	5,76±0,3	5,04±0,27	3,49±0,00	5,33±0,01	2,11±0,01	2,1±0,04	20,08±0,08	70,24±0,00	70,16±0,00	0,076±0,00
DB	6,15±0,59	5,14±0,53	3,58±0,004	5,18±0,005	2,82±0,05	2,27±0,04	16,39±0,17	58,61±0,005	45,24±0,02	12,7±0,014
DB'	6,86±1,43	5,96±1,26	3,31±0,008	4,98±0,00	3,18±0,02	1,9±0,06	16,06±0,02	53,26±0,005	46,91±0,01	6,051±0,02
***P* valure**	,136 DN	,136 DN	,000 DN*	,000 DN*	,006 DN*	,002 DN*	,002 DN*	,000 DN*	,000 DN*	,000 DN*
	,673 DB	,579 DB	,000 DB*	,000 DB*	,004 DB*	,008 DB*	,127 DB	,000 DB*	,000 DB *	,000 DB*
	,862 G	,735 G	,000 G*	,000 G*	,000 G*	,102 G	,509 G	,000 G*	,000 G*	,000 G*

* The average difference is significant at the 0.05 level.

existing of the larvae excrement, the holes prefer the penetration of mold. Consequently, acidity in dates will increase. One of the main obstacles is the pH that the microbial flora must cross to ensure its proliferation [15;16]. A pH of the order of 3 to 6 is very favorable for the development of yeasts and molds. According to Backet (1982), alcoholic fermentation in dates is strongly linked to the degree of acidity.

All the varieties reveal a high electrical conductivity in infested dates compared to healthy ones but does not exceed 3.18 ms / cm (Fig. 1). Statically, the difference is highly significant between the rates (p<0.010) (Tab.1). Probably this increase resulted either from the salivary secretions of the larvae rich in Salts (Arif, 2011), or the moth is attracted by the dates mineral richness especially the Deglet Nour variety [5]. [17] reported that the *E.ceratoniae* prefers dates with high electrical conductivity.

The ashes are high in healthy dates more than infested one for all varieties, they generally do not exceed 2.49% (Fig. 1). ANOVAs show highly significant results in Deglet Nour and Ghars dates with p = 0.000 and 0.008 successively and not significant for the variety Degela Beida (Tab. 1). Reduction of ashes in attacked dates is justified by the consumption of the larvae with the fruit mineral elements, because ash is the rest of the mineral compounds after the incineration of plant or animal organic matter [18].

Water content is not much influenced by the infestation, its content is slightly reduced in infested dates compared to the healthy ones for each variety, it's about a difference of 0.30% maximum (Fig. 1). The rate comparison reveals highly significant results only in Deglet Nour dates (p<0.002), it is the variety most infested by the moth, so the use of water will be a lot (Tab. 1). The infestation rate is not necessarily related to the date water content, but this element is necessary for the moth survival[6;12].

The results show that the infested dates in all varieties have lower total sugar and sucrose content than the healthy dates but rich in reducing sugars. The difference between the rates is highly significant (p = 0.000) for all the measured parameters (TS, RS and Scch) (Tab.1) which can be justified by the remarkable modification in sugars quantity either by consumption or synthesis. The dispersion of these parameters according to dates phytosanitary state is highly significant in all varieties (Fig.1). Reduction in total sugar levels in infested dates is caused by feeding larvae on date carbohydrates, to produce sufficient energy for its biological functions [19] on the other hand, sucrose is transformed into reducing sugars (glucose and fructose) by enzymatic degradation [20]

Strong enzymatic activity results from the increase in area acidity [21], following the indirect attack effect of the date moth and its role in increasing the infested dates acidity. *Ectomyelois ceratoniae* prefers to lay eggs on dates rich in sucrose to ensure the right conditions for future generations [6; 17].

.

4. Conclusion

In conclusion, the nutritional requirements of *E. ceratoniae* depend primarily on the choice of appropriate varieties. ANOVAs and the dispersion graph applied to the data according to the dates varieties phytosanitary state

show a highly significant difference, especially for sugars (totals, reducing sugars and sucrose) as a energic consumable item. Date acidity increased after infestation which accelerates the enzymatic degradations of the organic compounds necessary for the moth. The changes in studied parameters values are more distinguished in the variety Deglet Nour as preferable host of the moth.

Conflict of Interest

No potential conflict of interest was reported by the author(s)

References

1. Klingauf F.A., (1987). Feeding, adaptation and excretion. In *Aphids*: Their Biology, Natural Enemies and Control, Ed. A. K. Minks and P. Harrewijn, Elsevier, Amsterdam, The Netherlands .Vol (A) , pp: 225–253..
2. Slansky F. Jr., and Rodriguez J.G., (1987). Nutritional ecology of insects, mites, spiders, and related invertebrates: an overview, pp: 1-69.
3. Ohgushi T., (1992). Resource limitation on insect herbivore populations. In: Effects of resource distribution on animal- plant interactions. Edited by Hunter M. D., Ohgushi & P.W. Price. Academic Press Inc: 199-24.
4. Lepigre A., (1963). Essais de lutte sur l'arbre contre la pyrale des dattes (*Myelois ceratoniae* Zeller – (Pyralidae) Annal. Epiphyties. 14.(2), pp : 85-105.
5. Wertheimer M., (1958). Un des principaux parasites du palmier dattier algérien : le Myelois décolore. Fruits. 13 (8), pp : 109-123.
6. Jouve P., Loussert R., Mouradi H., (2006). La lutte contre la dégradation des palmeraies dans les oasis de la région de Tata (Maroc). Colloque international. Les Oasis : Services et bien- être humain face à la désertification. ERRACHIDIA – MAROC. 6 p.
7. Vilardebo A., (1975). Enquête-diagnostic sur les problèmes phytosanitaires entomologiques dans les palmeraies de dattiers du Sud-Est algérien. Bull. Agr. Sahar :1 (3) : 1-27
8. Idder-Ighili H., (2008). Interactions entre la pyrale des dattes *EctomyeloisCeratoniae* Zeller (lepidoptera-Pyralidae) et quelques cultivars de dattes dans les palmeraies de Ouargla (Sud-Est algérian), Mémoire de magstère. Universté de Kasdi Merbah Ouargla, pp : 42 ;58 ;85 ;87 ; 89.
9. Munier P., (1973). Le Palmier-dattier-Techniques agricoles et productions tropicales. Maison Neuve et Larose, Paris, 217 p.
10. Audigie D., Dupont G., Zonszain T., (1978). Manipulation d'analyse biochimique. Ed Doin Paris, 274 p.
11. Association Française de la Normalisation (ANFOR), (1970). Produits agricoles alimentaires. Directives générales pour le dosage de l'azote avec minéralisation selon la méthode de Kjeldahl.
12. Barkhatov V., Elisseev V., (1979). Guide des travaux pratiques du contrôle technico-chimique de la production des conserves. INIL, Boumerdes: pp : 23-41.
13. Arif Y., Lombarkia N.,(2015). Morphological characteristics of the sensilla ovipositor, tarsus and antenna in dates moth female, *Ectomyeloisceratoniae* (Lepidoptera: Pyralidae). *Acad.J.Entomol*. 8(2),pp : 34-37.
14. Bezziou S., Kadi N.H., (2016). Etat d'infestation de quelques cultivars de datte par *Ectomyelois ceratoniae* (Zeller) dans la région Touggourt. Mémoire de master, Université Kasdi Merbah Ouarglap, pp : 38- 45.
15. Hadjeb A., (2017). Etude boiécologique et répartition spatio – temporelle de la pyrale des dattes *Ectomyelois ceratoniae* Zeller ,1939 (Lepidoptera ,Pyralidea) dans des oasis de la Wilaya de Biskra étude du comportement alimentaire et assai de lutte ,Mémoire de doctorat , Université Mohamed Kheider Biskra, 25 p.
16. Ohgushi , (1992). Resource limitation on insect herbivore population.
17. Djoudi I., (2013). Contribution à l'indentification et à la caractérisation de quelques accessions du palmier dattier (*PhoenixDactylifera* L) dans la région de Biskra, Mémoire de magister , Université

Mohamed Kheider Biskra , pp : 6 ;8 ;14 ;15 ; 20 ; 34 ; 53.
18. Bocquet J., (1982). Généralités sur les microorganismes, Ed Tec et Doc Lavoisier, Paris, pp : 11-46

19. Krid K.., (2018). Efficience de l'ensachage des régimes et toilettage du palmier dattier *Phoenixdactylefira* Linné 1953 sur *Ectomyeloisceratoniae* Zeller (Lepidoptera : Pyralidae). Impact sur la qualité des dattes (Cultivar Deglet Nour), Mémoire de doctorat , Universté de Kasdi Merbah Ouargla, pp : 2 ; 10 ; 65 ; 94.

20. Salghi R., (2015). Analyses Physicochimiques I Analyses des denrées alimentaires I. ENSA Agadir. http://dhaouadiramzi.e-monsite.com/medias/files/analysephysico-chimie.pdf

21. Lamamra R., Zidane A., (2017). Influence des substances Allelo-chimiques sur le comportement de ponte de la pyrale des dattes *Ectomyeloisceratoniae* Zeller,1938 dans la région d'El-Oued, Mémoire de master académique. Université Echahid Hamma Lakhdar El-Oued, pp: 29- 51.
22. Hasegawa S., Smolensky D.C., (1970). Date invertase properties and activity associated with maturation and quality. J.Agricfood.chem, 18 (15), pp : 902-90.
23. Malou R., (2018). Contribution à la mise en évidence des modulateurs de l'activité enzymatique de la Béta Fructosidase, Mémoire de master. Université Abou Bekr Belkaid Tlemcen, 33 p.

.

Recommended Citation

Krid K. and Djellabi N. Relationship between biochemical properties of some date varieties and nutritional requirements of *Ectomyelois ceratoniae* Zeller (1839). *Alger. j. biosciences*.2022, 03(01):033-037.