

# Contribution to the Study of a New Date Palm Pest *Oryctes agamemnon* in the Palm Groves of El-Oued, Algeria

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## ABSTRACT

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A survey concerns *Oryctes agamemnon* in El-Oued governorate (Algeria) next to the border of Tunisia. Its aim is to study the spread and the damages caused by this pest, in three stations: Taleb Larbi, Ben Guecha, and Douar El-ma. In all 60 prospected farms, the insect damage was estimated at an average of 53.75%. The highest level of infestation was recorded in Taleb Larbi and Douar El-ma with 75 and 65%, respectively. However, Ben Guecha station was marked by the lowest rate of infestation and this was probably due to the presence of the Ghouts-type farms and/or the sandy and relatively wet soils increase juvenile stages proliferation. It has been also noted that the third larval stage was the most harmful stage due to its long development duration and its voracity. The difference in the recorded infestation rate can be explained by the geographical location nearby the Tunisian infested palm groves, soil nature, date palm seedlings origin and / or the poorly maintained palm groves. Concerning the varietal sensitivity, Deglet Nour exhibited the most serious damage in comparison with Ghars variety with severe infestations on roots and trunks. Therefore, the real threat of this insect will be the infestation expansion to new palm groves where the damage can be severe.

**Keywords:** Algeria, date palm, infestation, *Oryctes agamemnon*, survey

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Rhinoceros beetles constitute a group of medium to large sized scarabs of the Dynastinae (Rochat et al. 2004). Among rhinoceros beetles, the genus *Oryctes* includes about 40 species (Endrodi 1985) but only some of them have a real impact on the development of palm trees (Balachowsky 1962).

In certain Gulf countries (United Arab Emirates, Sultanate of Oman and Kingdom of Saudi Arabia), several species develop within oases (Al-Sayed and Al-Tamiemi 1999).

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However, damages caused by *Oryctes* to palm trees are economically secondary and of less importance alone but it attracts the xylophagous pest *Rhynchophorus ferrugineus* for oviposition which leads to the palm dying (Soltani and Ben Hamouda 2015).

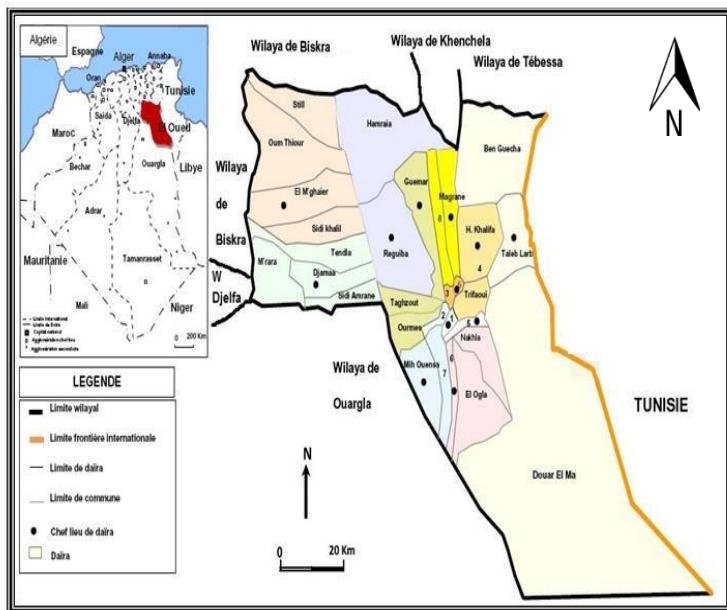
In the Maghreb countries, *Oryctes agamemnon arabicus* was accidentally introduced during the last three decades in Djerid region (Tunisia), via off-shoots of new varieties imported from United Arab Emirates oases (Khouldia and Rhouma 1997). In Algeria, *O. agamemnon* was discovered for the first time in 2013 in some oases of Taleb Larbi belonging to El-Oued governorate (INPV 2014). The present study aimed to

determine the current situation of the attack relative to this pest in the region of Taleb Larbi (El-Oued) which represented the primary focus in Algeria, to monitor its damage and impacts on date palm trees, and to determine the infestation rates of different infested parts by station and by grown varieties.

## MATERIALS AND METHODS

### Study area.

The study occurred in the region of Taleb Larbi, El-Oued governorate. It is located in the South East of Algeria and bordered with Tunisia by Tozeur and Kebili governorates. The concerned frontier with Tunisia extends for about 300 km (Fig. 1).



**Fig. 1.** Administrative limits of the region of Taleb Larbi (Anonymous 1997)

The survey was carried out in three stations: Douar El-ma, Taleb Larbi, and Ben Guecha which are located on the frontier with Tunisia on the side of Rjim Maatoug and El-Matrouha (Kebili governorate) and Hezoua (Tozeur governorate).

### Plant survey.

In the three stations of the Taleb Larbi area, the study was carried out in 60 farms. In each farm, four palm trees were chosen randomly taking into account the observed symptoms either on the trunk or

on roots. The work was focused on the two most dominant varieties Deglet Nour and Ghars. The selected samples of palm trees in each grove were equitably divided between them.

### Insect sampling.

Sampling of different stages of *O. agamemnon* was carried out on crowns, trunks and roots of date palm trees with different infestation levels. Insect survey concerned its different developmental stages and was performed as follow. At the palm tree bases, the sand surrounding the trunk was moved using a shovel until the appearance of the superficial roots. Searching operation for the different insect stages was carried out between the root biomass using a pickaxe to confirm their existence or not at 40 cm deep. Once observed, the extraction and the collection of insect samples were achieved using a large forceps. At the trunk level, the searching operation was carried out manually by eliminating the fibrillium layers and lifting petioles using a pickaxe. For the inspection of the crown, presence or absence of insect was checked between palms.

### Estimation of infestation rate.

In order to determine the infestation rate (I.R) by *O. agamemnon* in the surveyed date palm oases, the two following formulas were used. In fact, to calculate the general rate per region (for 240 palm trees) and per station (80 palm trees): IR (%) = (Number of infested palm trees/Total number of surveyed palm trees) × 100.

For each studied variety, it is calculated as: IR = (Number of infested palms/Total number of surveyed palms) × 100.

### Statistical analysis.

Data collected from the oases were presented as means ± SD (Standard Deviation) of percentage. They were also subjected to ANOVA analysis. Means were compared using a Least Significant Difference (LSD) test at  $P \leq 0.05$ .

## RESULTS

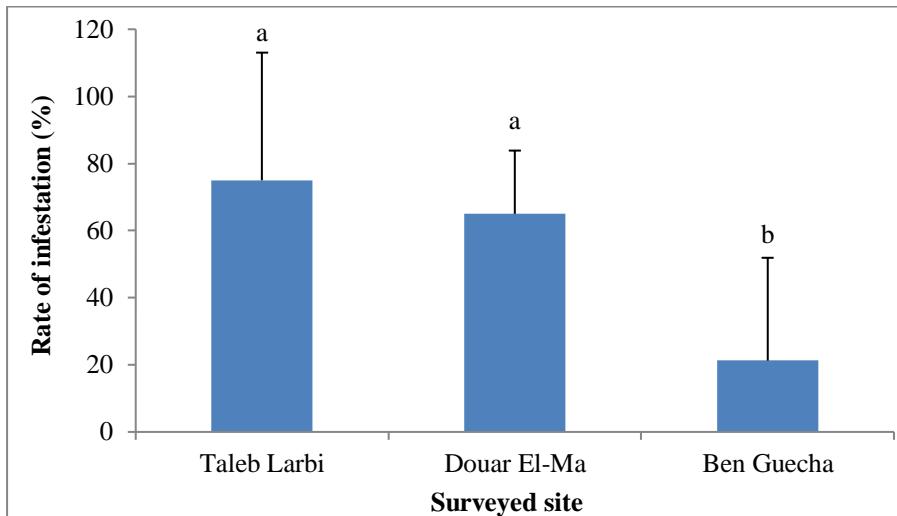
Surveys made at the different prospected areas showed that *O. agamemnon* is a monophagous species surviving strictly linked to date palm trees.

### Infestation rate per surveyed site.

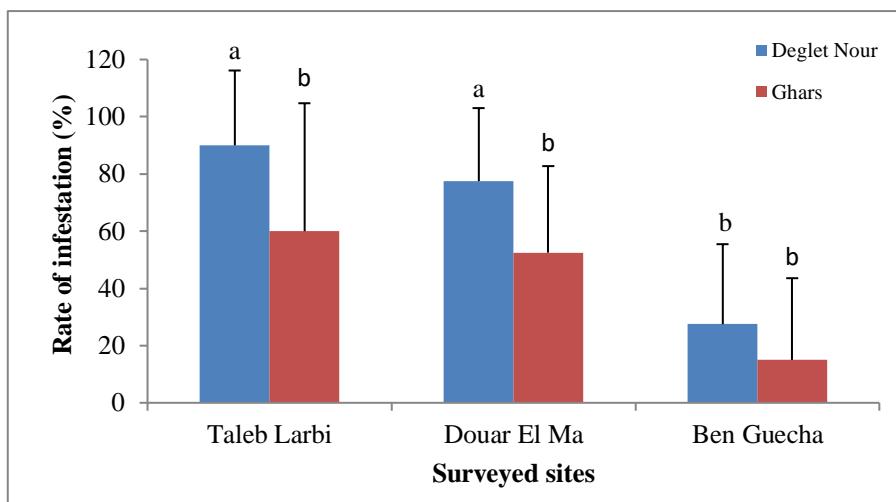
The general rate of infestation registered in the different surveyed sites of the region of Taleb Larbi was 53.75%. Fig. 2 indicates that the highest rate of infestation was recorded in Taleb Larbi (with  $75 \pm 38\%$ ) and Douar El-ma (with a rate of  $65 \pm 18.62\%$ ). The lowest rate ( $21.25 \pm 30.65\%$ ) was noted in Ben Guecha. Statistical analysis using ANOVA, revealed the existence of a significant difference between the study stations ( $df = 2$ ,  $F = 27.23$ ,  $P \leq 0.05$ ) as indicated by the two groups shown in Fig. 2.

### Infestation rate per variety.

The results of infestation rates by variety for the three surveyed sites are summarized in Fig. 3. In fact, the comparison between the studied varieties in different surveyed sites showed that *O. agamemnon* had a marked preference to Deglet Nour variety in comparison to Ghars. Also, as given in Fig. 3, Deglet Nour and Ghars grown at Taleb Larbi site showed the highest rate of infestation with  $90 \pm 26.16\%$  followed by Douar El-ma with  $77.50 \pm 25.52\%$ .



**Fig. 2.** Estimated rate of infestation with *Oryctes agamemnon* in the surveyed sites. Bars sharing the same letter are not significantly different based on LSD test at  $P \leq 0.05$ .



**Fig. 3.** Infestation rates of two date palm varieties in the three surveyed sites. For each surveyed site, bars sharing the same letter are not significantly different based on LSD test at  $P \leq 0.05$ .

It can be deduced that Deglet Nour trunk is strongly attacked by *O. agamemnon* compared to that of Ghars variety. This difference of attacks can be explained in part, by the circumference

of Ghars trunk which is very large in comparison to that of Deglet Nour. Additionally, woods of both petioles and trunk of Ghars were harder than those of Deglet Nour (Fig.4).



**Fig. 4.** Variation in the infestation level of date palms trees by *Oryctes agamemnon* depending on varieties.

#### Infestation rate per organ.

The damage caused by *O. agamemnon* was invisible and very difficult to detect in the beginning of attacks because larvae grow in hidden places. Based on surveys made on date palm trees in the different sites, infestations were localized at different levels throughout the plant starting from roots to the trunk but no infestation was

recorded on the crown.

#### Trunk symptoms.

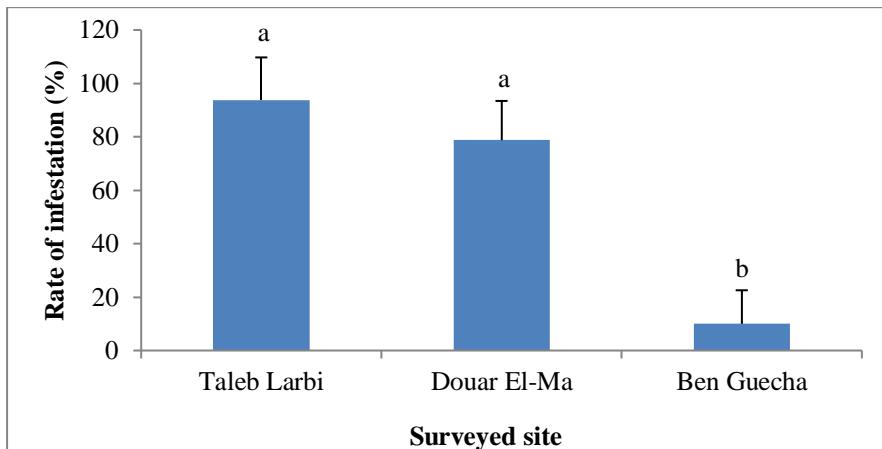
In general, attacks of the trunk concerned dead tissues such as fibrillum, the bark of the trunk and the base of dry petioles. The trunk attacks were easily identified by the presence of superficial cavities on the dry petiole that did not exceed 2 cm deep commonly caused by adults (Fig. 5).



**Fig. 5.** Cavities induced by *Oryctes agamemnon* on a date palm trunk.

Statistical analysis using ANOVA, shows the existence of significant difference between study stations ( $df = 2$ ,  $F = 190.44$ ,  $P \leq 0.05$ ). In fact, according to Fig.6, the highest rate of infestation in

Taleb Larbi was estimated to  $93.75 \pm 15.97\%$  followed by Douar El-ma with  $78.75 \pm 14.68\%$  whereas the lowest infestation rate ( $10 \pm 12.56\%$ ) was recorded in Ben Guecha.



**Fig. 6.** Infestation rate of the date palm trunks in the surveyed sites. Bars sharing the same letter are not significantly different based on LSD test at  $P \leq 0.05$ .



**Fig. 7.** Traces of brown powder on the ground and around date palm roots infested with *Oryctes agamemnon*.

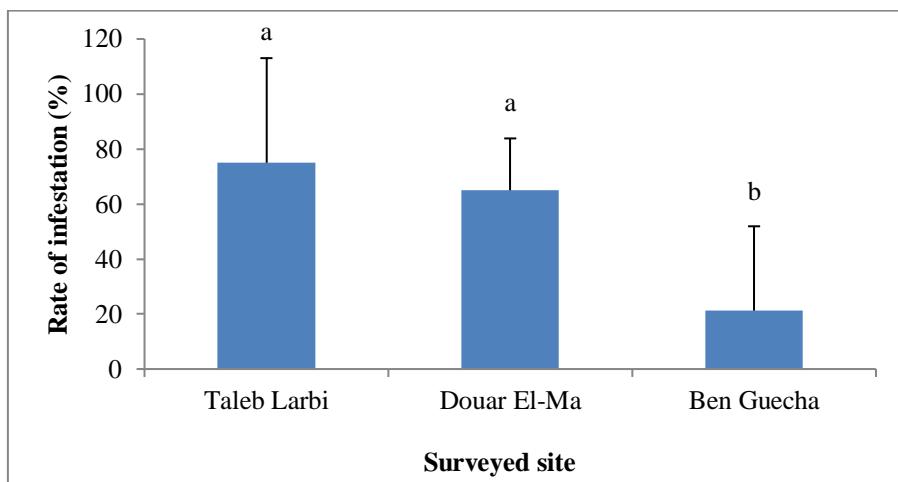
### **Root symptoms.**

The respiratory roots constitute the main environment for the survival and development of the insect. This part was a source of food for the offspring of the insect because it is composed of soft and moist root hair. The larvae infest the aerial roots at the base of the trunk as indicated by the traces of brown powder, later leading to yellowing and drying all the palms of the crown.

The repetition of root attacks for many years is a potential hazard that can lead to imbalance by weakening its

basal support and then total palm drying (Fig. 7).

Statistical analysis revealed the existence of a significant difference between the surveyed sites ( $df = 2, F = 27.23, P \leq 0.05$ ). Date palm trees grown in Taleb Larbi and Douar El-ma sites were the most heavily attacked at the root level as expressed by the infestation rates of  $75 \pm 38$  and  $65 \pm 18.62\%$ , respectively (Fig. 8). However, those of Ben Guecha showed the lowest infestation ( $21.25 \pm 30.65\%$ ).



**Fig. 8.** Infestation rate of the date palm roots in the surveyed sites. Bars sharing the same letter are not significantly different based on LSD test at  $P \leq 0.05$ .

**Off-Shoot symptoms.** The off-shoots are the main point of entry above all in

the basal zone of the roots before the weaning operation (Fig. 9).



**Fig. 9.** The total fall of a date palm tree due to a severe *Oryctes agamemnon* infestation.

Off-shoots are grown naturally in tuft at the base of the palm tree and they are rarely maintained by the farmer. For this reason, they are

considered the most targeted places by the insect because these tufts are dirty, wet, dark, and hard to reach by both farmer and other insect species.



Tuft of off-shoots non maintained



Off-shoot weaning operation



Dry palms and death of the off-shoots

**Fig. 10.** Stages of off-shoots infestations by *Oryctes agamemnon*.

Advanced stage of offshoots attacks led to the deformation and the stunting of the green palms but in case of total consumption of its internal basal part, date palms turn yellow, dry out and

perish (Fig. 10). Effectively, the heavy attacks were localized in the new plantations as noted in the zone of Ben Guecha (Fig. 11).



**Fig. 11.** Stages of infestation of off-shoots by *Oryctes agamemnon* larvae.

## DISCUSSION

*O. agamemnon* is a new pest recently introduced in date palm oases in the South East of Algeria. During field surveyed undertaken in different sites where 240 date palms were sampled, 129 trees showed symptoms of attack by this pest. Thus, the infestation rate of the surveyed areas was estimated at 53.75%.

The high rates of infestation recorded in the oases of Taleb Larbi and Douar El-ma can be explained by the type of sampled palm groves called Ghouts. This specific culture system was characterized by a relatively deep soils and sandy physiognomy. This environment is characterized by its favorable conditions of humidity, darkness and moderate temperature which attracted this insect species and offered suitable environment for the development of its all stages mainly larvae. However, the low rate of infestation found in the oases of Ben Guecha can be explained, in part, by the clay texture of soil, hard and compact, that does not facilitate the survival of this insect.

As for the variation of *O. agamemnon* attacks per organs and

especially at the crown level, no attack was recorded in different sites although the occurrence of favorable environmental conditions and the sufficient amounts of food. These findings are in agreement with those of same Khalaf et al. (2013) in Iraq. In general, attacks at this level interested dead tissue such as the inner part of the dry petioles and the fibrillium.

Bedford et al. (2015) reported that *O. agamemnon* adult generally dig the trunks. Khalaf et al. (2013) also demonstrated that the insect infests the middle of the trunk in the young ages and old palms. These cavities provide access to subsequent generations of adults for entry and oviposition. Groups of adults, mainly ovipositing females, can coexist in these cavities, along with larvae, and the continuous feeding and tunneling activity by larvae can lead to collapse of the palm within few years (Ehsine et al. 2009; Soltani 2009).

The larval stages infest the aerial roots at the base of the trunk due to the presence of frond bases near the soil surface. However, in Iran, larvae of the *Oryctes* rhinoceros live in the crown and

trunk, feeding on the petioles and on the palms, and this injury can allow the entry of fungi and secondary insect pests (Bedford et al. 2015).

Larval feeding activity is known to cause damage to aerial roots and dry petioles (Soltani 2009, 2010). In the same context, Surany (1960) reported that *Oryctes* spp. are generally not very active and do not go out and that most of them do not feed in their relatively short adult lives (Balachowsky 1962, Howard et al. 2001).

As for varietal preferences, this study revealed different degrees of attack by this pest between the variety Deglet Nour, which is the most attractive, compared to Ghars. This difference is probably due to the vigorous

characteristics and the trunk girth which is very important in comparison with Deglet Nour. In fact, the wood of the petioles of Ghars is harder than that of the Deglet Nour.

According to Soltani (2004), a similar study was carried out in the date palm oases of Mrah Lahouar (South-Tunisia) revealed similar results with a rate of 44.45% among the pollinators (Dokkar) and 30% for Deglet Nour.

However, the irremediable danger of this species is the infestation of new plantations where the risk can reach very important percentages (Soltani 2009). This is the case of groves of Ben Guech a site where the novel plantations are imported from an infested area.

## RESUME

**Chouia A., Guerfi Z. et Sadine S.E. 2018. Contribution à l'étude d'un nouveau ravageur de palmier dattier *Oryctes agamemnon* dans les palmeraies d'El-Oued, Algérie. Tunisian Journal of Plant Protection 13 (si): 159-170.**

Cette étude concerne l'*Oryctes agamemnon* dans la gouvernorat d'El-Oued (Algérie) avec la frontière tunisienne. Le but est d'étudier la propagation et les dégâts causés par ce ravageur dans trois stations d'études sont Taleb Larbi, Ben Guecha et Douar El-ma. Dans la totalité des 60 exploitations prospectées, le degré d'infestation a été estimé à 53,75%. Les plus élevés ont été enregistrés à Taleb Larbi et Douar El-ma avec 75 et 65%, respectivement. Cependant, la station de Ben Guecha s'est distinguée par le plus faible taux d'infestation. Cette différence peut être expliquée par la présence des exploitations des systèmes Ghouts et/ou les sols sablonneux et relativement humides favorisant la prolifération des stades juvéniles. Il a été aussi noté que la larve du troisième stade est la plus dommageable en raison de sa voracité et de la durée de son développement. La différence enregistrée dans le taux d'infestation peut être expliquée par la position géographique par rapport aux foyers tunisiens infestés, la nature du sol, l'origine des rejets et/ou le manque d'entretien des palmeraies. Concernant la sensibilité variétale, la variété Deglet Nour a présenté les dommages les plus graves par rapport à la variété Ghars avec une infestation sévère au niveau des racines et des troncs. Par conséquent, la véritable menace de cet insecte sera l'expansion de l'infestation vers les nouvelles plantations où les dégâts peuvent être plus graves.

*Mots clés:* Algérie, infestation, *Oryctes agamemnon*, palmier dattier, prospection

## ملخص

شوية، عبد الواحد وقرفي الزبير وسعدين صلاح الدين. 2018. مساهمة في دراسة آفة خنفساء وحيد القرن *Oryctes agamemnon* على النخيل التمر بولاية الوادي، الجزائر.

**Tunisian Journal of Plant Protection 13 (si): 159-170.**

هذا البحث يهتم بدراسة آفة خنفساء وحيد القرن (*Oryctes agamemnon*) بولاية الوادي (الجزائر) مع الحدود التونسية. الهدف هو دراسة انتشار هذه الآفة مع الخسائر التي تسببها بمناطق الدراسة الثلاث وهي الطالب العربي وبين قشة ودوار الماء. من خلال 60 مزرعة مستكشفة، تبين أن الضرر الإجمالي الناجم عن هذه الآفة مقدر بـ 53.75 %، حيث سجل أعلى معدلات الإصابة في منطقة الطالب العربي ودوار الماء على التوالي 75 و 65 %. ولكن بالمقابل سجل أعلى معدل إصابة في منطقة بن قشة. هذا الاختلاف يمكن تفسيره بوجود مزارع من نوع الغوط الذي يتميز بالترابة الرملية والرطوبة النسبية التي تساعده على تكاثر وانتشار أطوار هذه الحشرة. إن المطر الثالث للحشرة هو الأكثر ضرر بسبب شراحته ومدة حياته المعتدلة. كما يعزى هذا الاختلاف في الإصابات المسجلة إلى الموقع الجغرافي للمنطقة وقربه من الحدود التونسية المصابة، طبيعة التربة، مصدر فسائل النخيل المجلوبة من المناطق المصابة أو إلى عدم القيام بعمليات التنظيف والصيانة لمزارع النخيل. فيما يخص حساسية الأصناف المدروسة لهذه الآفة، يلاحظ أن الضرر الأكثر قد سجل على صنف نيلة النور مقارنة بصنف الغرس مع تسجيل درجة إصابة مرتفعة وخطيرة على مستوى الجذور والجذع. من ناحية أخرى إن مجمل فسائل النخيل المغروسة حديثاً في المنطقة تزداد فيها نسبة الإصابة بهذه الآفة إلى درجة خطيرة.

**كلمات مفاتيح:** استكشاف، إصابة، الجزائر، نخيل التمر، *Oryctes agamemnon*

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