

Host Plant Determination of *Brachytrupes megacephalus* Lefebvre, 1827 (Orthoptera, Grillinae) Using Faeces Analysis in the Region of Oued Righ (Algerian Sahara)

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Abstract: In the southeast of the Algerian Sahara (Touggourt), the host plant determination of *Brachytrupes megacephalus* was studied by faeces analysis (microscopic observations). The experimentation was conducted in mid August until the end of September 2014. The main results of faeces analysis showed that the plants consumed by *B. megacephalus* belong to 8 families: Arecaceae (*Phoenix dactylifera*), Apocynaceae (*Nerium oleander*), Asteraceae (*Chrysanthemum*), Myoporaceae (*Myoporum sandwicense*), Plumbaginaceae (*Armeria maritima*), Rosaceae (*Prunus armeniaca*), Solanaceae (*Solanum lycopersicum*) and Triochylaceae (*Cherry fantasia* and *White Kristina*). *Phoenix dactylifera* is the most preferred host species by the adults of *Brachytrupes megacephalus*, with a consumption rate 85,87%.

Key words: *Brachytrupes megacephalus* • Faeces • Southeast of Algeria • Touggourt • *Phoenix dactylifera*

INTRODUCTION

Brachytrupes megacephalus is a cricket of the desert. It is announced in several localities in southern Algeria and Tunisia. This insect is also found in the sandy grounds of the Mediterranean coastline and more particularly in the irrigated crops. This lifestyle gave it the name of the "cricket of sands" [1].

The damages of the cricket are usually seen in the fall when it is in the larval state and extremely voracious.

In Tunisia, the farmers found the damage of this insect in three locations. In 1942, a nursery gardener of Sfax had destroyed sowings of bigarad; another nursery gardener in another area announced various damages. In 1948, young conifers were decapitated at the level of 2 cm or 3 cm ground and did not survive and In 1950, a plantation of young apple trees was decimated; the trees remained upright but dried [2].

These crickets attacked different types of plants but it is mostly visible on young plants, which it is very sensitive to this insect.

In the last few years ago, several complaints were made by the farmers of the area of Sidi Mehdi (Touggourt, region of Oued Righ, south-east Algeria) concerning the damage caused by this cricket [3]. The host range of *B. megacephalus* remains unknown. That is why we aimed in this study to determine the host range and food preferences of this pest in relation to plant diversity in the two experimental sites.

MATERIALS AND METHODS

Presentation of the Experimental Site: The study was conducted in the region/ area of Sidi Mehdi (Touggourt) which is a large part of the oasis of Oued Righ valley. The area of Oued Righ is a valley situated in the North-east of



Fig. 1: Experimental sites



Fig. 2: Recovery of deposit (Original)

the Algerian Sahara. It covers a South-North axis whose latitude is 32°54' to 39°9' North and longitude 05°50' to 05°75' East [4].

The experiment was conducted out at two locations (Fig. 1): 1st one at the experimental station of Sidi Mahdi which is approximately 07 km of Touggourt on the road leading to the airport and the 2nd one at the station of Saoud which is a small private palm plantation contains cultures subjacent with the date palm. The choice of this site is made with an aim of identifying the cultures attacked by *B. megacephalus*.

Test Sample Selection: During the fields' trip, we take the individuals of *B. megacephalus* were collected from the sites of study. The specimens were placed individually in containers to avoid their cannibalism (Phenomenon observed during breeding). After 24 hours, their faeces deposits are recovered to be studied at the laboratory (Fig.2).

Preparation of Faeces Deposit: The technique of treatment of faeces deposit is inspired by the method of [5] which consists in softening the samples in distilled

water during 24 hours. They then passed in bleach (sodium hypochlorite) in order to clear them up, then to rinse with distilled water and to dehydrate in alcohol baths (70, 90 and 100°). The assembly of deposit is then realized between blade and plate in a drop of liquid of Faure. The observation of the fragments of the rejected vegetable skins is carried out under photonic microscope (Fig. 3).

Comparison Study of the Epidermis Reference: The method consists in sampling the ground plants, which are available and good to preserve. At the laboratory, an epidermis of reference is carried out (Fig. 4) and which will be used by comparison to determine the fragments of the plants found in the preparations of faeces deposit by taking into account all the air parts of the plant; the stem, the leaf and the fruit.

Study of the Host Plant: The study of the host plant of *B. megacephalus* was made by analysis of faeces deposit.

Analysis of the Results: The goal of this study is to identify (qualitative study) and to quantify the vegetable fragments contained in faeces deposit of the captured individuals.

- The qualitative study is done by calculating the relative frequency of plant species in the faeces. According to [6] this method is to note the presence or absence of plants in the faeces, it is expressed as follows.

$$F(i) \% = (n_i / N) \times 100$$

F(I)% : Relative frequency of plant epidermis contained in faeces as a percentage.

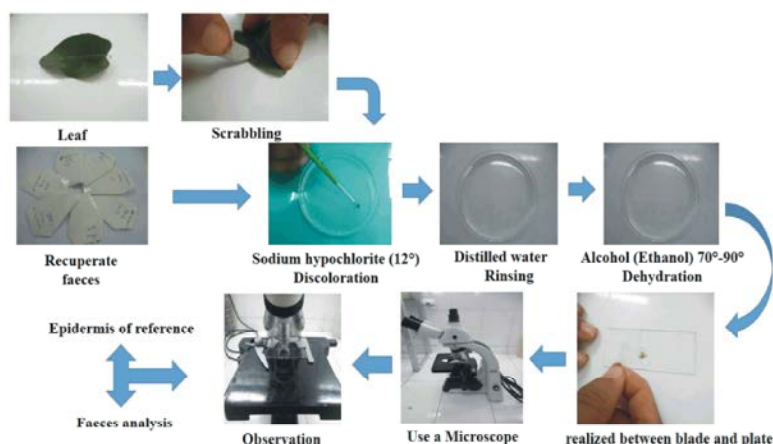


Fig. 3: Realization of an epidermis of reference and deposit analysis. (Original)

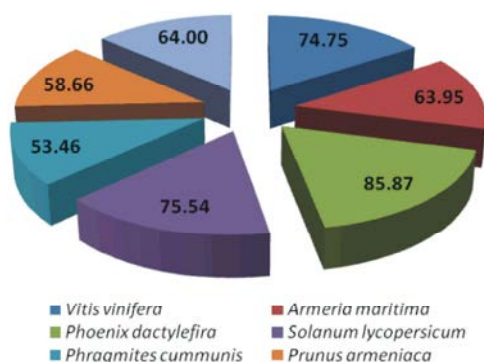


Fig. 4: Consumption rate of the adults of *B. megacephalus*

ni : Number of times that the fragments of the plant species (i) is present in the faeces.

N : Total number of examined faeces.

- The quantitative study is done by calculating the Consumption rate with a simple equation:

$$Tc = Pi - (Pr + Pf)$$

Tc : Consumption rate

Pi : Weight of green leaf (0,300g)

Pr : Weight of rest leaf

Pf : Weight of faeces

Statistical Analysis: The variances (σ^2), averages and standard deviation (SD) of various repetitions were calculated and analyzed by the software of statistics (STAT BOX 6.0.4. GRIMMERSOFT) and the device used are the global uni-factorial randomization (One studied factor, F1 is Plants consumption), by the test of Newman-Keuls at $P_{0.05}$ and $P_{0.01}$.

RESULTS AND DISCUSSION

During the summer period, the results showed that 9 plant species were found in the faeces of *B. megacephalus* at both locations (Fig. 9). The host range study of *B. megacephalus* showed that faeces deposits of the males contain more plant species ($S = 6$) than those of the females ($S = 4$), for the two sites of study (Table 1).

Qualitative Study of the Host Range of *B. megacephalus*:

In the two sites of study, the plants consumed by *B. megacephalus* belong to 8 families: Arecaceae (*Phoenix dactylifera*), Apocynaceae (*Nerium oleander*), Asteraceae (*Chrysanthemum*), Myoporaceae (*Myoporum sandwicense*), Plumbaginaceae (*Armeria maritima*), Rosaceae (*Prunus armeniaca*), Solanaceae (*Solanum lycopersicum*) and Triochylaceae (*Cherry fantasia and white Kristina*) with two unspecified species.

Quantitative Study of the Host Range of *B. megacephalus*:

The results of the consumption rate obtained show that the preference plant species of *B. megacephalus* was *Phoenix dactylifera* (85,87%), *Solanum lycopersicum* (75,54%) and *Vitis vinifera* (74,75%) (Fig. 4).

We noticed a reliable test (C.V. = 16.66%). The consumption rate of insect showed a highly significant effect (Table 2).

According to the study carried out by [7], *Brachytrupes* who obtained that host range of this insect was of vegetable origin.

According to 8, *Brachytrupes megacephalus* is a vegetarian species, which consumes its food inside the tunnels after collected from the surface.

Table 1: The total richness and the average richness of the plant species in deposit of the males and the females of *B. megacephalus* found in the stations of studies

Vegetable species	Site of sisi Mehdi		Site of Saoud (farmer)	
	10 males	10 females	10 males	10 females
<i>Armeria maritima</i>	+	+	-	-
<i>Polygonum convolvulus</i>	-	-	-	-
<i>Nerium oleander</i>	+	+	-	-
<i>Prunus armeniaca</i>	-	-	+	+
<i>Chrysanthemum</i>	-	+	+	+
<i>phoenix dactylifera</i>	+	+	+	+
<i>Limonium decatum</i>	-	-	-	-
<i>Solanum lycopersicum</i>	-	-	+	+
<i>Portulaca oleracea</i>	-	-	-	-
<i>Cherry fantasia</i>	-	-	+	-
<i>White Kristina</i>	-	-	+	-
<i>Myoporun sandwicense</i>	+	-	-	-
<i>Cynara cardunculus</i>	-	-	-	-
<i>Medicago sativa</i>	-	-	-	-
<i>Mentha piperitae</i>	-	-	-	-
Unsp 1	+	-	-	-
Unsp 2	+	-	-	-
(S) Total richness	6	4	6	4
(Sm) Middle richness	0,6	0,4	0,6	0,4

Table 2: Consumption rate of *B. megacephalus*

Plant species	X ± δ	F calculated	C.V.
<i>Vitis vinifera</i>	74.74 ^{ab} ± 8.11	7.81**	16.16
<i>Armeria maritima</i>	63.95 ^{bc} ± 13.8		
<i>Phoenix dactylifera</i>	85.87 ^a ± 9.46		
<i>Solanum lycopersici</i>	75.53 ^{ab} ± 14.92		
<i>Phragmites cummunis</i>	53.45 ^c ± 7.42		
<i>Prunus armeniaca</i>	58.87 ^c ± 8.19		
<i>Nerium oleander</i>	63.99 ^{bc} ± 14.48		

**Highly significant effect at P_{0.01}; C.V.: Coefficient of variation (%); X: Means of consumption rates; δ: Standard deviation

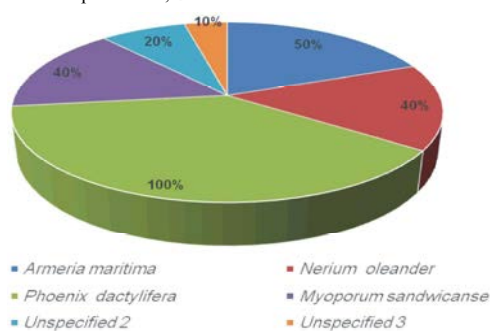


Fig. 5: Relative frequencies of plant species present in the deposit of male individuals of *B. megacephalus* (Station of INRAA)

In Sicily, it was shown that these insects prefer the sandy places mainly those cultivated in vine where they dig long galleries by corroding and cutting the roots which they meet [9].

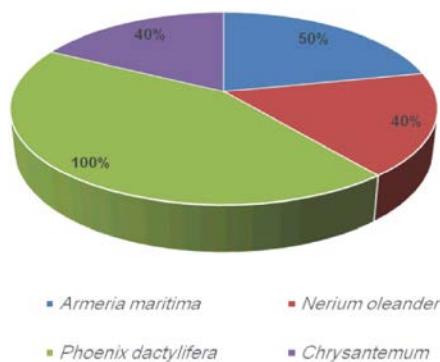


Fig. 6: Relative frequencies of plant species present in the deposit of female individuals of *B. megacephalus* (Station of INRAA)

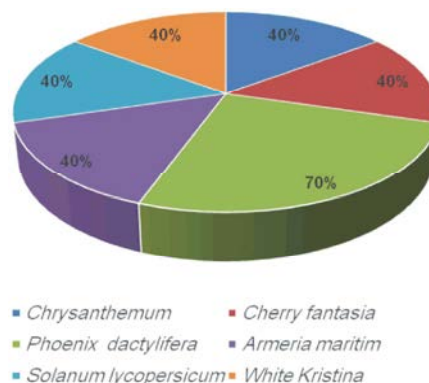


Fig. 7: Relative frequencies of plant species present in the deposit of male individuals of *B. megacephalus* (site of Saoud)

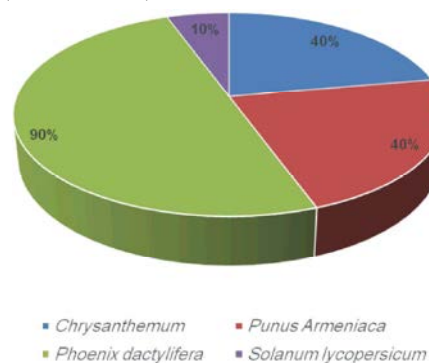


Fig. 8: Relative frequencies of plant species present in the deposit of female individuals of *B. megacephalus* (site of Saoud)

In FEZZAN, it was noted that these orthopter make damage on the plants of the gardens, on the cultures of tomato, sorghum, but of onion, carrot and on mint [7]. It was noted that all the found skins are of vegetable origins; therefore, one can say that the food of *B. megacephalus* is based on the plants.

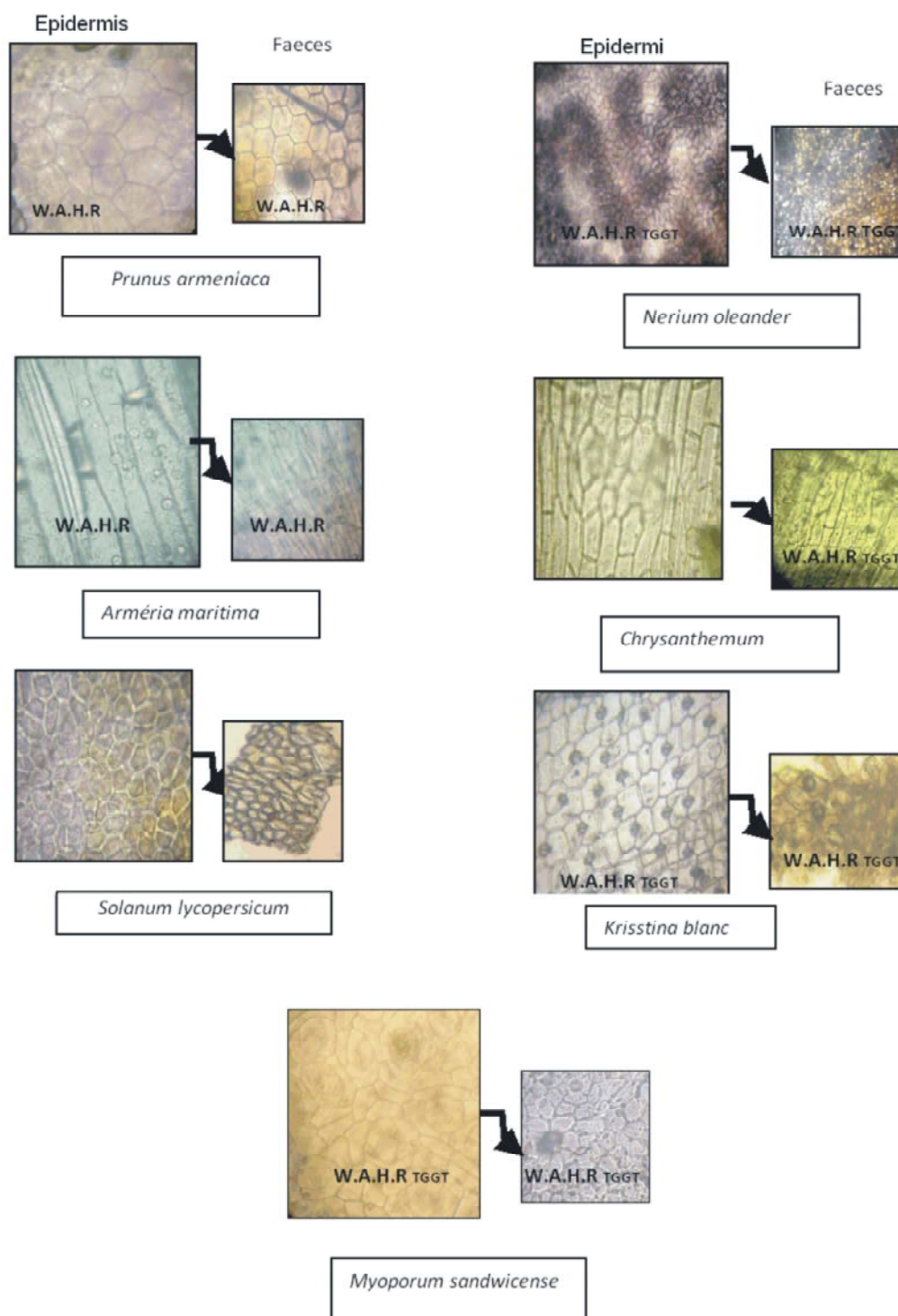


Fig. 9: Epidermis and fragments of plants found in the faeces (Original)

The results obtained in the site of Sidi Mehdi show that the plant mostly consumed by the greatest number of males is *Arecaceae (Phoenix dactylifera)* with one $F_i=100\%$, followed by species *Armeria maritima* with a

frequency of 50%, than the species *Myoporum sandwicense* and *N. oleander* with a frequency of 40% and two unspecified species with frequencies of 20%, 10% (Fig. 5).

As for the plant consumed by the greatest number of the females is Arecaceae (*Phoenix dactylifera*) with one $F_i=100\%$, followed by species *A. maritima* with a frequency of 50% and two other species *Chrysanthemum* and *N. oleander* with a frequency of 40%. 6).

In the site of Saoud, the species consumed by the greatest number of males is Arecaceae (*Phoenix dactylifera*) with one $F_i=70\%$, followed by the species *Chrysanthemum*, *Cherry fantasia*, *Armeria maritima*, *Kristina*, *Solanum lycopersicum* with F_i of 40% (Fig. 7).

As for the species consumed by the greatest number of females, it is *Phoenix dactylifera* with $F_i=90\%$, followed by the species *Prunis Armeniaca* and *Chrysanthemum* with of F_i 40%. The species *Solanum lycopersicum* consumed with a frequency of 10% (Fig. 8).

These results are identical to those recorded by [10] who worked on the variation of the food mode of *Schistocerca gregaria* where it shows that *Phoenix dactylifera* is the most appreciated species with (62,86%) in the males and (62,05%) females of this locust. This choice can be done due to the richness in the plant.

According to [11], the first quality of a food source is to be convertible in nutrients usable in the development, the maintenance of the organization and the reproduction.

According to 5, the proportions of the introduced plants can correspond to the relative density of the plant species observed on the ground, or results from a real choice increasing the ingestion of certain species, which are abundant or rare.

The two unspecified species, which were present in deposit of *B. megacephalus*, were not present in the studied area, let suppose that they consumed elsewhere. Indeed, this pest is very mobile and can travel long distances going up to 7 km [12].

CONCLUSION

Results of faeces analysis showed that 9 plant species were found in the faeces of *B. megacephalus* at both location from 15 species selected from the study on land with two unspecified species. Males have consumed five plant species.

The results showed that the plants consumed by the *B. megacephalus* belong to 8 families: Arecaceae (*Phoenix dactylifera*), Apocynaceae (*Nerium oleander*),

Asteraceae (*Chrysanthemum*), Myoporaceae (*Myoporum sandwicense*), Plumbaginaceae (*Armeria maritima*), Rosaceae (*Prunus armeniaca*), Solanaceae (*Solanum lycopersicum*) and Triochylaceae (*Cherry fantasia* and *White Kristina*). *Phoenix dactylifera* is the most preferred host species by the adults of *Brachytrupes megacephalus*, in the station of Sidi Mehdi with a relative frequency of ($f_i=100\%$) for the males and ($f_i=100\%$) for the females and a consumption rate equal to 85,87%

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