

Annual evaluation of *Phoracantha semipunctata* Fabricius, 1775 (Coleoptera: Cerambycidae) in the North Eastern Morocco

G.S. Belal *, G. Chavanon, A. Chafi, K. Chaabane

Department of Biological, bp 717, ma-60000 Faculty of Sciences-Oujda (FSO), University Mohammed premier, (UMP)
Oujda, Morocco

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- ✓ North Eastern Morocco.

ghizlaine.belal@gmail.com+2126
72 98 76 28

Abstract

The *Phoracantha semipunctata* (Cerambycidae) is a wood-boring pest of the most formidable of *Eucalyptus* stands. It is considered as a very invasive species. Its proliferation has increased since the last decade. Nowadays it is an ecological disaster longhorn. It causes dramatic damage in many parts of Morocco. This problem requires special care to ensure the preservation of *Eucalyptus* plantations. The objective of our work is to conduct a study on the annual evaluation of imagos *Phoracantha semipunctata* in north-eastern Morocco for control purposes. After an overview on *Eucalyptus gomphocephala*, the characteristics of the stations used in this study as well as the sampling methods and statistics methods are presented. This study was conducted in two different regions, Saïdia's coastal area in 2013 and the green curtain Taourirt-Oujda in 2014 by trapping in natural conditions supplemented by monitoring emergence of semi-natural environment imagos using hatching prepared at the laboratory. The experiments conducted in the field and inside the laboratory helped us to determine the Longhorn development cycle which is a monovoltine species in Saïdia and bivoltine in green curtain Taourirt-Oujda.

1. Introduction

The *Eucalyptus* is of considerable importance on the scale of the global forest economy. In Morocco, it was widely planted because of its rapid growth and its adaptation to different soil types, planting of this tree was essential objective feeding paper pulp mills [1].

Knowing the fact that *Eucalyptus* plantations are faced with a serious pest attacks wood boring: *Phoracantha semipunctata* which is considered the main enemy of the *Eucalyptus*, the damage caused since the 80's are huge and estimated at more than 2,000,000 infected trees, whether 1.18% of *Eucalyptus* stands country [2].

The Oriental region of Morocco is not immune to this wood boring that continues to cause losses of vitalities *Eucalyptus* plantations installed in various reforestation areas especially at the green curtain Oujda-Taourirt to "Bessam", to "Tazegart", and "Boughriba". The fight against *Phoracantha semipunctata* as against all boring insects, presents some difficulties. Currently there is no effective treatment for exterminating [3]. Of this fact and considering the peculiarity of this pest, it will be only mastered efficiently and sustainably if the *Eucalyptus* plantations are intrinsically unfavorable for *Phoracantha semipunctata*, so there must be have hereditary resistance properties [4]. The aim of this work is to study for the first time in Northern Morocco Oriental this invasive pest, in particular its emergence dynamics, the level of infestation on its host *Eucalyptus* and its life cycle while trying to give at least the most exact dates of takeoffs adult for control purposes.

2. Materials and methods

2.1. Study Areas

2.1.1. Localisation of stations

Our study covers the northern part of the Northeastern Morocco where almost all *Eucalyptus* plantations are located. In order to compare the diversity of longhorn, the choice fell on two plots of *Eucalyptus gomphocephala* where dieback is accentuated. The first one is the coastal area of Saïdia spanning from 35 ° 03'N to 35 ° 08'N latitude North and 02 ° 19'W to 02 ° 26'W longitude West, limited by the Mediterranean coastline over a distance of 35 km north, it is located at a distance of 60 km from Oujda and 25 km from Berkane. Segregated of Algeria by “Oued Kiss” and the rural commune “Aghbal” to the east, the rural commune “El Berkani Yine” to the west and rural communes “Oulad Daoud Zhanine”, “Boughriba”, “Zegzel” and “Fezouane” South. It includes a Site Ecological and Biological Interest (SIBE) at the mouth of the Moulouya [5] which is the largest river in the Mediterranean slope of the Maghreb [6].

The second study area concerns the green curtain Taourirt-Oujda, precisely in the perimeters of Naima. These limits are those of the green curtain along the national road N6 over an approximate length of 135 km, starting at “Wadi Tlagh” (between Guercif and Taourirt) and ending at “Wadi Isly”, Just before the entrance to Oujda city. This area is located between the following coordinates Lambert: West limit (X : 722671,45 m, Y : 425190,61 m). East limit (X : 814912,83 m, Y : 458723,24 m). The area falls within the water services and forests Taourirt, Oujda and Berkane. It straddles of rural communes territories “Ahl Oued Za”, “El Guetitr”, “Ain Lahjar Mestigmer”, “Sidi Bouhria”, “Mestferki” and “Sidi Boulanouar” and three municipalities: Taourirt, El Ayoun and Naima.

2.1.2. Climate framework

The climate of the coastal area of Saïdia is Mediterranean, characterized by mild winters and hot dry summers. The precipitations are characterized by an inter-annual irregularity with an annual average of 317 mm [7]. The annual temperatures Average range is between 17.6 ° and 35 ° C CM. According to the climagraph Emerge, the station is classified as bioclimatic stage semiarid temperate with pluviometric Quotient = 36.3 [8]. On the other hand, the green curtain Taourirt-Oujda is opening aerological on an arid continent. The most rains fall are observed during December and March, whereas July and August are the most arid months almost for every year. The annual precipitations average is 600 mm [9]. The annual average temperatures varies between 15 ° C and 20 ° C, where the maximum may exceed 40 ° C, and the absolute minimum is sometimes lowered below 0 ° C.

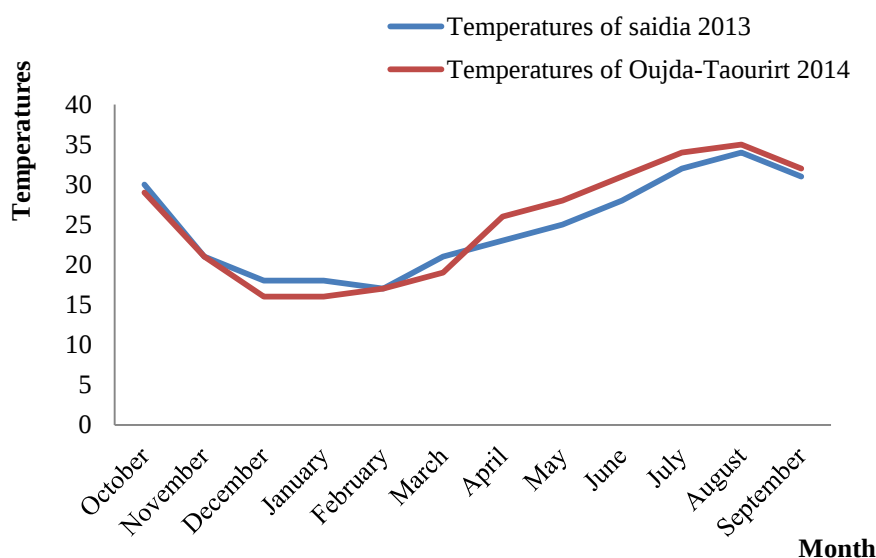


Figure1: The average temperatures of the Green curtain Taourirt-Oujda 2014 and the coastal area of Saïdia 2013 (source: agency from the hydraulic basin of the Moulouya Oujda, Morocco).

2.1.3. Identification of damage and symptoms of *Phoracantha semipunctata* on *Eucalyptus gomphocephala* in the North of Morocco Eastern

At the first survey of prospection and observations conducted on September 21, 2013 in the coastal area of Saïdia, we have noticed that the insect was absent in plots 1, 2 and 3 where the trees were healthy and robust with a greenish foliage, while it was present in the plot 4, plot in which trees presented galleries observable by the eye only. Furthermore, the emergence of adults oval holes with 0.5 to 1 cm in diameter showed numerous galleries girdling trunk and having blocked all flow of sap. The holes attest an old attack with the presence of a shrub about 10 m outright destroyed on Earth.



Figure 2: Prospection and global observation on damages of *Phoracantha semipunctata* in the Green curtain Taourirt-Oujda October 8, 2014

In the second survey of exploration and observations, performed on October 8, 2014 throughout the green curtain Taourirt-Oujda, we noticed that the insect was present everywhere. The affected trees are identified by the presence of galleries filled with sawdust under the bark. The newly attacked trees were very debilitated with yellowish foliage. On the other hand, during the levy trunks logs and legs for the livestock development in the laboratory, we found a larva *Phoracantha semipunctata* stage 4 within a branch.





Figure 3: Prospection and global observation on damages of *Phoracantha semipunctata* in the coastal area of Saïdia
September 21, 2013

2.2. Field sampling

After making the two outdoor investigations (September 21, 2013 and October 8, 2014) previously cited, we have proceeded to a systematic sampling of *Eucalyptus gomphocephala* to study the rhythm of envol imagos of *Phoracantha semipunctata*. The inventory was conducted for two years with monthly monitoring in the two transects North West Morocco.

For the 2013-2014 campaign, we chose 4 trapping sites in the coastal zone Saïdia:

S1: 35° 05,245' N - 02° 14,399' W

S2: 35° 05,178N - 02° 14,737' W

S3: 35° 05,681N - 02° 16,113' W

S4: 35° 05,427N - 02° 18,091' W

For the 2014-2015 campaign, we chose 5 trapping sites in the green curtain:

P1: 34° 40,702' N - 02° 03,215' W

P2: 34° 40,366' N - 02° 04,263' W

P3: 34° 39,812' N - 02° 05,890' W

P4: 34° 39,649' N - 02° 06,567' W

P5: 34° 39,637' N - 02° 07,372' W

2.3. Harvests in the field

To study the rhythm of emergences imagos of *Phoracantha semipunctata* and deduce the biological cycle in the region, we used several methods of trapping and biological follow based on the work realized by Bonneau [10]. The samples were carried out by a stratified randomly test in a way covering quite a large spot in each study area as described in [11]. For this, a choice of nine trees randomly in each plot has been done. The total number of selected trees was 81. In each point, three plots were spaced 20 m from each other to ensure the samples independence following the protocol described in [12, 13, and 14].

The traps in the stations S1, S2, S3, and S4 of the Saïdia coastal area have been set up on July 18th, 2013. While, in the stations P1, P2, P3, P4 and P5 of green curtain Taourirt-Oujda the traps were installed on September 21th, 2014. Each station contains six types of traps:

Air traps, traps to human height, the yellow plastic buckets, traps in the ground such as plastic goblets beverage, yellow containers and fine mosquito net. The installation of the traps was in a triangle equidistant from 3 m according to the method defined by Jung and al. [15] on three types tree: healthy trees, the dieback in trees, trees completely withers. The contents of the traps are then removed and nutrient media renewed every two weeks throughout the sampling period according to the method defined by Traugott [16]. Similarly, the plastic bottles and goblets renewal was performed whenever they were dirty or degraded. No disruption of traps by animals or people was observed during the study period. The date of each harvest output is noted and the number of individuals of each Longhorn collected in trap. The identification of other insects captured, at the species, genus, family or order as the case, was made by Professor G. Chavanon in the laboratory of "Water Sciences, Ecology and Environment", University of Oujda (Morocco).

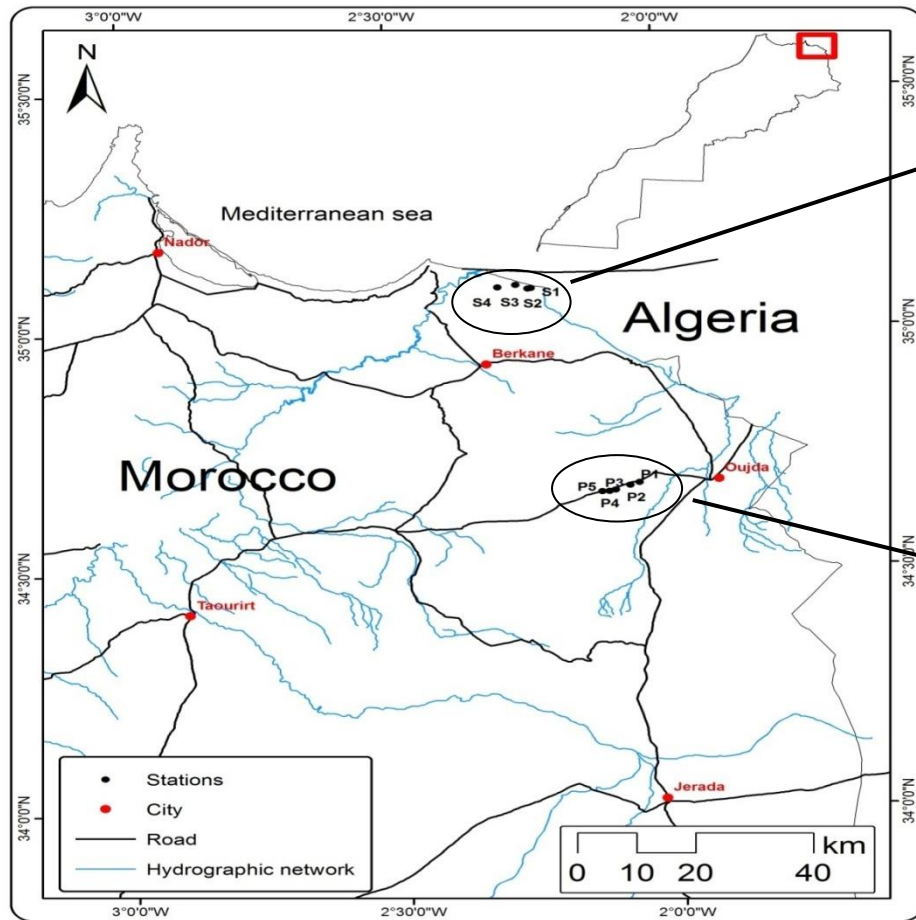


Figure 4: Overview map of the sampling sites in the North Eastern Morocco

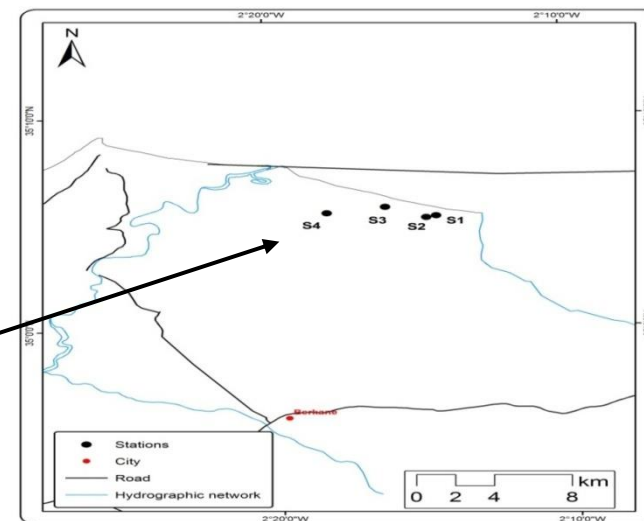


Figure.5: Sampling sites of the coastal area Saïdia

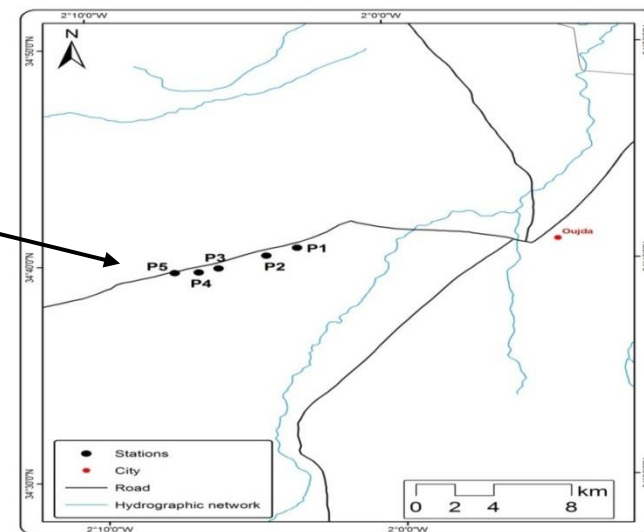


Figure 6: Sampling sites of the green curtain Taourirt-Oujda

2.4. Laboratory study

Alongside followed by catch traps, emergence of adults was observed in the laboratory from logs trunks or branches of *Eucalyptus* harvested randomly October 8, 2013 in the Saïdia area and 21 September 2014 in the Curtain green Taourirt-Oujda, in areas where attacks were significant. The segments cut up with a chainsaw (thin bark) and bottom (thicker bark) 18 trees were transported to the laboratory. After measuring the length (about 50 cm) and diameter logs of each tree there were placed in hatchers. The trunks of the Saïdia area have a diameter of 2 to 3cm, 4.5cm, 7cm to 5, 7 to 8 cm and 9.5 cm, while, the diameters of those from the corridor Taourirt-Oujda diameter: 3.5 4 cm, 5 to 6cm, 7cm to 6.5 and 7.5 to 8.5. Hatchers were manufactured using a cardboard box on which we practiced a circular orifice on which was placed a clear plastic bottle whose conical summit was cut and fixed, upside down, in the another part of the bottle. This system has risen in bottles, imagos emerging attracted to light as Benhalima indicates [17]. Emerging from all hatchers were collected and counted three to four times a week during the whole year and kept in bottles of alcohol at 60° for their examination.

2.5. Description of the sampling system

In order to collect the greatest possible of individuals various traps systems have been installed in each station of the two study areas.

2.5.1. Attractive traps

Insects are lured into traps by the smell of the bait. Two types of traps were installed: one on the ground (type "Barber") and the others hanging in the trees.

Two types of bait were used. One was composed to a volume of 5 liters, of: 1 l apple juice (very attractive liquid for capturing beetles from Bonneau 2008), 200 g of sugar, 1/2 liter of vinegar, 200 g salt, complemented with water. The other was composed of: 500 g of fermented bananas, 100g of sugar and 100g salt.

2.5.1.1. Air traps realized with transparent plastic bottles of 2 a volume of liters of capacity and 10 cm in diameter, provided with their plug through which is fixed as a hook or ring. Two openings, more or less circular, were performed in face to face, to permit entry of insects. Some small holes at mid-height allow the flow of an eventual overflow during violent storms. The traps with a hook installed on the branches to a height of 4 to 5 meters and those bearing a ring are attached to the trunks at breast height with a nail in the trunk.

2.5.1.2. Yellow plastic Buckets: with 1.75 l of volume and 15 cm in diameter, they were placed on the shaft up to 4 to 5 m through a wire attached to the handle.

2.5.1.3. The traps on the ground: These are plastic cups beverage of 0.2 l and 7 cm in diameter, embedded in the ground right up to the edge.

2.5.1.4. Colored containers: These ones are yellow bins of 11 cm diameter and 6 cm in height placed on the ground in the open area or in a sunny edge.

2.5.1.5. Passive traps: They consist of the installation of a fine mesh mosquito net of 1 mm, 80 cm wide by 1.20 m high fastened to the tree trunk.

2.6. Statistical approaches

The abundance of *Phoracantha semipunctata* was determined for each height in the two study areas and for each shaft section in the hatchers, taking account of the environmental variable (temperature). For each station, we have grouped firstly all the data from the traps and secondly all data from hatchers according to the protocol [15]. Then we performed a statistical analysis using the SPSS statistics software system for data processing program 20 PRISM [14]. We have used an Anova single factor [18] to compare the data collection of the four sites green curtain (P1 site giving any individual) and to compare data from three hatcheries in the same area (the hatcher E1 did not yield any individual). In the coastal area of Saïdia, individuals have been captured in the S4 site. A student test for independent samples was performed to compare the hatchers E1 and E3 of this site, no individual emerged of hatchers site S1, S2, S3. Similarly, the total number of *Phoracantha semipunctata* trapped in the two study areas was combined to make comparisons between two samples. Therefore, we have made student test for independent samples to conduct a comparison between data: site and hatchers of the Taourirt-Oujda curtain, site and hatchers of the coastal area Saïdia, Site corridor Taourirt-Oujda and site of the coastal zone Saïdia, hatcher of the Taourirt-Oujda curtain and hatcher of the coastal area Saïdia.



- a. b : air traps 4-5 m high
- c. d : air traps at human height
- e. f : hanging buckets
- g. h : barber type of floor traps
- i. j : colorful containers
- k. l : mosquito nets in place

Figure7: the different types of trap

3. Results

Our results show that the beetle was present in both study areas but with a different level of infestation. A total of 54 individuals were collected over two years' period.

3.1. Green Curtain Taourirt-Oujda

3.1.1. Traps

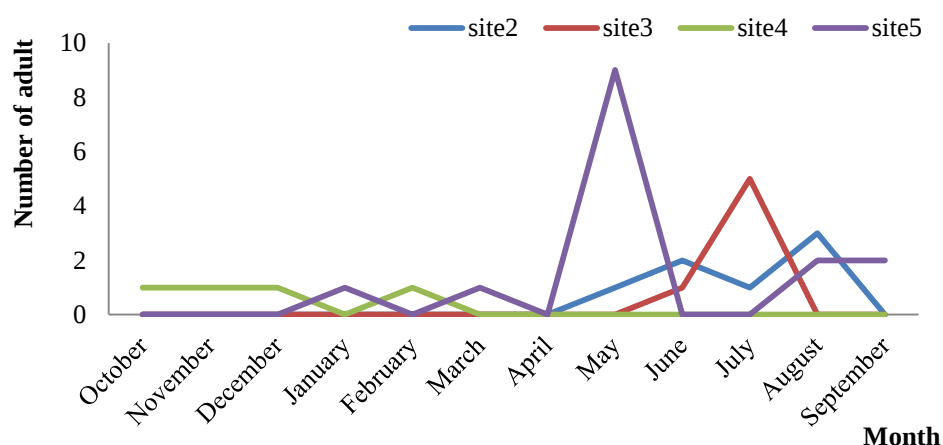


Figure 8: chronology of emergences of adults *Phoracantha semipunctata* in the Green curtain Taourirt-Oujda 2014.

Figure 8. Presents the abundance of imagos *Phoracantha semipunctata* harvested in traps sites 2, 3, 4 and 5 of the Green curtain Taourirt-Oujda collected during 2014. The Anova test statistical analysis gives a single factor revealed $F = 1.276$, a significance level of 0.29, and $P > 0.05$. The hypothesis H_0 of equality of means is accepted, therefore there is no significant difference between the values obtained collected in the 4 sites of the green curtain. The capture of longhorn began at setting up traps. However, the catches were greatly reduced and stable between October and March then null in April. The maximum catches were obtained in May 20th, 2014 with a total of 10 imagos trapped mainly in the S5 site. After a decrease in June, a further increase in catches, but lower than in May, appears during warm July (Site 3) and August (Sites 2 and 5) before decreasing again in September.

3.1.2. Hatchers

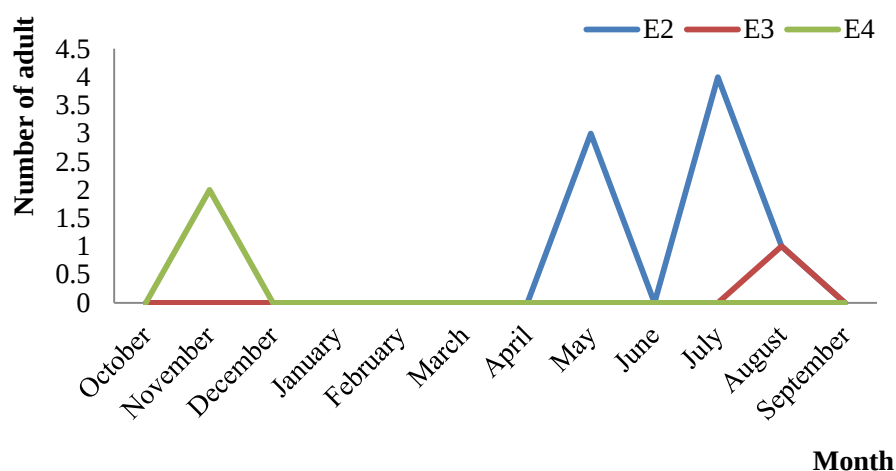


Figure 9: chronology of emergences of adults *Phoracantha semipunctata* in hatchers of the Green curtain Taourirt-Oujda 2014

Figure 9. Represents the variations between the number of emergences hatches E2, E3 and E4, containing logs of the Green curtain Taourirt-Oujda. The analysis of one factor ANOVA showed $F = 1.561$ with a significance level of 0.23, $P > 0.05$. The hypothesis H_0 of equality of means is accepted, so there is no significant difference between the values obtained as a function of the trunk diameter and branches. It may be concluded that the beetle is present in most green curtain plots and the main period of emergence of imagoes is in late spring (May) and summer (July and August) with a clear slowdown in June. There is, moreover, a second period of emergence, in late autumn (November).

3.1.3. Comparison between traps and hatches

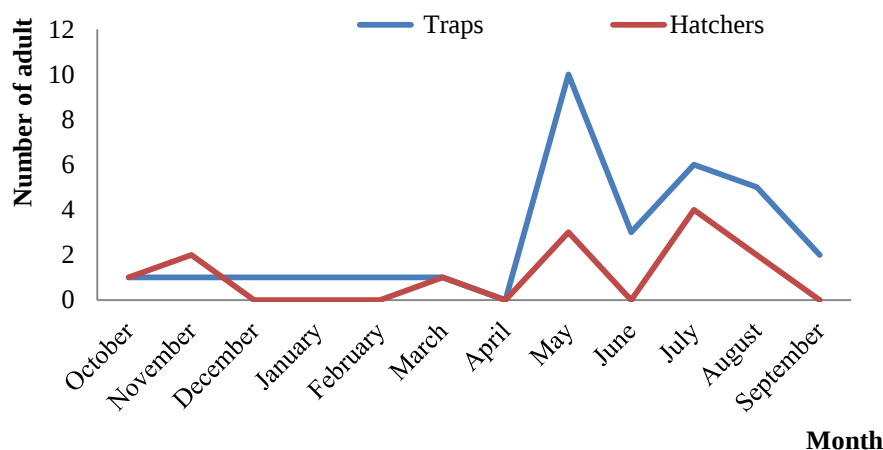


Figure 10: chronology of emergences of adults *Phoracantha semipunctata* in traps and hatches of the Green curtain Taourirt-Oujda 2014

Figure 10. Compares the abundance of *Phoracantha semipunctata* in traps and hatches of the Green curtain Taourirt-Oujda for the year 2014, data from the four sites and three hatches are grouped together. Student test gives a $T = 1.535$ with a significance level of 0.07, $P > 0.05$ the hypothesis H_0 of equality of means is accepted, so there is no significant difference between the values obtained from the traps and hatches. Emergences obtained in hatches in May, July and August are consistent with the catch in the traps at that period, individuals trapped in June probably from May emergences and those in September from August emergences. The November emergences likely match imagoes passing to winter in diapauses since it is not found in the traps. The low catch rates in the traps during the other months are linked to the absence of emergences during these periods, however, they reflect a number of individuals remain more or less active during the cold season, thanks to some thaw without doubt.

3.2. Coastal area of Saïdia

3.2.1. Traps

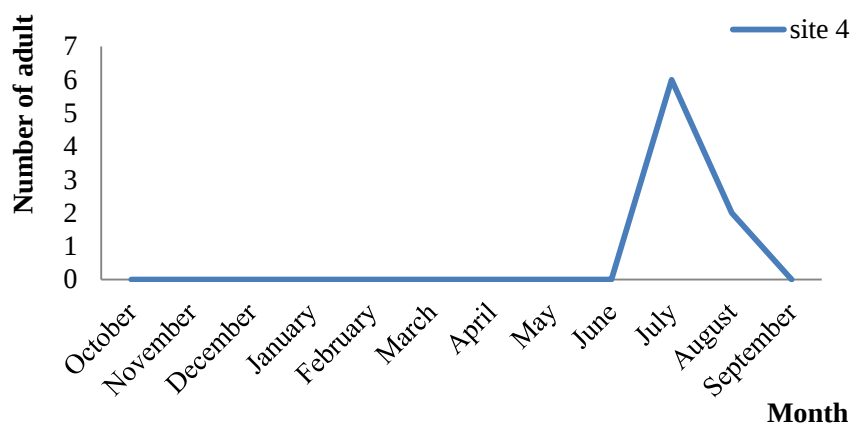


Figure11: chronology of emergences of adults *Phoracantha semipunctata* in the coastal area of Saïdia 2013

Figure11. Presents the abundance of imagos *Phoracantha semipunctata* harvested in traps Site 4 of the coastal area of Saïdia during the year 2013 (the other sites did not provide any individual). All individuals were captured in July and August with a peak in July.

3.2.2. Hatchers

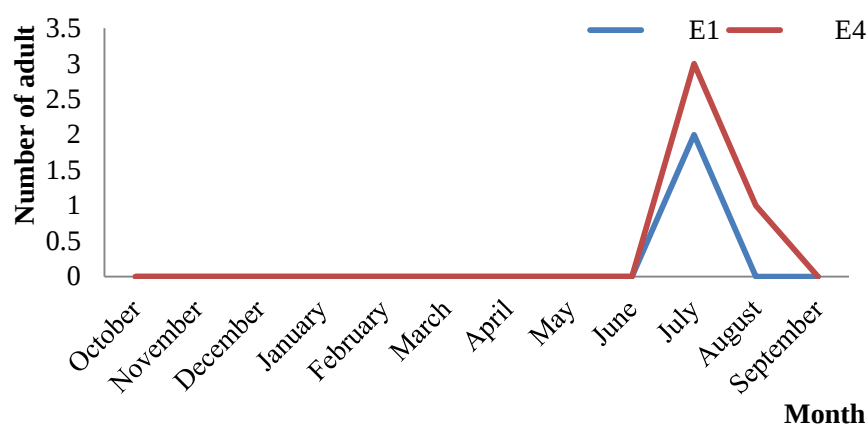


Figure12: chronology of emergences of adults *Phoracantha semipunctata* in hatchers site 4 of the coastal area of Saïdia 2013

Figure12. Represents the variations from the number of adult emergences of *Phoracantha semipunctata* in hatchers E1 and E4 of site 4 from the coastal area of Saïdia. The statistical analysis of student test for independent samples give a $T = -0.545$ with a significance level of 0.29, $P > 0.05$. The hypothesis H_0 of equality of means is accepted. Thus, there is homogeneity of the values obtained in the two hatchers of Site 4 whatever the diameter of the trunks and branches. The insect is found as well in trunks as in the branches. All emergences have occurred in the summer, mainly in July.

3.2.3. Comparison between traps and hatchers

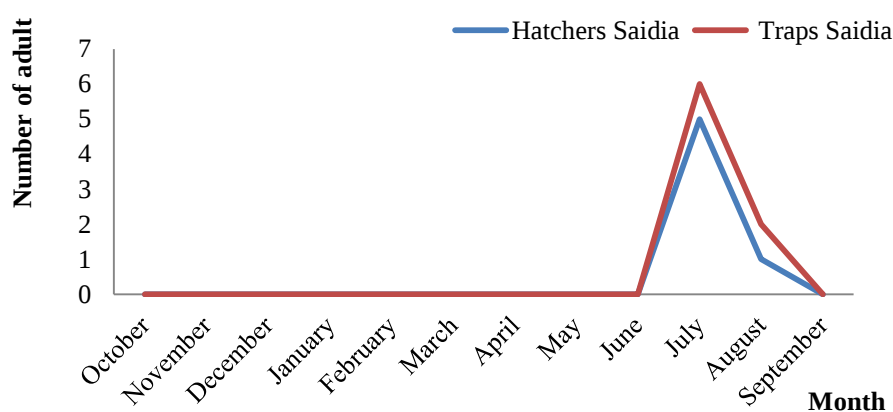


Figure 13: chronology of emergences of adults *Phoracantha semipunctata* in traps and in hatchers from coastal area of Saïdia 2013

Figure13. Compares the abundance of *Phoracantha semipunctata* in traps and hatchers of the coastal area of Saïdia in the year 2013. The student test gives a $T = 0.252$ with a significance level of 0.4, $P > 0.05$. The hypothesis H_0 of equality of means is accepted, therefore there is homogeneity between the values obtained in traps and hatchers. The catch in the traps are in close relation with emergences obtained by rearing. The emergence period and activity imagos is limited only to the summer period (July and August), species is entirely absent the rest of the year.

3.3. Comparison of the two stations

3.3.1. in traps

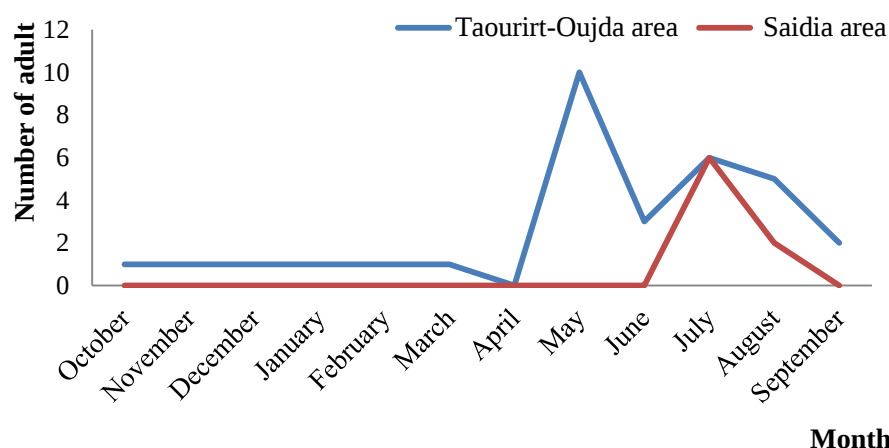


Figure 14: chronology of emergences of adults *Phoracantha semipunctata* in the coastal area of Saïdia 2013 and in the green curtain Taourirt-Oujda 2014

Figure 14. Compares the abundance of *Phoracantha semipunctata* collected in the traps of the coastal area of Saïdia in the year 2013 and in the green curtain Taourirt-Oujda during 2014. The student test provides a $T = 2.021$ with a significance level of 0.03, and $P < 0.05$. The hypothesis H_0 of equality of means is rejected, so there is a significant difference between the values obtained in the two study areas. This is because, *Phoracantha semipunctata* is more abundant in the Taourirt-Oujda area than the coastal area Saïdia. Furthermore,, the emergence period of activity and imagos is much longer in the Taourirt-Oujda area in the coastal area of Saïdia. Indeed, the emergence period of imagos activity is much longer in the Taourirt-Oujda area than the coastal area of Saïdia. These differences may be related to various factors such as the fact that the measurements were fact for two different years. It is however likely that the explanation lies in the existence of a less abundant population in Saïdia. The existence of frequent salty spray in this site associated with some soil salinity could be the cause.

3.3.2. in hatchers

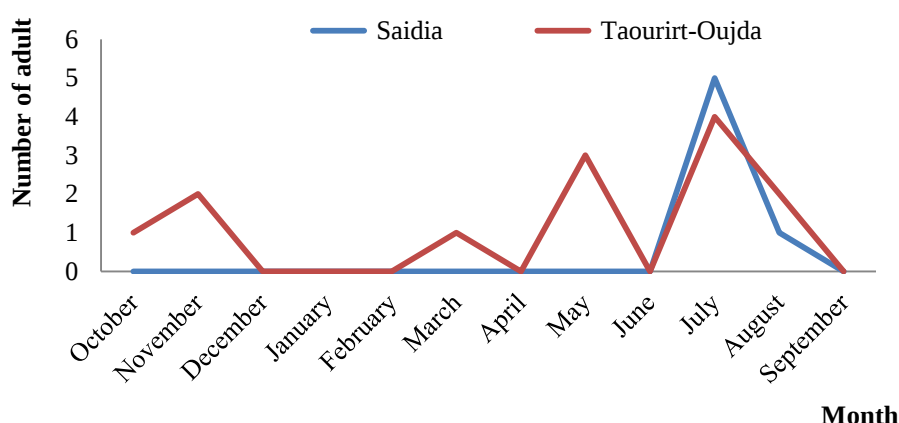


Figure 15: chronology of emergences of adults *Phoracantha semipunctata* in hatchers of coastal area Saïdia 2013 and green curtain Taourirt-Oujda 2014

Figure15.Compares the abundance of imagos *Phoracantha semipunctata* harvested in the hatchers of the coastal area of Saïdia and the green curtain Taourirt-Oujda. The student test provides gives a $T = 0.706$ with a significance level of 0.21, $P > 0.05$. The hypothesis H_0 of equality of means is

accepted, so there is no significant difference between the values obtained in the two study areas. In both cases, the main emergence period is in July and August. Emergences observed in May and November in the hatcheries of green curtain Taourirt-Oujda, are more modest and do not appear sufficient to mark a difference between the two stations.

4. Discussion

During the period of our study, the main emergence period imagines were observed in late spring season (in May) and during the hottest time of the year (July and August). Less important emergences appear in the autumn in the green curtain Taourirt-Oujda, which is not the case in Saïdia. In the last station the imagoes appear as active in the summer when they are almost all year in the green curtain Taourirt-Oujda, either sporadically from October to March is more importantly from May to September. These results are in agreement with those of various authors that concluded an extended period of takeoffs adults without distinct generations [19, 20, and 21].

Infestations recorded at the green curtain Taourirt-Oujda which is known by an arid climate are higher than those in the coastal area of Saïdia, which have a warm sub-humid climate. During our study period, we have seen a rapid spread of the species at the green curtain, especially during the summer period, in which there was no precipitation causing a net water deficit while, temperatures were very high. This propagation is reflected, to the shaft, in the one hand by the partial or total drying of branches, yellowing and leaf drop. Also, by the presence of galleries on the trunk and the flow gum on the bark on the other hand. However, in the coastal area of Saïdia, the presence of imagoes was only in summer and the lowest rate of infestation (one site on the 4 studied) reflects the existence of a smaller population which imagoes appear during the most favorable period (during the summer). This can be explained by biological potential of Longhorn as noted by some authors [22] and especially by the presence of adverse factors such as humidity as mentioned by Hanks [23], in addition to the high salinity as Meijer indicates [24, 25]. The latter factor seems to explain this relative scarcity as the only site where the species are present as the one that is furthest from the sea, therefore the more sheltered sea spray.

Life cycle of *Phoracantha semipunctata* (figure 16)

Phoracantha semipunctata is a pest stenophagous which attacks to various species of *Eucalyptus*, the host has an olfactory taxi with respect to the insect as is the case among various xylophagous [26]. This one is especially attracted to weakened or cut trees but also attacks more vigorous trees. The species has a coupling duration about 1 minute so close to that of other cerambycids (about 90 seconds) [23]. The insect flies, bridge and develops as the thermal conditions that permit it and prefers to attack the weakened trees, for climatic, edaphic or pathological reasons. Oviposition occurs between September and April in South Africa (southern hemisphere) [27, 28] and from March to November in Palestine (northern hemisphere) [29]. Moreover, Chararas [19] states that in Tunisia oviposition begins at above 16 ° C, knowing that egg laying lodged in spring provide short larval development to individuals who give the autumnal emerging and those filed in late summer and in the autumn have a long larval development and give the emerging spring. Females choose the ovipositor site which they explode with their oviscape. Oviposition may contain to 160 eggs deposited by succesifs packages in the bark crevices or at the junction point of two branches [1]. It is done on the moisture of which bark is 35 to 40% [30]. It begins after 24 to 36 hours on a Eucalyptus sawn section [31, 20] and the insect never lay another essence. Hatching occurs after 10 to 14 days incubation period [32] or even 3 to 8 days at 27.6 C and 68% of relative humidity [33]. However, Gil Sortes and Mansilla Vazquez [34] achieved a maximum of hatching on the 16th day at 26 ° C and a relative humidity of 80%. The hatched larvae burrow into the bark tab under which the female laid. Then they pass through the bark perpendicular by digging the subcortical galleries [35]. Gradually of their growth, galleries are developing in depth and width. Larval development extends over at least five stadia taking about 2 to 4 months according to [36] and [37]. It ends in nymphal logettes, closed by

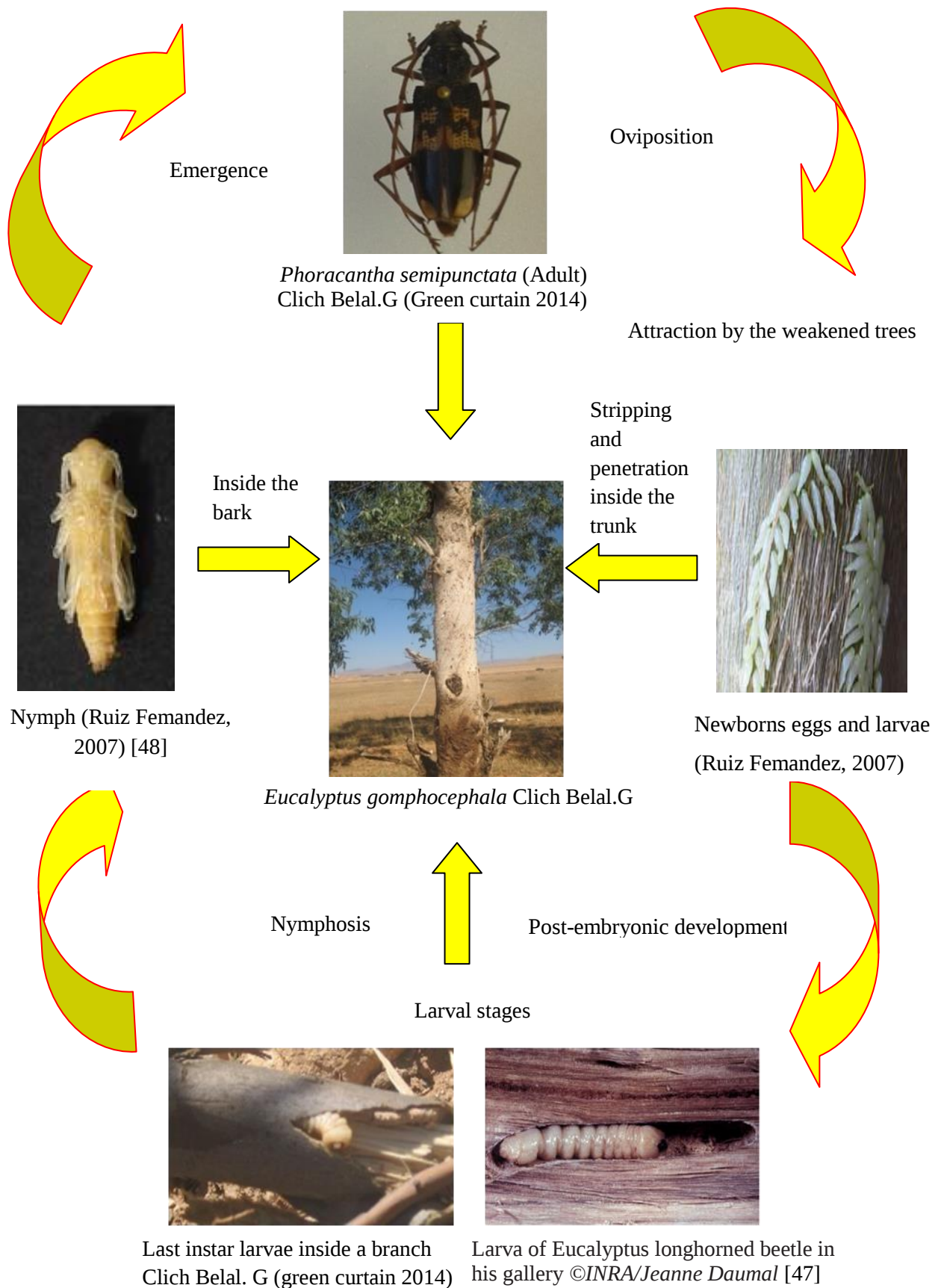
opercula sawdust. During their growth they destroy the cambium, and outer xylem and sapwood [29, 38]. The larva of *Phoracantha semipunctata* has the ability of digesting cellulose directly without the intervention of symbionts [30]. Chararas and Chipoulet [39] indicate that the larvae feed on the sapwood, rich in soluble sugars (many carbohydrates except lactose), starch, pectin, xylan, carboxymethyl cellulose, hemicellulose and cellulose. This power supply disrupts the transport of water and the supply of nutrients in the tree [40]. The duration of larval development requires 60 days minimum [33]. For Scriven and al [32]. Larva evolves in 70 days; this period is extended to 180 days in dry sections (Loyttyneimi, 1983). Laboratory studies performed by Hanks and al [41]. Showed a strong positive correlation between larval development and an optimum temperature of 25 ° C. After the evolution of larval stages L1 to L4, each larva of the fourth stage enters a resting stage prepupal for about 10 days [37] and then pupates into chrysalis rooms where it remains about 10 days to two weeks [42, 43]. The adult, once melanise lot by the nymph tunnel by eating sawdust [34] through an oval hole. In California adult emergence occurs from late April to October usually during twilight who gives rise to a first generation. And the emergence of imagoes from August to September gives rise to a 2nd generation. The longhorn is multivoltine in California and has 2-3 overlapping generations per year, the imaginal emergence is effected in two periods: spring and fall. In spring and summer, requires 3-4 months to complete its life cycle, but from the autumn and winter the cycle can take up to nine months. The larvae may be present at any time during the year, and the adults can emerge from pupae from April until October [43]. Otherwise, the successive phases of insect development in Morocco [35], Tunisia [19] and Israel [21] have varying durations depending on the temperature and quality of the food. In Algeria, according [1] and [44], taking account of the spreading of the oviposition, one can meet in the same population one or two generations per year. The imago *P. semipunctata* is nocturnal habits [45]. Its activity begins in the evening and continues through during the night with frequent short flights. The longevity of the adult was 40 days in summer to 180 days in winter according [32] but not exceeding 90 days according Chararas [19] which states that the reproductive activity is possible below 15° C. The imago is flying mainly between 18 and 40° C [30] and hardly below 18° C [30, 20].

Conclusion

According to the synthesis of the authors on the life cycle of *Phoracantha semipunctata* and results achieved in the North Eastern Morocco, it can be deduced that the species appears to be clearly monovoltine in the coastal zone Saïdia, with a single emergence period (summer). This emergence period of adults has occurred with a maximum catches on July. However, at the green curtain Taourirt-Oujda, the emergence of the adults in May, July and August on the one hand and in November, on the other hand, suggests the presence of two overlapping generations the first being more abundant than the second.

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Figure 16: Development Cycle of *Phoracantha semipunctata*



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