

NEW CONTRIBUTION TO THE KNOWLEDGE OF MYCANGIA IN *PLATYPUS CYLINDRUS* (FABRICIUS, 1792), AND COMMENTS ABOUT THE VARIATION OF SOME MORPHOLOGICAL STRUCTURES IN MEDITERRANEAN ISOLATED POPULATIONS (COLEOPTERA: CURCULIONIDAE, PLATYPODINAE)

Latifa Belhoucine¹, Rachid T. Bouhraoua¹, Jamal M. Harrak², Amador Viñolas³, Armando Equihua-Martinez⁴, Jorge Valdez-Carrasco⁴ & Juli Pujade-Villar³

¹ University of Tlemcen. Laboratory: conservation management of water, soil and forests, Algeria.

– belhoucine_latifa2@yahoo.fr, rtbouhraoua@yahoo.fr

² University of Amsterdam, Institute for Biodiversity and Ecosystem Dynamics, Amsterdam, The Netherlands.

–harrak@hotmail.com

³ Universitat de Barcelona, Facultat Biologia. Dept Biologia Animal. Avda Diagonal, 645. 08028-Barcelona, Spain.

–jpujade@ub.edu, av.rodama@gmail.com

⁴ Instituto de Fitosanidad, Colegio de Postgraduados, 56230 Montecillo, Texcoco, Estado de México (México).

–equihuaa@colpos.mx, jvaldez@colpos.mx

Abstract: Ambrosia beetles have an obligate relationship with the ambrosia fungi that they feed on. Some of them have special structures called mycangia, used to convey fungi when they colonize new hosts. This paper describes the mycangia of the cork oak pinhole borer *Platypus cylindrus*, based on material collected in Algeria, France, Italy and Spain. The external morphology of these structures is compared with those of different species of the genus *Platypus*. The presence of non prothoracic mycangia is also explored and male genitalia variations are discussed.

Key words: Coleoptera, Curculionidae, Platypodinae, *Platypus cylindrus*, mycangia, morphology, Mediterranean basin, Algeria.

Nueva aportación al conocimiento de los micangios en *Platypus cylindrus* (Fabricius, 1792), y comentarios sobre la variación de algunas estructuras morfológicas en poblaciones mediterráneas aisladas (Coleoptera: Curculionidae, Platypodinae)

Resumen: Los coleópteros ambrosiales tienen una relación obligada con algunas especies de hongos de los que se alimentan. Algunos de ellos tienen estructuras especiales llamadas micangios, que utilizan para transportar los hongos cuando colonizan nuevos huéspedes. En este trabajo se describen los micangios del barrenador del alcornoque, *Platypus cylindrus*, a partir de ejemplares colectados en Argelia, Francia, Italia y España. Se compara la morfología externa de estas estructuras de diferentes especies del género *Platypus*. Se discute la presencia o ausencia de micangios no protorácicos. Por último, se exponen los cambios o variaciones morfológicas de la genitalia masculina de las poblaciones europeas estudiadas.

Palabras clave: Coleoptera, Curculionidae, Platypodinae, *Platypus cylindrus*, micangia, morfología, cuenca mediterránea, Argelia.

Introduction

All Platypodinae species are known as “ambrosia beetles”, they inhabit the sapwood of trees and both adults and larvae feed on ambrosia fungi carried and introduced by the adults inside the galleries dug on the wood (Beaver, 1989). Several fungi have already been isolated from *Platypus cylindrus* and its galleries in *Quercus* spp. (Baker, 1963; Cassier *et al.*, 1996; Sousa *et al.*, 1997; Morelet, 1998; Henriques *et al.*, 2006, 2009; Belhoucine *et al.*, 2011b, 2012; Belhoucine, 2013, among others); in Algeria only a study is reported Belhoucine *et al.* (2011b). The beetles and their fungi are intimately associated in a mutualistic relationship (Batra, 1963) causing damage of economic significance to trees and timber (Nakashima, 1975; Cassier *et al.*, 1996). Besides the implication in insect feeding, ambrosia fungi might also be involved in other processes such as host weakness, through pathogenic action; decomposition of lignocellulolytic compounds, which helps gallery construction and enables fungi colonization; and/or antagonism that controls the growth of other fungi (Sousa & Inácio, 2005; Henriques *et al.*, 2006, 2009).

Beetles and their associated fungi have evolved morphological adaptations to ensure maintenance of symbiosis from generation to generation. The most obvious adaptations of the insects for consistent dispersal of certain fungi are specialized structures in the integument of the beetles used for the storage, transport and transmission of fungi (Kirisits, 2007).

These structures have been defined as mycangia or mycetangia (Batra, 1963; Francke-Grosman, 1967; Beaver, 1989; Berryman, 1989). Mycangia are cuticular tubes, pouches or pits of various sizes, associated with glandular cells that produce secretions which protect and preserve the spores of associated fungi and opening to the surface of the body (Francke-Grosman, 1967; Batra, 1963; Beaver, 1989; Léveux *et al.*, 1991; Six, 2003). Whitney (1982) and Six (2003) defined the mycangium as a structure that functions in the transport and protection of fungi, regardless whether glandular cells are present or not.

These structures are commonly classified on the basis of their location on the beetles and structural characteristics.

There is a great diversity in the location, form, structure and size of mycangia in xylomycetophagous species (Batra, 1963; Francke-Grosmann, 1967; Beaver, 1989; Berryman, 1989). Mycangia can be present on both sexes, only on the males or only on the females, depending on the species (Francke-Grosmann, 1967; Beaver, 1989). They may be found in many parts of the body (head, thorax, and elytra), but are usually constant in position in a particular genus (Beaver 1989). As yet, they have not been used in classification (Knížek & Beaver, 2007).

Within Platypodinae, only a few species have been described (Roche & Lhoste, 1960; Farris & Funk, 1965; Francke-Grosmann, 1966; Nakashima, 1971, 1972, 1975). In the genus *Platypus*, some species were used to describe the fungal transport organs (Wood, 1958; Nakashima, 1972, 1975; Atkinson, 1989, 2004; Moon *et al.*, 2008; Kent, 2008). Most often, specialized structures of the integument for transporting fungi in this genus are located on the middle upper part of the prothorax (Nakashima, 1975) as a median disc of two to many mycangia (Kent, 2008). In some species, mycangia have been reported occurring as a single pouch at the rear of the preoral cavity, which is the case of female's *Crossotarsus niponicus* Blandford (Nakashima, 1971, 1975). In the other hand, fungi were found in enlarged forecoxal and mesocoxal cavities in various male *Platypus* sp. (Nakashima, 1972, 1975).

The most important work on the mycangia' structure of *Platypus cylindrus* was reported by Cassier *et al.* (1996) studying prothoracic mycangia using specimens from France and Portugal. However, no specimen from the North Africa was ever studied. Furthermore, some ambrosial species have coxal mycangia but according to our data these structures have never been examined in *P. cylindrus*. Primarily attacks the cork oak "*Quercus suber* Linné (*Fagaceae*)", nevertheless other host are mentioned (Ferreira & Ferreira, 1989; Cassier *et al.*, 1996; Cebeci & Ayberk, 2010). This species has originally a circummediterranean distribution but African and European populations (as well as those that are circumscribed in islands) are isolated from each other, so that could be signs of incipient speciation. The first record of *P. cylindrus* from Algeria was mentioned by Lucas (1849).

For all this mentioned, the aim of this study is: (i) to describe the thoracic mycangia of *Platypus cylindrus* collected in Algeria, not only to increase their morphological knowledge but also to discuss any differences from different populations, (ii) to compare the external morphology of mycangia in different species of *Platypus*, (iii) to explore the presence or absence of non prothoracic mycangia in *P. cylindrus*, and (iv) to examine whether some isolated populations from *P. cylindrus* could be considered or not morphologically different species.

Material and methods

Adult individuals of the ambrosia beetle *Platypus cylindrus* were collected from infested cork oak trees at the littoral forest of M'Sila, located 30 km west of Oran in the northwest region of Algeria. 80 beetles have been collected in 2002 (Bouhraoua) and 122 in 2010 (Belhoucine). These materials were maintained in alcohol 70% until their use. We have examined 97 males and 105 females from Algeria in this study. Also we have examined specimens from Cadiz and

Girona (Spain), Nuoro (Sardinia, Italy) and Roquebrune sur Argens (France) (table I).

Electron microscope images were obtained with FEI Quanta 200 ESEM without any coating at 15 KV or with SEM Stereoscan Leica-360 with gold coating at 15 KV. The material was (i) treated according to standard procedures of these microscopes, (ii) untreated since the specimens were cleaned and the pictures have been made by Eva Prats (technician of "Serveis Científico-Tècnics" at Barcelona University).

External optical images were obtained using a Carl Zeiss Tessovar Microscope and a Digital Camera PAXcam 3. Alcohol preserved specimens were dry out to natural conditions for the study. Images were adequate using the GIMP 2.8.2. Program.

Results

Thoracic mycangia

In *Platypus* sp. they are located only in dorsal prothorax area in both sexes (Fig.1), in the middle upper part. The mycangial plate is formed by pits (Fig.1c).

The integumentary pits are grouped into two areas on either side of a cuticular depression line corresponding to the longitudinal apoderme, localized in the medial posterior pronotum forming two mycangium groups. The morphology of these structures shows a clear sexual dimorphism.

In females the pits are very numerous (380 ± 50) ($n = 72$), usually with ovoid shape but we can observe some ones rounded or elongated (around $14 \pm 3.5 \times 11 \pm 2.5 \mu\text{m}$). They are distributed homogeneously on the two mycangial areas and cover a surface more or less circular, around $(360 \pm 40) \times (420 \pm 30) \mu\text{m}$ in average. This area is always incised dorsally and basally and they are more or less symmetrical along the median depression; these sub-unities, ovoid in shape, measure $(360 \pm 40) \times (190 \pm 20) \mu\text{m}$. These mycangia are not very variable in shape (Fig. 2) in all specimens studied ($n = 100$).

In males the mycangial area is much reduced and the number of total pits is scarce. The pits are located on a small area about $150 \times 140 \mu\text{m}$ and they have smaller dimensions ($11 \pm 1.5 \times 9 \pm 1 \mu\text{m}$). The distribution of pits is not homogeneous even in males with the same number of pits and also it is different in both mycangial areas in the same specimen. The number is variable (Fig. 3); the maximum observed is 27 ($n = 80$) but usually varies between 5-15 ($n = 70$, 87.5% of studied population). Nevertheless, we have observed some specimens without thoracic mycangia (Fig. 3).

In both sexes, the openings pits are filled with different fungal spores (Fig. 1d, 1e). In some specimens (males and females), growing mycelia were observed at the entrance of the integumentary holes. Between the pits the cuticular surface is relatively smooth without gland openings neither setae. There is a spatial dissociation between the mycangial cavities and the sensorial setae (which are outside the mycangial area). The pits have not externally visible internal skeletal structure.

Coxal mycangia

Originally the structures observed in coxae I and II (Fig. 4) were suspected as potential mycangia pits, particularly in external view, however when the longitudinal cut was done into coxae it was observed that these "pits" correspond to

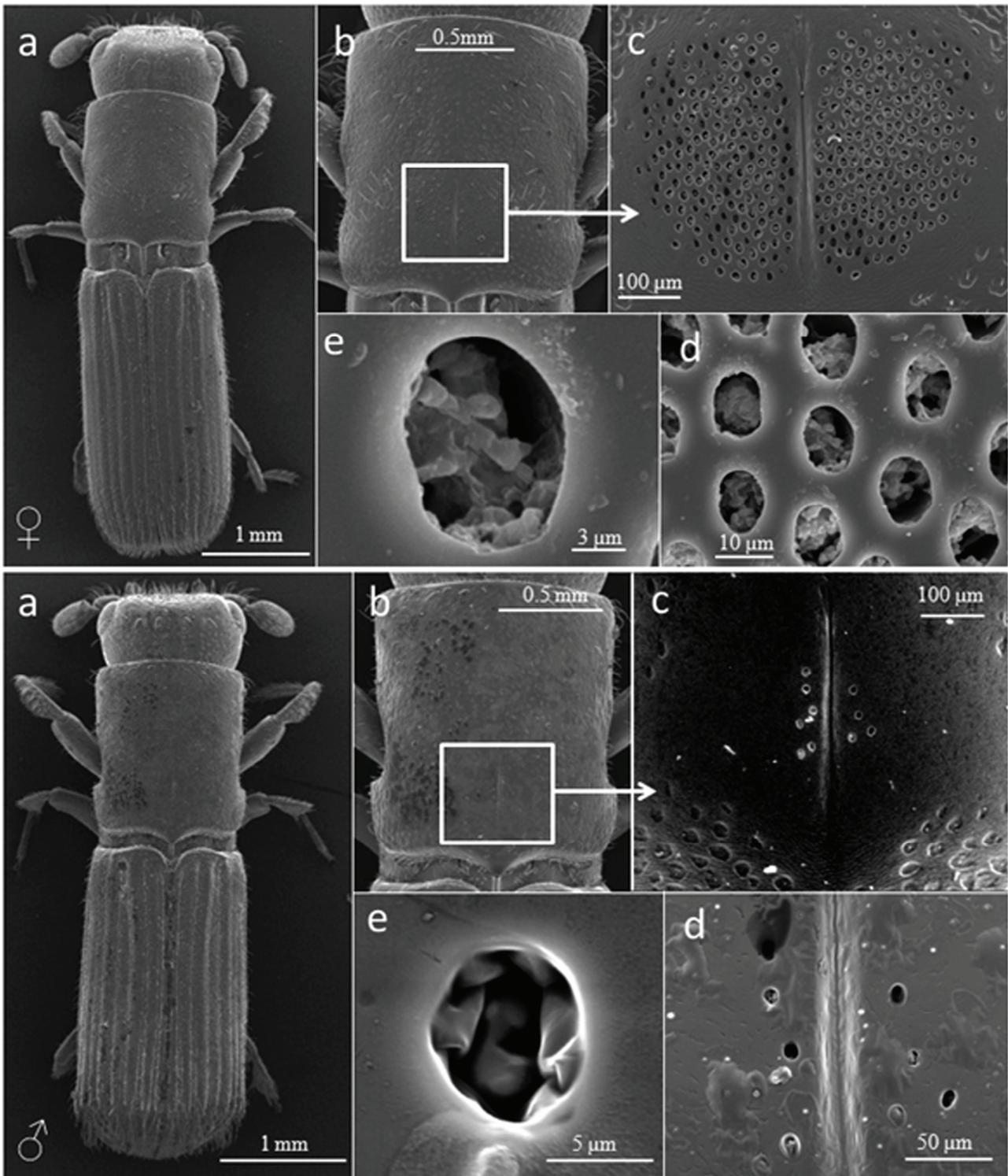


Fig. 1. *Platypus cylindrus* female and male. **a)** adulte beetle, **b)** dorsal prothorax, **c)** mycangial area, **d)** mycangial pits storing spores, **e)** details of a mycangial pit.

cuticular internal apodemes implantations which enforce the dorsal articulation of the coxae. It was probed that mycangial pits are not present in coxae of *Platypus cylindrus*. In other *Platypus* species, these structures are described (Nakashima, 1975).

Male genitalia

The differences observed in isolated populations of *P. cylindrus* led us to undertake a morphological study of the

genitalia to visualize possible population differences and then to discuss the existence of more than one species of *P. cylindrus*.

The edeagus of this species is very simple, well sclerotized and tubular. The apical part is very small; the basal surface in the apical third presents a coarse and sparse punctation. The genital segment is also very simple, in a "V" shape, without differentiating any particular structure.

In the studied specimens from M'Sila (Algeria) and the Natural Park of Alcornocales (Cadiz, Spain) the curve of the

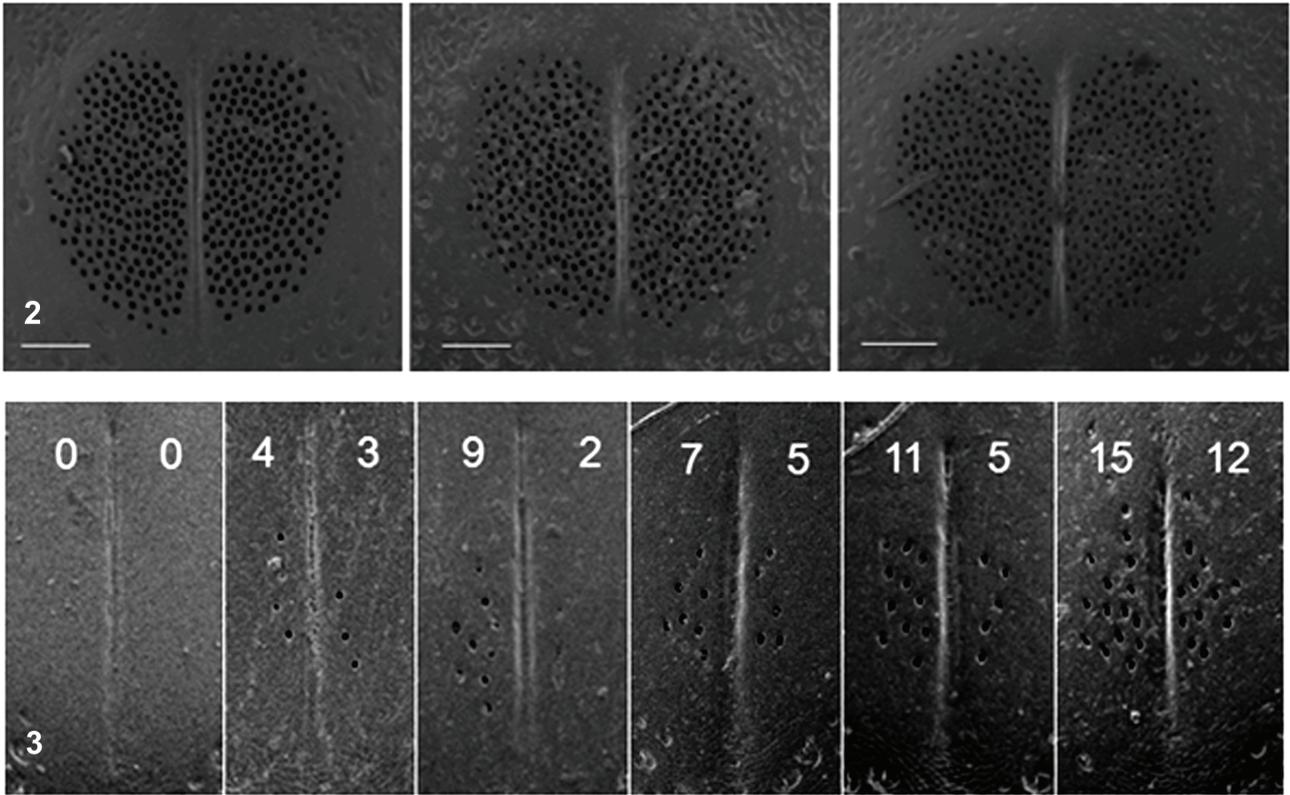


Fig. 2. Some variation shape of thoracic mycangia in *Platypus cylindrus* female from Algeria. Scale corresponds 100 μ m. **Fig. 3.** Some variation in number and disposition of thoracic mycangia pits in *Platypus cylindrus* male from Algeria.

Table I. Origin and numbers of specimen studied.

Origin	Algeria (M'Sila)		Spain (Girona/Cadiz)		France (Roquebrune sur Argens)		Italy (Sardinia)		Total
	♂	♀	♂	♀	♂	♀	♂	♀	
Used in									
Mycangia	80	100	33	25	---	---	9	12	259
Coxal parts	5	5	7	7	---	---	---	---	24
Genital parts	12	---	23	---	7	---	6	---	48
Total	97	105	63	32	7	---	15	12	331

apical part is regularly rounded (Fig. 5a). In contrast to the specimens from the Montseny Natural Park (Girona, Spain), and also those from France and Italy, the curve of the apical part of the aedeagus is presented more or less incised in the middle (Fig. 5b). Also in these specimens the punctuation of parameral sheath is more dense and impressed, and the lateral projections in the basal part are longer.

For the observed differences apparently we have two populations, distinctly separated by small differences in the conformation of male copulatory organ, although these populations can not be distinguished by the external adults morphology. According to the studied specimens two different populations can be located: (i) in the south of the Iberian Peninsula and North Africa and (ii) in the peninsular area of Catalonia, France and Italy. These populations are confined to the areas occupied by *Quercus suber* (Fig. 5).

To differentiate these mentioned populations, several specimens from other areas colonized would be studied in the future in order to know their variability and the eventual intermediate transition stages between them.

Discussion

Some Scolytids and Platypodids carry mutualistic fungi in repositories in their integument (Francke-Grosman, 1963).

Such organs may occur on the thorax, head or elytra of various species (Furniss *et al.*, 1987) but also in the coxae of males in some species (Farris, 1963; Francke-Grosman, 1966, 1967; Nakashima, 1972, 1975). These are mycangia as called by Batra (1963). He described them as ectodermal origin, found mainly in females near glandular parts of the body. The morphology of the mycangia is usually genus specific (Beaver, 1989). However, variations can be found between species within the same genus (Nakashima, 1972, 1975).

In Platypodids, the genus *Platypus* includes around 120 species distributed in Europe and Africa to Japan and Australia (Wood, 1993). Nevertheless, mycangia (Table I) have been rarely described in the Platypodinae (Nunberg, 1951; Lhoste & Roche, 1959, 1960; Farris & Funk, 1965; Nakashima, 1971, 1972, 1975; Cassier *et al.*, 1996; Moon, 2008; Kent, 2008). The external morphology of *Platypus* mycangia is in general, ovoid in shape (Fig. 6) as in *P. cylindrus*. In some species, mycangia are only present in the female as *P. quercivorus* (Kinura, 2002) and *P. jansoni* (Nakashima 1975). In others, both sexes possess mycangia but reduced in some cases in the male (Table II, Fig. 6).

Several *Platypus* species have been introduced in Palaearctic area but only two species are considered as autochthonous: *P. oxyurus* and *P. cylindrus*. The first one is limited to

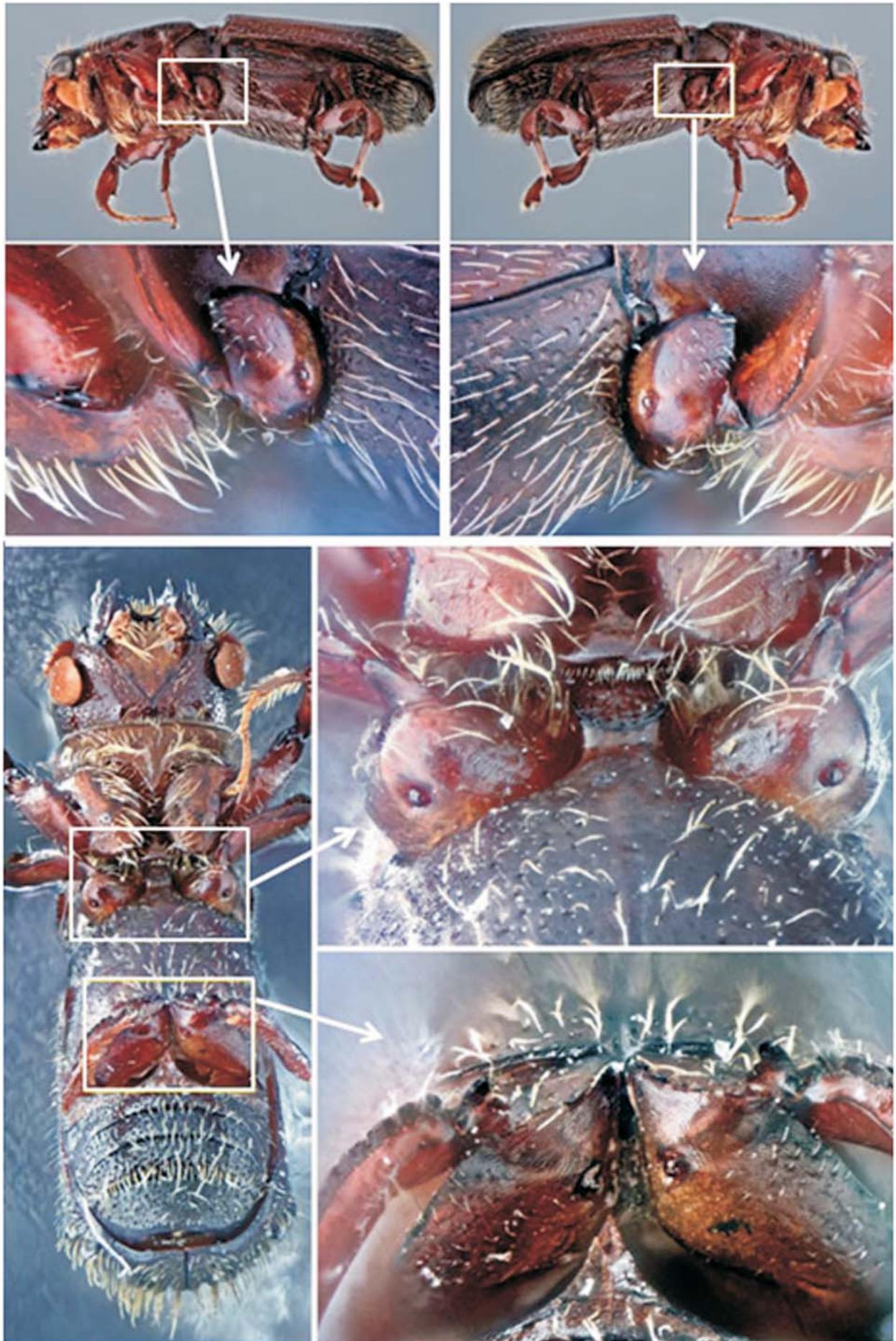


Fig. 4. Coxal apodemes in *P. cylindrus*.

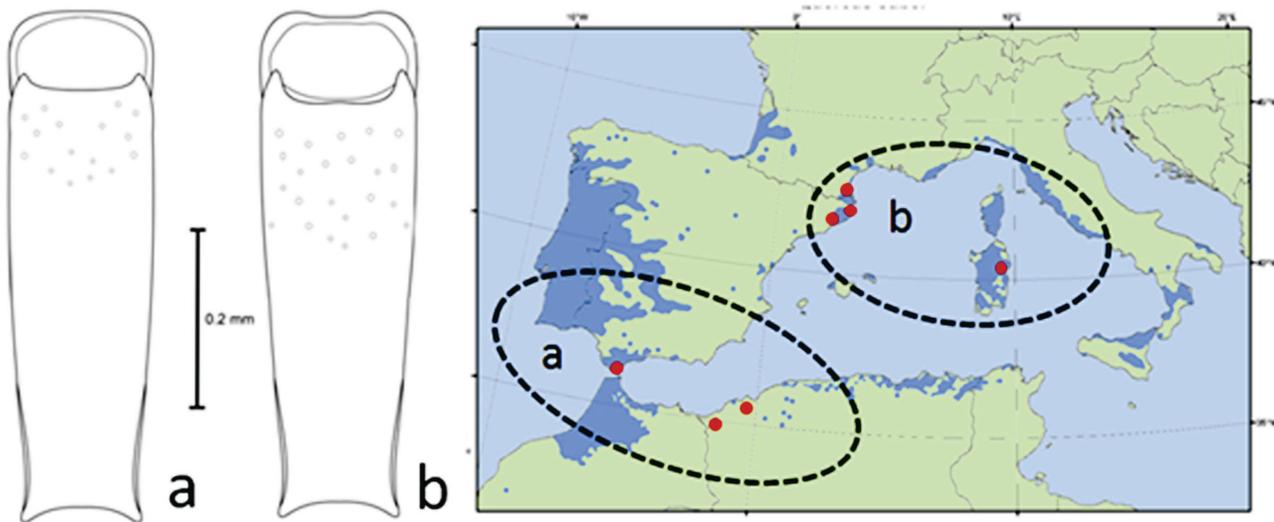


Fig. 5. Edeagus in ventral view of *Platypus cylindrus*: a) specimens from M'Sila (Algeria); b) from Girona (Spain), and distribution map of the two different populations associated to aedeagus morphology. Scale = 0.2 mm. Map taken from http://www.euforgen.org/distribution_maps.html, February 2011.

the Pyrénées mountains, Corsica, Calabria, Greece and Turkey which is in accordance to Cassier *et al.* (1996) and it attacks only *Abies alba* (Balachowsky, 1949). However, *P. cylindrus* has a wide distribution throughout Eurasia and in the countries of the Mediterranean basin, including North Africa and it was introduced in Australia and New Zealand; it attacks the genus *Quercus*, *Fagus*, *Castanea sativa* and *Prunus avium* (Ferreira & Ferreira, 1989; Cassier *et al.*, 1996; Cebeci & Ayberk, 2010). In Algeria, *P. cylindrus* has been observed only in *Q. suber*. The morphology of mycangia in both species from two sexes is different (Fig. 6). According to Cassier *et al.* (1996), the mycangia of *P. cylindrus* from Europe (Portugal and France) are similar to those from Algerian populations. Nevertheless, Algerian specimens have a mycangial area more or less circular incised dorsally and basally, but in Iberian specimens the mycangial region is usually wider than long and basally less incised.

The dimensions of the mycangial zone varied in European *Platypus* from 460 x 530 μm in the female to 140 x 140 μm for the male (Cassier *et al.*, 1996). While in Algerian *P. cylindrus*, the mycangial area in females is about (360 \pm 40) x (410 \pm 30) μm against 150x140 μm in males. This is a dimorphic character in this genus and it has a defined shape (cordate, reniform, or like an arrow feather in outline) in different species. According to Nakashima (1975), *Platypus* genus is divided in five groups depending on mycetangia's types; *P. cylindrus* is not included in Nakashima's study but by all mentioned here it belongs to "Group B" because: (i) females has several tens or several hundred of integumentary pits-type mycetangia concentrated in the posterior part half of the pronotum, (ii) males mycetangia are similar to those of the female, but somewhat less developed or less numerous, and (iii) males have not coxal mycangia.

In Algerian females of *P. cylindrus* examined the number of pits in mycangia varied from 300 to 400, which is approximately similar to the European specimens (Cassier *et al.*, 1996; Inacio *et al.*, 2011). Even so, no female in our samples did show less than 300 pits while Cassier *et al.* (1996) found females with only 68 openings. In comparison with other

species of the genus *Platypus*, *P. cylindrus* females have a double number of pits compared to female's *P. oxyurus* with 150 holes only (Cassier *et al.*, 1996); in addition *P. cylindrus* has more pits than *P. calamus* (around 250), *P. caliculus* (around 300) and *P. (Shoreanus) bifurcus* (between 250-270), according to Nakashima's data (Nakashima, 1975). While *P. Jansoni* and *P. Severini* present more pits than *P. cylindrus*, with respectively 650 and 600, according to the same author. Farris & Funk (1965) reported 222 to 478 holes in *P. wilsoni* which is relatively similar to *P. cylindrus*.

In Algerian males' *P. cylindrus*, the mycangia exhibited around 0-27 holes while the European specimens presented 5-25 (Cassier *et al.*, 1996) with a maximum of 53 reported by Inacio *et al.* (2011), which is similar to some Asian *Platypus* (*P. calamus*, *P. caliculus*, *P. pseudocupulatus* and *P. severini*) showing less than 20 openings in their mycangia (Nakashima, 1972, 1975). Some other species from Nakashima's collection presented, by cons, more than 100 pits as *P. curtus*, *P. (Shoreanus) bifurcus* and *P. (Shoreanus) multitalus*. Several other males do not present mycangial holes as *P. wilsoni* (Farris & Funk, 1965), *P. jansoni* (Nakashima, 1975) and *P. quercivorus* (Kinuura, 2002) (Table II). In this study we observed several *P. cylindrus* males without mycangial pits; except for Inacio *et al.* (2011) (Portugal) any other records in the bibliography referentiated the absence of mycangia in males of *P. cylindrus* in front the other European species *P. oxyurus* (Cassier *et al.*, 1996).

The mycangia's openings in the Algerian *P. cylindrus* under study, measured about (14 \pm 3.5) x (11 \pm 2.5) μm in females against (11 \pm 1,5) x (9 \pm 1) μm in males, which are slightly smaller than those in European specimens (Cassier *et al.*, 1996). These data show also similarities with other *Platypus* species (Nakashima, 1972, 1975; Farris & Funk, 1965). But in some cases (Nakashima, 1975), the species present two kinds of mycangial openings as in female *P. curtus* (Fig. 6:7). Female *P. quercivorus* as reported by Kinuura (2002) presents only 5 to 10 sac-like organs located in the middle of the pronotum around the median sulcus (Fig. 6:9). These openings seem larger than those of *P. cylindrus*.

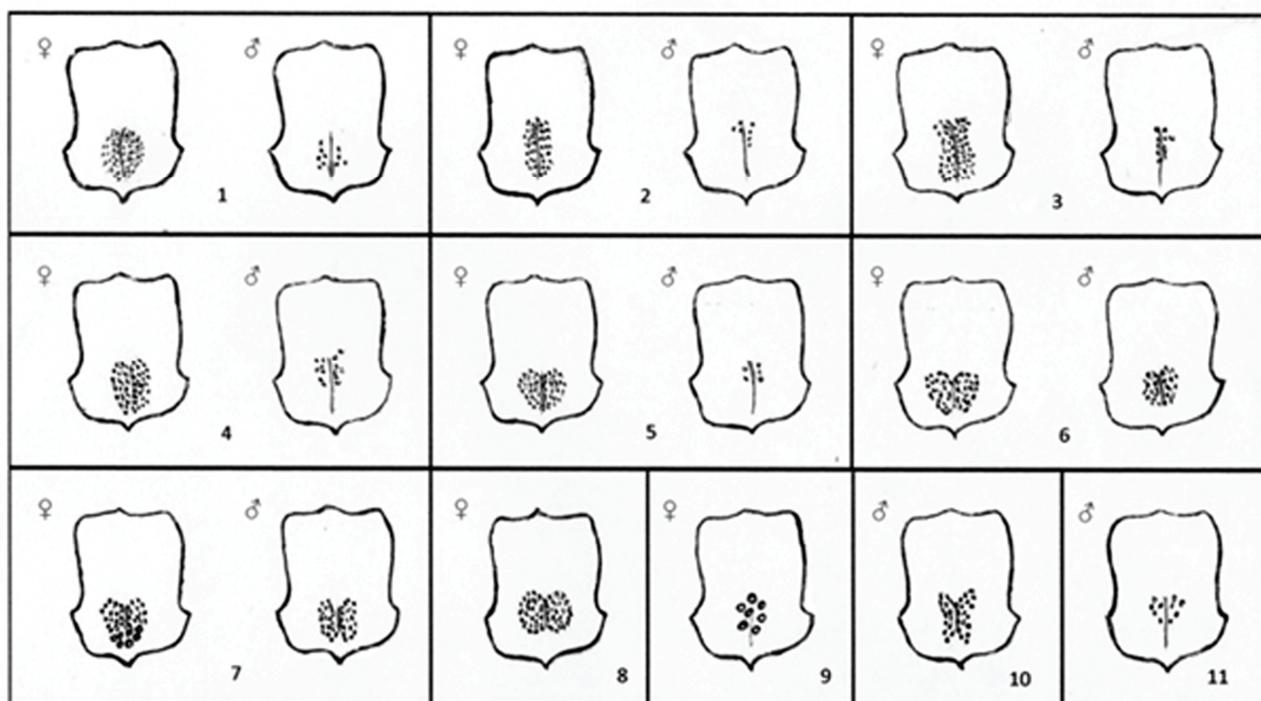


Fig. 6. External shape of prothoracic mycangia area of some different species of the genus *Platypus*; 1: *P. cylindrus*, 2: *P. oxyurus*, 3: *P. severini*, 4: *P. calamus*, 5: *P. caliculus*, 6: *P. (Shoreanus) bifurcus*, 7: *P. curtus*, 8: *P. jansonii*, 9: *P. quercivorus*, 10: *P. (Shoreanus) mutilatus*, 11: *P. pseudocupulatus*. Drawings made by Belhocine L. from (Nakashima, 1972, 1975; Cassier *et al.*, 1996; Kinuura, 2002).

Table II. Some species of *Platypus* with described mycangia according to Nakashima (1972, 1975), Cassier *et al.* (1996) & Kinuura (2002) data

<i>Platypus</i> species with mycangia figured	Host	Distribution	Presence of thoracic mycangia	
			females	males
<i>P. calamus</i>	<i>Fagus crenata</i>	Japan	+	+
<i>P. caliculus</i>	<i>Shorea</i> sp2	Borneo	+	+
<i>P. curtus</i>	<i>Shorea</i> sp1	Filipinas	+	+
<i>P. cylindrus</i>	usually <i>Quercus suber</i>	Palaeartic occidental	+	+
<i>P. jansonii</i>	<i>Camnos perma</i>	Islas Salomon	+	-
<i>P. oxyurus</i>	<i>Abies alba</i>	Probably circimediterranea	+	+
<i>P. pseudocupulatus</i>	<i>Shorea</i> sp2	Sumatra	¿?	+
<i>P. quercivorus</i>	<i>Quercus quercivora</i>	Japon	+	-
<i>P. severini</i>	<i>Fagus crenata</i>	Japon	+	+
<i>P. (Shoreanus) bifurcus</i>	<i>Shorea</i> sp1	Filipinas	+	+
<i>P. (Shoreanus) mutilatus</i>	<i>Shorea</i> sp2	Borneo	¿?	+

In Platipodids, according to different authors (Farris & Funk, 1965; Francke- Grossmann, 1967; Nakasima, 1971), true mycangia have been found only in the female, while it is the male which attacks the host plant first. This is not the case of *P. cylindrus*, although the male possess mycangia, attacks first the tree host and actively begins boring the galleries (Bouhraoua, 2003; Sousa & Inacio, 2005; Bouhraoua & Villemant, 2010; Belhocine *et al.*, 2011a; Belhocine, 2013) creating a penetration corridor of about 1-2 cm in length starting from the bark wounds (Jover, 1952). The female continues the gallery construction started by the male (Husson, 1955). During this construction, the male role is restricted to sawdust removal (Hickin, 1963).

In males and females examined the openings were filled with fungal spores. In *P. cylindrus* both sexes carry in their mycangia relatively the same fungal species but the results obtained in a previous work (Belhocine *et al.*, 2011b) confirm the significant role played by females in the transport and inoculation of ectosymbiotic fungal spores, which agrees

with others (Batra, 1963; Beaver, 1989). Nevertheless, we should not deny the role of male *P. cylindrus* in transporting fungi to be probably deposited on the gallery wall in its early stages of construction. But, this function has to be less important compared to that of females since in *P. cylindrus*: (i) males have limited number of pits compared to females and (ii) males without pits have been collected.

Fungi of Ophiostomatales order, represented by *Ophiostoma quercus*, *O. stenoceras*, *O. nigrocarpum* and *Raffaelea montetyi*, are the most important fungi carried by both sexes (Belhocine *et al.*, 2011b, 2012; Belhocine, 2013). *R. montetyi* is identified as *P. cylindrus* primary ambrosia fungus in France (Morelet, 1998) and Portugal (Inacio *et al.*, 2008, 2011; Henrique *et al.*, 2009) and is probably the same brownish fungus described by Cassier *et al.* (1996). The other *Ophiostoma* species isolated are already known as important fungi to other bark beetles (Reay *et al.*, 2002; Kirisits, 2007; Linnakoski *et al.*, 2009), their importance to *P. cylindrus* must to be confirmed. Whereas, phylogenetic studies show that

Ophiostoma and *Raffaelea* species are closely related (Harrington *et al.*, 2010). The isolation of *Geosmithia langdonii* from *P. cylindrus* mycangia of both sexes is a new association for this beetle (Belhoucine *et al.*, 2011b, 2012; Belhoucine, 2013). Members of *Geosmithia* genus have not been linked to Platypodinae until now thought they are usually part of fungal ambrosia beetle galleries (Kirschner, 2001; Kolarik *et al.*, 2005).

The presence of growing mycelia at the entrance of the integumentary holes in both sexes of several specimens analysed agrees with observations of some authors as Whitney and Farris (1970) in some beetles and Inacio *et al.* (2011) in one specimen of *P. cylindrus*. Fungi, as reported in some studies, are present in mycangia in spore form and sprouting cells (Farris, 1963) but also in yeast-like form (Harrington & Fraedrich, 2010; Yuceer *et al.*, 2011). The mechanism by which mycangial fungi are maintained in the yeast-like form in the mycangia is not known but some authors suggested that chemical secretions from associated glandular cells surrounding mycangia may regulate fungal growth and morphology (Batra, 1963; Francke-Grossmann, 1967; Barras & Perry, 1971; Six, 2003; Beaver, 1989). In *P. cylindrus*, Cassier *et al.* (1996) described particular glandular cells in mycangium probably with this role.

Introduction of these fungi into the mycangia most likely occurs after adults emerge from pupal chambers (Whitney *et al.*, 1987; Kent, 2008). When ambrosia beetles emerge from parental hosts, they often carry mutualistic fungi within their mycangia (Barras, 1973; Hofstetter *et al.*, 2006; Kent, 2008; Yuceer *et al.*, 2011). Kent (2008) mentions this act from *Austroplatypus incomptus*, an Australian species; any data has been reported from *P. cylindrus*.

In some Scolytids and Platypodids, males have another type of mycangia represented by enlarged forecoxal and mesocoxal cavities in which many globular fungi materials or spores were observed (in *Platypus severini*, for example); however, in the same study (Nakashima, 1975) several species of *Platypus* did not show fungi materials although similar structures to those found in *P. severini* (as *P. caliculus*, *P. solidus*, *P. jansonii* and *P. calamus*). In our study, the examination of coxal parts did not show any mycangia of this kind in *P. cylindrus* (Fig. 4); these pores observed are apodemas. It is possible that some of the pores previously reported in some *Platypus* spp. may carry fungi material only because of the shape of the structure and not because they may constitute a mycangial structure.

Conclusions

Platypus cylindrus is an ambrosia beetle whose prothoracic mycangia have a variable number of pores. In females, the shape of mycangial area is similar in different populations but instead the number of pores varies widely; in males, these pores are very scarce and very variably disposed. These differences are present not only in Algerian populations but also comparing European and Algerian populations. Females and males examined from Algeria have slightly less number of pores than European samples. Furthermore, coxal mycangia are absent in all populations examined.

Nevertheless, the study of genitalia does not allow separating species even though there are weak morphological differences between isolated populations. Then, for this mo-

ment, only one species is present attacking cork oak (*Platypus cylindrus*) considering these differences as a morphological gradation in genitalia. More material from different areas could be solving this aspect in a future.

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