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in

Kodad O. (ed.), López-Francos A. (ed.), Rovira M. (ed.), Socias i Company R. (ed.).
XVI GREMPA Meeting on Almonds and Pistachios

Zaragoza : CIHEAM

Options Méditerranéennes : Série A. Séminaires Méditerranéens; n. 119

2016

pages 237-240

Article available on line / Article disponible en ligne à l'adresse :

<http://om.ciheam.org/article.php?IDPDF=00007399>

To cite this article / Pour citer cet article

Chebouti-Meziou N., Chebouti Y., Merabet A., Behidj N., Doumandji S. **Effect of *Chaetoptelius vestitus* on the chemical composition of pistachio seed (*Pistacia vera*) harvested in Bechloul (Algeria)**. In : Kodad O. (ed.), López-Francos A. (ed.), Rovira M. (ed.), Socias i Company R. (ed.). XVI GREMPA Meeting on Almonds and Pistachios. Zaragoza : CIHEAM, 2016. p. 237-240 (Options Méditerranéennes : Série A. Séminaires Méditerranéens; n. 119)



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Effect of *Chaetoptelius vestitus* on the chemical composition of pistachio seed (*Pistacia vera*) harvested Bechloul (Algeria)

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Abstract. It is noteworthy that in the fruit pistachio orchard Bechloul two types of pistachio fruits are available namely the following healthy tree seed and the second type comes from tree attacked by wood-boring. For this purpose, a comparative study that will focus on the nutritional value of each type of seed on the water content, dry matter content, the determination of crude protein, the rate of crude fat, and the determination of sugars. The total analysis results pistachio seeds infested *Chaetoptelius vestitus* not reveal solids content with an average of $3.60 \pm 0.45\%$. Regarding the dry matter content of seeds from trees infested by xylophagous, it is $3.85 \pm 0.12\%$. There was no significant difference between the dry matter after pistachio control seeds and trees infested with wood-boring because the probability Pr 0.05 is greater than 0.228 ($Pr > 0.05$) for a 95% confidence interval. The water rate control seeds is $7.21 \pm 0.36\%$. For pistachio seeds taken from trees infested the percentage of water reached $7.63 \pm 0.8\%$. The analysis of variance on the water content contained in the control trees and pistachio seeds infested by xylophagous shows that there is no significant difference, the probability (Pr) is 0.57, greater than 0.05 ($Pr > 0.05$) for a confidence interval equal to 95% .. in this study the average fat content of $47.1 \pm 1.21\%$ for controls pistachio seeds. It is $45.4 \pm 2.09\%$ for the seeds of pistachio trees from infested. In this study the analysis of variance of the fat content of the seeds from witnesses pistachio fruit trees and those infested Scolytidae, shows that there is a significant difference because the probability is 0.04 or less than 0.05 ($Pr < 0.05$) for a 95% confidence interval. As for the average rate of sugars, it is $3.9 \pm 0.49\%$ for the fruit pistachio seed witness. The sugar rate is $5.4 \pm 0.88\%$ in fruit pistachio seeds harvested from infested trees. The analysis of variance of total sugars between the seeds of the fruit pistachio witness and those of infested trees bud borer shows that there is no significant difference since the probability is therefore 0.50 greater than 0.05 ($Pr > 0.05$) (95% confidence interval). Proteins rate reached $39.5 \pm 2.88\%$ in the control seeds. One of infested seeds is $21.1 \pm 6.48\%$. Analysis of variance between proteins pistachios seeds harvested from control trees and those from trees infested seeds shows that there is a significant difference considering the fact that the probability 0.007 is less than 0.05 ($Pr < 0.05$) for a 95% confidence interval. The total nitrogenous matter is $6.2 \pm 0.99\%$ in the control pistachio seed. The percentage of total nitrogen matter, it is $4.8 \pm 0.21\%$ in seeds from trees infested *Chaetoptelius vestitus*.

Keywords. *Chaetoptelius vestitus* – Chemical composition – *Pistacia vera* – Algeria.

Effet de *Chaetoptelius vestitus* sur la composition chimique des graines de pistache (*Pistacia vera*) récolté à Bechloul (Algérie)

Résumé. Il est à noter que dans le verger de pistachier fruitier à Bechloul deux types de graines de pistaches à savoir la graine saine issue d'arbre sain et le second type vient de l'arbre attaqué par le xylophage. A cet effet, une étude comparative qui mettra l'accent sur la valeur nutritionnelle de chaque type de semence sur la teneur en eau, teneur en matière sèche, la détermination de protéine brute, le taux de matières grasses brutes, et la détermination des sucres. En ce qui concerne la teneur en matière sèche des graines des arbres infestés par les xylophages, il est de $3,85 \pm 0,12\%$. Il n'y avait pas de différence significative entre la matière sèche des graines saines de pistache et les graines issues d'arbres infestés par le xylophage parce que la probabilité est supérieur à 0,228 ($Pr > 0,05$) pour un intervalle de confiance de 95%. Les graines saines ont un taux d'eau de $7,21 \pm 0,36\%$. Pour la graine de pistache provenant d'arbres infestés le pourcentage d'eau atteint $7,63 \pm 0,8\%$. L'analyse de la variance sur la teneur en eau contenue des graines de pistaches infestées par xylophages montre qu'il n'y a pas de différence significative, la probabilité (Pr) est de 0,57, supérieur à 0,05 ($Pr >$

0,05) pour un intervalle de confiance à 95..% dans cette étude la teneur moyenne en matière grasse est de $47,1 \pm 1,21\%$ pour les graines saines. Il est de $45,4 \pm 2,09\%$ pour les graines d'arbres de pistaches infestées.. Dans cette étude, l'analyse de la variance de la teneur en matières grasses des graines saines et ceux infestées de Scolytidae, montre qu'il ya une différence significative parce que la probabilité est de 0,04 ou inférieur à 0,05 ($Pr < 0,05$) pour un intervalle de confiance de 95%. Comme pour le taux moyen de sucres, il est de $3,9 \pm 0,49\%$ pour graines de pistache issues d'arbres sains. Le taux de sucre est de $5,4 \pm 0,88\%$ dans les graines de pistaches de fruits récoltés à partir arbres infestés. L'analyse de variance de sucres totaux entre les graines saines de pistache et ceux des arbres infestés par le foreur des bourgeons montre qu'il n'y a pas de différence significative puisque la probabilité est donc 0,50 supérieur à 0,05 ($Pr > 0,05$) (intervalle de confiance de 95%). Le taux de Protéines a atteint $39,5 \pm 2,88\%$ dans les graines saines. Des semences infestées est de $21,1 \pm 6,48\%$. Analyse de la variance entre les protéines de graines de pistaches récoltées sur des arbres sains et les graines issues d'arbres infestées montre qu'il existe une différence significative compte tenu du fait que la probabilité est inférieure à 0,007 0,05 ($Pr < 0,05$) pendant un intervalle de confiance de 95%. La matière azotée totale est de $6,2 \pm 0,99\%$ dans la graine issue d'arbre sain.

Mots-clés. *Chaetopterus vestitus* – Composition chimique – *Pistacia vera* – Algérie.

I – Introduction

Generally pistachios are characteristic species of the Mediterranean region (Boudy, 1952). Yet in the field of pistachio production in Algeria certainly remains far behind the other Mediterranean countries. It should be recalled that Aleta *et al.* (1997) insist that gender *Pistacia* brings together a large number of species that have no agronomic interest appart their possible use as rootstocks. Similarly in Algeria, Boudy (1952) mentions several endemic species, as the pistachio atlas (*Pistacia atlantica*), the terebinth (*Pistacia terebinthus*) and the mastic tree (*Pistacia lentiscus* L.). In Algeria, pests of pistachio fruit (*Pistacia vera* L.) are little studied, despite their harmful effects and their economic importance. Benmenni (1995) in Batna, Abdesslem (1999) in Djelfa and Boukeroui (2006) in Blida have established inventories on insect fauna in fruit pistachio orchards. In the same context, Mes-saoudene (2006) in the region of Ain Oussara near Djelfa examined fluctuations of aphids on the pistachio of the Atlas. Similarly in Batna, Bouira and Tlemcen, Chebouti-Meziou *et al.* (2006), Chebouti-Meziou *et al.* (2007) Chebouti-Meziou *et al.* (2009a), Chebouti-Meziou *et al.* (2009b) and Chebouti-Meziou *et al.* (2009c) report the presence of a driller buds *Chaetoptelius vestitus* (Mulsant and Rey) on the young shoots of the fruit pistachio inducing a significant loss of production.

The beetle pistachio *Chaetoptelius vestitus* is a species found in the Mediterranean. It is subservient to wild *Pistacia* such as *P. Terebinthus*, *Lentiscus P.* and *P. atlantica*) and grown Pistachio (*P. vera*). It belongs to the Scolytidae family. It measures 2.5 to 3.5 mm long. The husks are dark, black or very dark brown with a pronotum almost entirely denuded above. The elytra are covered with white and brown spiniform squamules among which emerges a row of spaced stiff bristles (Balachowsky, 1949).

It is noteworthy that in the pistachio orchard Bechloul, two types of pistachio fruits are available, some from healthy trees and other from trees infested with *Chaetoptelius vestitus*. A comparative study of the chemical composition of two kinds of seed was made.

II – Material and methods

Bechloul station is located at an altitude of 449 meters ($36^{\circ} 18' 44''$ N, $03^{\circ} 4' 42''$ E). This pistachio orchard was planted as part of a cooperation program with FAO between 1972 and 1975. It consists of a homogeneous population, aged about 36 years and not maintained. Tree height is between 3 and 5 meters and occupies an area of 40 hectares. Adjacent rows are spaced 6 meters.

The total number of trees is 1059. It should be noted the presence of a row of male plants from the northeast side of the prevailing wind. Inside the orchard, the male feet are arranged in a random manner. The orchard does not benefit from cultural operations such as control of the size of tree branches and irrigation.

The dry matter content of various foods was conventionally determined by the weight of the food after drying in an oven. The crude protein was assayed by the Kjeldahl method. The crude fat correspond to substances extracted under reflux with a solvent. The determination of total sugars was carried out by the method of Dubois.

The data were subject to an analysis of variance. This test consisted of comparing the means of several populations from data of random samples, simple and independent (Dagnelie, 1970). Performing the test was done either by comparing the value of Fobs with the theoretical value F1 corresponding α , extracted from the Fisher F table for a significance level $\alpha = 0.05$ or 0.01 or 0.001 with k_1 and k_2 degrees of freedom, or by comparing the value of the probability p with always different values $\alpha = 5\%$ or 1% or 0.1% .

III – Results

The results of analysis of pistachio seeds non infested with *Chaetoptelius vestitus* (Table 1) reveal a water content is $7.21 \pm 0.36\%$. Fat contents are $46.00 \pm 0.90\%$. As for the average sugar content is $4.02 \pm 0.47\%$. The protein reaches $29.88\% \pm 0.76$. The crude protein was $6.53 \pm 0.55\%$.

Table 1. Results of chemical analysis of seeds from fruit pistachio infested and non-infested (control) by the bark beetle

Control	Infested									
Repetition	Water %	Fat %	Sugar %	Protein %	T.N.M. %	Water %	Fat %	Sugar %	Protein %	T.N.M. %
1	6.99	47.39	4	29.01	7.01	7.67	43.59	4.04	29.37	4.63
2	7.61	45.12	3.39	30.13	6.99	7.91	43.72	5.97	13.75	4.68
3	6.74	46.19	4.2	31	6.12	7.25	47.79	5.56	19.37	5.1
4	7.5	45.3	4.5	29.4	5.99	7.69	46.55	5.78	21.9	4.87
Average	7.21	46	4.02	29.88	6.53	7.63	45.41	5.34	21.10	4.82
S.D.	0.36	0.90	0.47	0.76	0.55	0.28	2.09	0.88	6.48	0.21
		F (Fisher test)		Pr > F						
Water		0.361		0.574						
Fat		7.368		0.042						
Soluble sugar		0.521		0.503						
Protein		19.713		0.007						

T.N.M.: total nitrogenous matter; Pr: probability; F: fisher test.

Regarding the dry matter content of seeds from trees infested by *Chaetoptelius vestitus*, it is $3.85 \pm 0.12\%$. The percentage of water is $7.6 \pm 0.28\%$. The fat is $45.4 \pm 2.09\%$. Sugar rate is $5.3 \pm 0.88\%$, the protein of $21.1 \pm 6.48\%$. The percentage of the total nitrogenous matter was 4.8 ± 0.21 .

There was no significant difference between the water and soluble sugar contents found in the seeds of control and pistachio tree seeds infested by the xylophagous insect.

It should be noted that the analysis of variance of the fat and the protein contents of the seeds from the fruit pistachio witnesses and those of infested trees, shows that there are significant differences at $Pr < 0.05$ for a confidence interval of 95% (Table 1).

IV – Conclusions

The objective of this study is to provide an overview of the insect fauna effect on the fruit pistachio in Algeria, which is unknown. Statistical analysis of the biochemical composition of seeds harvested from pistachio *Chaetoptelius vestitus* uninfested and infested trees shows significant differences in lipid and protein levels. Thus, the infestation of fruit pistachio by *Chaetoptelius vestitus* not only causes reduced yields but it also causes a decrease in the value of the nutritional quality of the seed pistachio. However, further studies are required on the parasites and pest insects used in the context of a biological control against the enemies of the fruit pistachio. And technical improvement and selection of the genus *Pistacia* are to be considered in order to obtain genetically resistant varieties.

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