

Distribution and Hosts of *Monochamus galloprovincialis* in Tunisia

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ABSTRACT

Mejri, M., Naves, P., Sousa, E., and Ben Jamâa, M.L. 2014. Distribution and hosts of *Monochamus galloprovincialis* in Tunisia. Tunisian Journal of Plant Protection 9: 171-176.

The pine sawyer beetle *Monochamus galloprovincialis* is one of the main vectors of the pathogenic pine wood nematode *Bursaphelenchus xylophilus*, the causal agent of pine wilt disease. Although the nematode is absent from northern Africa, the vector *M. galloprovincialis* has been previously reported in Morocco, Algeria and Tunisia. Despite these ancient reports, the insect's distribution, hosts and biology are largely unknown for this part of the world. In this paper, we report on the presence of *M. galloprovincialis* in Tunisia, and record several new locations and the associated pine hosts, with brief notes on its emergence pattern. *M. galloprovincialis* was found to be widely distributed in Tunisia, being especially abundant on Aleppo and maritime pine forests. Insect was found to have a one-year life cycle, with the emergence pattern starting in the middle of May and prolonging until August, with a peak in June. This information will serve to develop a map intended to predict the risk of establishment and incidence of the pine wood nematode in Tunisia.

Keywords: *Monochamus galloprovincialis*, pine wood nematode, *Pinus* spp., Tunisia.

Cerambycid beetles are among the most diverse group of insects with more than 35.000 species grouped in about 4.000 genera (9). The *Monochamus* genus (Coleoptera: Cerambycidae) comprises about 150 species (25), which are worldwide distributed with different

trophic specializations (8, 10). Most of the species are secondary forest pests, which reproduce only in stressed, dying or dead coniferous trees (5). Nevertheless, this genus is worldwide known as the vector of the pathogenic pine wood nematode *Bursaphelenchus xylophilus* (19, 23), which is the causal agent of the pine wilt disease causing wilting and killing susceptible species of pines (15, 28).

Being native to North America, the nematode was introduced into south-east Asia (Japan, China and Korea), and subsequently was detected on maritime pine (*Pinus pinaster*) in Europe, initially

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Accepted for publication 28 October 2014

in Portugal in 1999 (16) and since 2008 in Spain (4, 21). In Europe, *B. xylophilus* is associated with the native pine sawyer *M. galloprovincialis* which appears to be its sole vector (22). The most important aspects of the biology and ecology of this insect have been studied in Europe (2, 7, 13, 17, 24), although no similar studies have been conducted in North Africa where *M. galloprovincialis* appears to be the sole species of its genus to be present (10, 26). In fact, and with the exception of some isolated notes on the presence of this insect in Aleppo pine (*Pinus halepensis*) and maritime pine from Algeria (12), there is no recent information on the distribution, hosts, ecology and biology of this species from any of the Maghreb countries, including Tunisia. In this paper, we report the presence of the pine sawyer in Tunisia, recording several new locations and its

associated local hosts, and giving brief notes on its biology and emergence pattern.

To record the presence of *M. galloprovincialis* in Tunisian pine forests, the trap-tree technique was used. Each month, from April to July 2011 and in each locality, two healthy pine trees (with 15 to 20 cm of diameter) of Aleppo pine, maritime pine and stone pine (*Pinus pinea*) were felled and kept for one month in the field, making them attractive to the oviposition of *M. galloprovincialis* females in the stand. After 30 days, these trees were cut and brought to the laboratories in Tunis, where the logs were individually stored inside meshed tissue in shaded ambient conditions until the insect's emergence. The study was carried out in 13 most important pine forests of Tunisia (Table 1).

Table 1. Characteristics of sampling sites and pine species present

Zone	Forest	GPS coordinates	Pine
Nabeul	Oued Bir	N36°53,354'; E10°47,896'	Aleppo pine, Stone pine
	Dar Chichou	N36°57,725'; E10°59,514'	Aleppo pine, Stone pine
Bizerte	Azib	N37°12,862'; E09°58,332'	Aleppo pine, Stone pine, Maritime pine
Beja	Ouchtata	N36°57,876'; E08°59,852'	Stone pine, Maritime pine
Tabarka	Sidi Badr	N36°56,176'; E08°48,644'	Stone pine, Maritime pine
Ain Drahem	Majen Essef	N36°46,025'; E08°47,511'	Stone pine, Maritime pine
	Babouche	N36°50,690'; E08°42,832'	Maritime pine
	Dar fatma	N36°49,090'; E08°44,795'	Aleppo pine, Stone pine, Maritime pine
Zaghouan	Sidi Aouidet	N36°22,69'; E09°76,45'	Aleppo pine
Siliana	Sidi Said	N36°11,623'; E09°39,140'	Aleppo pine
Kef	Kebouche	N36°12,773'; E08°54,566'	Aleppo pine
Kasserine	Sammama	N35°20, 14'; E08°48,32'	Aleppo pine
	Ain Amara	N35°16,41'; E08°30,00'	Aleppo pine

Emerging *Monochamus* beetles were hand collected from each log and placed individually in plastic tubes with alcohol (95%). Insect identification was made at the Entomological Laboratories of INRGREF in Tunisia and of INIAV in Portugal, using several keys (20, 25, 26, 27, 29). Voucher specimens were kept in the INRGREF entomology collection in Tunis.

A total of 978 adults of *M. galloprovincialis* emerged, during this survey, from the logs of Aleppo pine, maritime pine and stone pine from all the 13 localities studied (Table 2). The most frequent host was Aleppo pine from which 86% of the adults were collected, while 11% emerged from maritime pine and only 3% from stone pine.

Table 2. Hosts and number of *Monochamus galloprovincialis* recovered adults

Zone	Forest	Colonized pine	Number of adults
Nabeul	Oued Bir	Aleppo pine	109
		Stone pine	5
	Dar Chichou	Aleppo pine	58
		Stone pine	4
Bizerte	Azib	Aleppo pine	64
		Stone pine	1
		Maritime pine	41
Beja	Ouchtata	Stone pine	18
		Maritime pine	1
Tabarka	Sidi bader	Maritime pine	18
Ain Drahem	Majen Essef	Maritime pine	2
		Stone pine	1
	Babouche	Maritime pine	39
	Dar Fatma	Aleppo pine	21
Maritime pine		8	
Zaghouan	Sidi Aouidet	Aleppo pine	64
Siliana	Sidi Zid	Aleppo pine	125
Kef	Kebouche	Aleppo pine	128
Kasserine	Samama	Aleppo pine	232
	Ain Amara	Aleppo pine	39

No insects emerged during 2011. The earliest specimen emerged on 12 May 2012, nearly one year after trap tree setting from a maritime pine log from Babouche forest, while the last one emerged on August 07 from an Aleppo pine log from Oued Bir forest. The peak of emergence was observed in the middle of June, 2012.

In this study, the presence of *M. galloprovincialis* in Tunisia was

confirmed; it is being the sole species of its genus found during the survey. Besides Darnaya Aleppo pine forest (Kef; Northwest of Tunisia), where this species was previously recorded several decades ago (26), the beetle was now found in 13 new Tunisian localities, belonging to nine different zones (Fig. 1), confirming that it is an apparently common and widely distributed species in Tunisian pine forests.

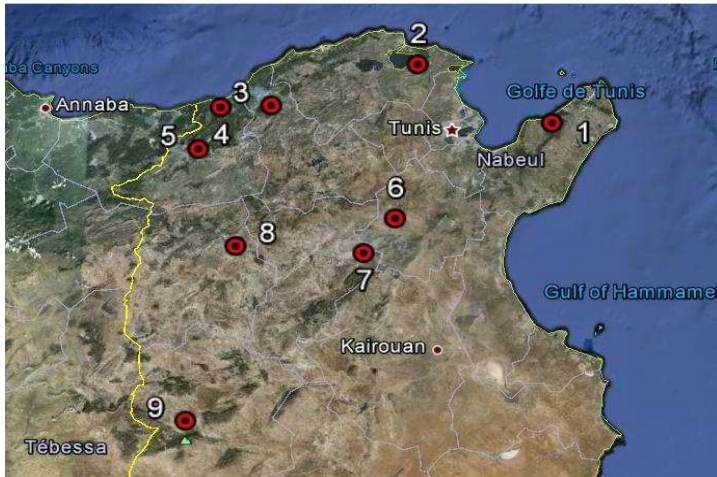


Fig. 1. Distribution of *Monochamus galloprovincialis* in Tunisia (1: Nabeul; 2: Bizerte; 3: Beja; 4: Tabarka; 5: Ain drahem; 6: Zaghouan; 7: Siliana; 8: Kef; 9: Kasserine).

Our observations suggest that the pine sawyer appears to have an univoltin cycle (only one generation per year) in northern Africa, similarly to neighboring European countries such as Portugal (17), Italy (7), Turkey (1, 3) or France (14). The emergence pattern recorded in Tunisia is also similar to the pattern described in southern Portugal, where the first beetles likewise emerge in May and the last one in August/September, with a peak in June/July (17). However, further studies detailing the biology and ecology of this species in Tunisia are in progress.

The most important pine host of this insect in Tunisia is undoubtedly Aleppo pine, followed by maritime pine which is also being a frequent host. These observations are in full agreement with studies made under controlled conditions in Portugal where these two pines, along with *P. radiata* and *P. sylvestris*, were found to be suitable hosts for oviposition and larval development of *M. galloprovincialis* (18). Few beetles emerged also from stone pine in Tunisia, contrasting with previous observations in

Europe where this pine is not a natural host (18). Although the number of beetles emerging from stone pine were low (29 insects out of a total of 978), this atypical association deserves to be studied with more detail in the future.

In Tunisia, *B. xylophilus* and its *Monochamus* vector are listed as quarantine pests (11), in view of the general concern about the risk of introduction and dispersion of the exotic nematode pathogen by the international wood trade, the presence of native vector insects and susceptible pine hosts. We have now found that the insect, which could serve as vector for the pine wood nematode, appears to be abundant and widespread in Tunisian forests, therefore increasing the risk associated with the establishment of the pine wood nematode in case this exotic organism is introduced into northern Africa. Furthermore, the frequent association of *M. galloprovincialis* with Aleppo pine, which is the most important and widespread species in Tunisia (53% of the total forest area) and with maritime

pine (0.78% of the forested area) which is more frequent in the North West (6), also creates some concern, specially for the last pine species, since maritime pine is considered to be very susceptible to *B. xylophilus* and is the nematode's main host in Europe (16). Future studies on the

biology of the insect vector, its abundance and host preference in Tunisia will constitute valuable information for the elaboration of a risk-map intended to predict the establishment and incidence of the pine wood nematode in case of introduction in Tunisia.

RESUME

Mejri M., Naves P., Sousa E. et Ben Jamâa M.L. 2014. Distribution et plantes hôtes de *Monochamus galloprovincialis* en Tunisie. *Tunisian Journal of Plant Protection* 9: 171-176.

Monochamus galloprovincialis est l'un des principaux vecteurs du nématode du pin, l'agent causal de la maladie du dépérissement du pin. En dépit du non signalement de la présence de ce nématode en nord d'Afrique, son vecteur a été toujours rapporté au Maroc, en Algérie et en Tunisie. Toutefois, les données sur sa distribution, ses plantes hôtes et sa biologie restent toujours méconnues pour cette partie du monde. Cette note confirme la présence de *M. galloprovincialis* en Tunisie, apporte des éclaircissements quant à sa distribution, les espèces de pins auxquelles il est associé et décrit brièvement son cycle. Ainsi, cet insecte est largement réparti en Tunisie. Il est plus abondant sur pin d'Alep et pin maritime, où il forme une seule génération par an. Son émergence commence en mai et s'étend jusqu'au mois d'août avec un pic en juin. Cette information va servir pour le développement d'une carte permettant de prédire le risque d'établissement et l'incidence du nématode du pin en Tunisie.

Mots clés: *Monochamus galloprovincialis*, nématode du pin, *Pinus* spp., Tunisie

ملخص

ماجري، منال وبادرو نافاس وإدمندو سوسا ومحمد لحبيب بن جامع. 2014. التوزيع الجغرافي والنباتات العائلية لخنفساء الخشب *Monochamus galloprovincialis* بتونس.

Tunisian Journal of Plant Protection 9: 171-176.

تعتبر خنفساء الخشب *Monochamus galloprovincialis* من أهم الحشرات الناقلة لنيماتودا الصنوبر الذي يسبب التيبس لهذه الأشجار. ورغم تسجيل وجود هذه الحشرة في شمال أفريقيا سابقا إلا أنه لا توجد دراسات حول التوزيع الجغرافي أو النباتات العائلية أو البيولوجيا. ولقد مكنتنا هذه الدراسة من تأكيد وجود هذه الحشرة بتونس ومن توضيح توزيعها الجغرافي بالبلاد وتحديد أنواع الصنوبر التي تعيش عليها وكذلك من توصيف جزء من خصائصها البيولوجية. فهذه الحشرة تتواجد في أغلب غابات الصنوبر ببلادنا وخاصة غابات الصنوبر الحلبي والصنوبر البحري حيث تكون هذه الخنفساء جيلا واحدا في السنة. ويبدأ ظهور الحشرات البالغة من أوائل شهر ماي ليلبلغ أقصاه في شهر جوان ويتواصل إلى شهر أوت. ستساعد هذه المعلومة على وضع خارطة تسمح بالتكهن بمخاطر انتصاب وتأثير نيماتودا الصنوبر في تونس.

كلمات مفتاحية: تونس، صنوبر، نيماتودا الصنوبر، *Monochamus galloprovincialis*

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