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Abstract. In Tunisia, The pistachio twig borer, *Chaetoptelius vestitus* Mulsant & Rey (Coleoptera, Curculionidae, Scolytinae) is a serious pest of pistachio tree, *Pistacia vera*. The insect has two dispersal phases: in the first, mature adults seek recently cut pistachio branches, or live tree branches weakened by drought or physiologically stressed to lay eggs and initiate reproduction; in the second, new emerged adults fly toward healthy trees where they feed on the buds and excavate feeding galleries just beneath the buds toward the center of the twig. This paper deals with a study over two successive years conducted in the field in the Centre-East of Tunisia on shoot feeding, overwintering and the presence of *C. vestitus* inside pistachio twigs. The duration of these processes including age, diameter, length, of the burrowed tunnels as well as degree of shoot infestation were reported. The sampled twigs varied from 1 to 53 cm in length and between 0.2 and 1.1 cm in section. Results indicated that the percentage of the shoots damaged by *C. vestitus* ranged from 70 to 100% all year round except during the period from late March to late April where the percentage of infestation varied from 15 to 25%. This period could be attributed to the swarming of adults emerged from reproduction sites. Adults are present in feeding galleries all year round. However their densities dramatically decrease from late October to late March from an average of 16 adults per meter of twigs to 4 adults. This period could be a sign of adult migration as demonstrated the low number of adults per gallery; an average of 0.2 adult per gallery compared with an average of 0.8 adult per gallery throughout the other period. Most adults were found in feeding tunnels in current-year shoots. The length of feeding galley varied from 0.03 cm to 2.75 cm and diameter varied from 0.2 cm to 1.1 cm. The mean number of adults per meter of twigs varied from 0 to 68.18 depending on sampling dates. Consequently, the insect overwinters in two forms (1) a portion of the population hibernate as adult stage inside feeding galleries of pistachio shoots and (2) the other fraction leaves feeding galleries in autumn to initiate reproduction phase. The knowledge of shoot-feeding phase is one of the main elements when developing integrated management strategies.

Keywords. *Chaetoptelius vestitus* – *Pistacia vera* – Shoot feeding – Tunisia.

Essais de caractérisation de la phase de nutrition du scolyte du pistachier

Résumé. *Le scolyte du pistachier,* Chaetoptelius vestitus *Muls & Rey (Coleoptera, Curculionidae, Scolytinae) est un ravageur clé du pistachier, Pistacia vera L. L'insecte évolue en deux phases bien distinctes : dans la première, les adultes matures recherchent des branches cassées du pistachier, des arbres stressés ou dans un état physiologique médiocre pour pondre des œufs et se reproduire ; dans la seconde l'insecte attaque les bourgeons puis mine des galeries profondes dans le cœur du rameau. Les rameaux minés par les galeries de nutrition flétrissent très rapidement puis se dessèchent. Dans ce travail d'une durée de deux ans, réalisé dans le centre Est de la Tunisie, on a essayé de caractériser la phase de nutrition de l'insecte, la durée de présence de l'insecte dans les galeries nutritionnelles, son mode d'hibernation ainsi que la longueur, le diamètre des galeries et le taux correspondant d'infestation des rameaux. Vingt rameaux (dont la longueur varie de 1 à 53 cm et le diamètre de 0,2 à 1,1 cm) ont été prélevés au hasard, avec une fréquence généralement hebdomadaire sur au moins 5 arbres et examinés au laboratoire en distinguant les rameaux de l'année, des rameaux d'un an d'âge puis disséqués et examinés sous loupe binoculaire. Les résultats indiquent un fort pourcentage d'infestation des rameaux variant de 70 à 100% durant les deux années d'étude à l'exception de la période allant de la fin mars à la fin avril où ce taux variait de 15 to 25%, période caractérisée par le début de débourrement des arbres avec faible présence de nouvelles pousses et où les adultes issus de la phase de reproduction ont débuté leur émergence. Les adultes sont présents dans les galeries de nutrition l'année du-*

rant toutefois leur densités diminuent fortement (de 16 adultes par mètre linéaire de rameau à 4 adultes par mètre) durant la période de la fin octobre à la fin mars témoignant de la migration des imagos vers les sites de reproduction. La plupart des adultes sont localisés dans les pousses de l'année. La longueur moyenne de la galerie varie de 0,03 cm à 2,75 cm alors que le diamètre entre 0,2 cm et 1,1 cm. Le nombre moyen d'adultes par mètre linéaire de rameau varie de 0 to 68.18 et ce en fonction des dates d'échantillonnage. De ces résultats il ressort que l'insecte hiverne sous deux formes (1) une fraction de la population passe l'hiver sous forme d'adultes dans les galeries nutritionnelles, pour les quitter au débourrement de l'arbre et s'attaquer aux nouvelles pousses (2) une fraction quitte sa logette pour amorcer une phase de reproduction en automne. La connaissance de la période de nutrition du scolyte du pistachier, C. vestitus *est un élément important à prendre en considération dans une stratégie de lutte intégrée contre ce déprédateur.*

Mots-clés. Chaetoptelius vestitus – Pistacia vera – *Galeries nutritionnelles – Tunisie.*

I – Introduction

The pistachio bark beetle, *Chaetoptelius vestitus* Mulsant & Rey (Coleoptera, Curculionidae, Scolytinae), has been reported as a pest of pistachio tree throughout the Mediterranean as well as in Asia (Davatchi, 1958, Balachowsky 1963, Mehrnejad, 2001). In Tunisia, *C. vestitus* is considered to be an important pest of Pistachio tree. The insect has two biological periods (1) a reproduction phase which takes place in stumps, pruned pistachio logs left over from annual pruning or occasionally in live tree branches, weakened by drought, physiological stress, mechanical damage or unsatisfactory pruning and (2) a feeding phase on healthy pistachio shoots and buds (Braham and Jardak, 2012). Generally, the new generation of beetle emerges in spring. Adults fly to the crown and nearby pistachio trees where they feed on the buds and excavating feeding galleries inside twigs seriously affecting the growth of the tree and its flowering. This paper deals with the characterization of the duration of feeding phase, its importance, the presence of *C. vestitus* inside shoots and the length of feeding galleries. The knowledge if these processes contribute to the best management of the insect.

II – Materials and methods

The study was undertaken in a private pistachio orchard in the Sfax region (34°44'N; and 10°45' East). Sixty one female pistachio trees and 9 males were planted in 1979 under rain fed conditions. The orchard, unsprayed was known to be infested by the pistachio twig borer. Twenty pistachio shoots were randomly sampled at weekly interval from a least 5 different trees during two consecutive years (from 21 June 2001 to 23 August 2003). Twigs were categorized in the laboratory as newly shoots (current shoots) or one-year old shoots and then dissected under stereomicroscope to record the number of feeding galleries, the length of each gallery, the number of alive or dead insects. The percentage of infested twigs was calculated as the ratio of infested twig divided by the total number of sampled twigs.

III – Results

1. Twig section

The diameter of the sampled twig varied from 0.2 to 1.1 cm with an average of 0.51 cm (Fig. 1).

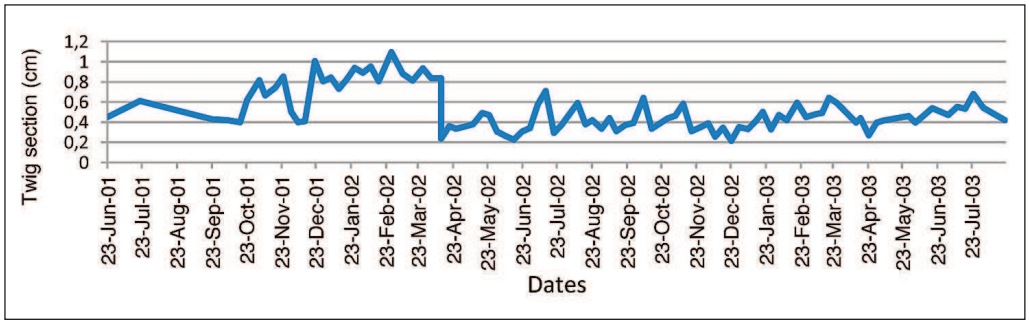

Fig. 1. The average measures of twig sampled during the study.

2. Shoot and twig infestation

Twigs were highly infested showing high percentage of buds damaged by adults. This percentage varied from 70 to 100% all year round except from late March to late April where the percentage of infestation varied from 15 to 25% (Fig. 2). During April newly formed shoots were sampled following bud and leaves appearing. Likely, this period could be attributed to the swarming of adults emerged from reproduction sites.

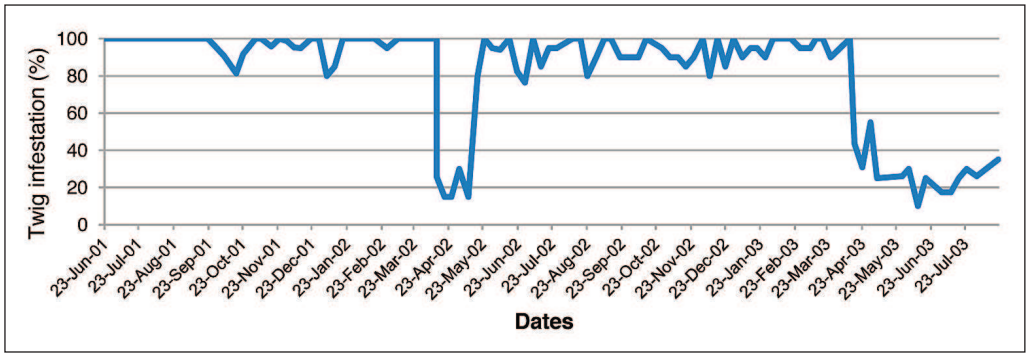

Fig. 2. Percentages of infested twigs during the study period.

3. Average number of adults per feeding gallery

The average number of adult per gallery varied from zero to 1 according to season. The mean number varied between 0.8 in summer and autumn to 0.13 in winter-early spring. In spring this percentage approaching 0.6 adults per gallery. We only found at the most 1 adult per gallery (Fig. 3). It is possible that the adult inside gallery emits pheromone to prevent congeners for colonizing twigs. Most adults were found in feeding tunnels in current-year shoots.

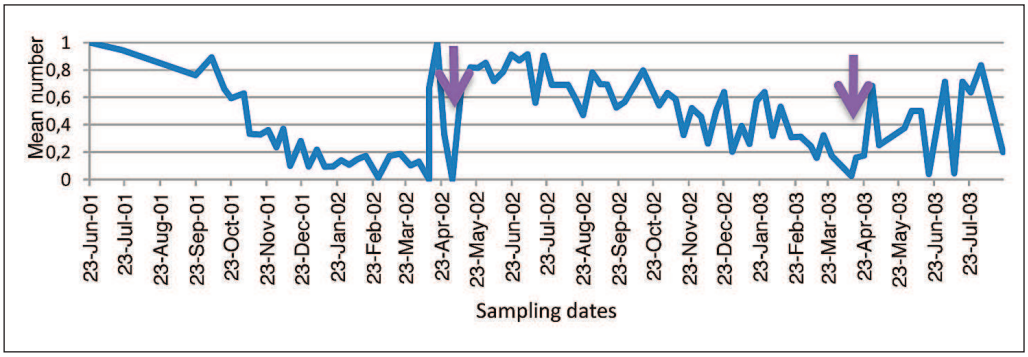

Fig. 3. Number of *C. vestitus* adult per feeding gallery (arrows indicate new flushing).

4. Mean gallery length

During the study period, the mean length of feeding gallery was 1.23 ± 0.66 cm (Min = 0.03 cm; Max = 2.75 cm) and diameter varied from 0.2 cm to 1.1 cm. The gallery length is low following bloom then increases thereafter (Fig. 4).

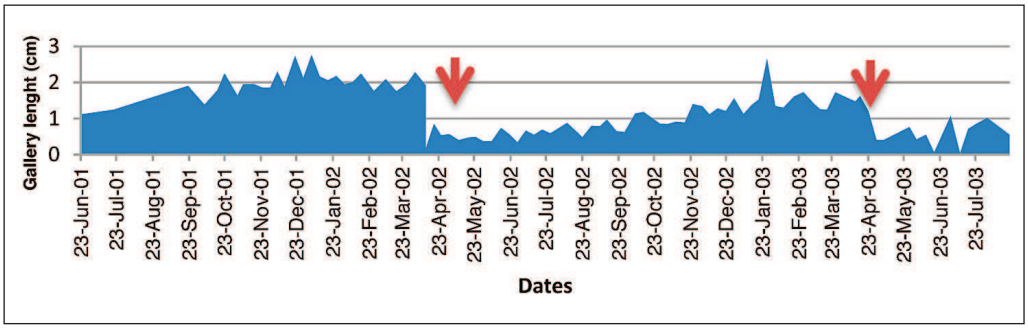

Fig. 4. Mean gallery length (arrows indicate new flushing).

5. The mean number of adults per meter of twig

For the two years of study, adults are present in feeding galleries all year round with an average of 8 insects per meter of twig (minimum 0; maximum 68.18 insects depending on sampling dates). However their densities dramatically decrease from late October to late March (from an average of 16 adults per meter of twigs to 4 adults). This period could be a sign of adult migration as demonstrated the low number of adults per gallery; an average of 0.2 adult per gallery compared with an average of 0.8 adult per gallery throughout the other period.

IV – Discussion and conclusions

According to our Knowledge there is no published study reporting the characterization of *C. vestitus* feeding period. Indeed, In Algeria, Chebouti-Meziou *et al*. (2011) studied mainly the reproductive period of the insect in Tlemecen. They reported that the insect lays eggs and makes the reproductive tunnels in the young shoots of the year. Their results were in contradiction with ours, since we have never found eggs or reproduction galleries in young shoots. Indeed Braham and Jardak

(2012) studying the life cycle of the pistachio twig borer reported two different ecological cycles (1) a reproduction phase which takes place in stumps, pruned pistachio logs left over from annual pruning, weakened by drought, physiological stress, mechanical damage or unsatisfactory pruning and (2) a feeding phase on healthy pistachio shoots and buds. The insect begins attacking new shoots few days following bud and leaves initiation (late April-early May). Our data are in agreement with results reported by Mehrenjed (2001) in Iran who indicated that *C. vestitus* infestation commenced in May. The small difference in time emergence between Tunisia and Iran may be attributed to local climatic conditions. The insect overwinters in two forms (1) a portion of the population hibernate as adult stage inside feeding galleries of pistachio shoots and (2) the other fraction leaves feeding galleries in autumn to initiate reproduction phase. The knowledge of shoot-feeding phase is one of the main elements when developing integrated management strategies.

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