MYXOMYCETES FROM THE BARK OF THE EVERGREEN OAK QUERCUS ILEX

by
DIANA WRIGLEY DE BASANTA*

Resumen
Se presentan los resultados de 81 cultivos en cámara húmeda de corteza de Quercus ilex vivo. Se citan 37 táxones, que amplían a 55 el número de especies de mixomicetes encontrados sobre este sustrato. Se confirma la presencia en la Península Ibérica de Licea deplanata, y se incluyen siete nuevas citas para la provincia de Madrid. Se aportan datos sobre frecuencia de aparición y tiempos de incubación de algunas especies.
Palabras clave: Mixomicetes corticícolas, Madrid, Quercus ilex, cultivo en cámara húmeda.

Abstract

The results of 81 moist chamber cultures of bark from living Quercus ilex trees are reported. A total of 37 taxa are cited, extending the number of species found on this substrate to 55. The presence of Licea deplanata on the Iberian Peninsula is confirmed. Seven new records are included for the province of Madrid. Some data are contributed on species frequency and incubation times.
Key words: Corticolous myxomycetes, Madrid, Quercus ilex, moist chamber culture.

INTRODUCTION

Quercus ilex L. is one of the most characteristic trees of the Iberian Peninsula. It has dark grey bark with shallow irregular fissures, and as the tree ages, the bark surface fractures into many small plaques. This provides an ideal microenvironmeant for the development and fruiting of myxomycetes creating areas between and beneath the outer surface which retain moisture. LADO (1993a) stresses how productive the substrates from Quercus ilex are, citing over 90 species collected from Spanish territories fruiting in leaf litter, on fallen and decaying wood, on leaves and twigs as well as on bark. The bark however presents a special ecological situation (BROOKS, 1967) and is an important habitat for many species, some of which appear nowhere else (ING, 1997). Table 1 shows the species that have been recorded in the literature from the bark of living Q. ilex trees in Spain, either in the field or from moist chamber cultures. This paper presents the combined results of 81 moist chamber cultures of the bark of living trees sampled at various intervals over a period of 13 years (WRIGLEY DE BASANTA, 1987, 1996a, 1996b).

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**TABLE 1**

**LIST OF MYXOMYCETES REPORTED IN THE LITERATURE FROM THE BARK OF LIVING *QUERCUS ILEX* IN PENINSULAR SPAIN**

<table>
<thead>
<tr>
<th>Myxomycete</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arcyria cinerea (Bull.) Pers.</td>
<td>PANDO, 1997b (Cu)</td>
</tr>
<tr>
<td>A. incarnata (Pers. ex J.F. Gmel.) Pers.</td>
<td>MORENO &amp; al., 1990 (Cc)</td>
</tr>
<tr>
<td>Badhamia folicola Lister</td>
<td>HONRUBIA &amp; al., 1985 (Mu)</td>
</tr>
<tr>
<td>B. versicolor Lister</td>
<td>PANDO, 1997b (Cu)</td>
</tr>
<tr>
<td>Badhamiopsis ainoae (Yamash.) T.E. Brooks &amp; H.W. Keller</td>
<td>CARILLA &amp; GRACIA, 1991 (Hu)</td>
</tr>
<tr>
<td>Comatricha laxa Rostaf.</td>
<td>Wrigley, 1987 (M)</td>
</tr>
<tr>
<td>Craterium minutum (Leers) Fr.</td>
<td>GRACIA &amp; al., 1980 (Mu)</td>
</tr>
<tr>
<td>Cribaria violacea Rex</td>
<td>PANDO, 1997b (Se)</td>
</tr>
<tr>
<td>Didymium squamulosum (Alb. &amp; Schwein) Fr.</td>
<td>CARILLA &amp; GRACIA, 1991 (Hu); OLTRA, 1995 (V)</td>
</tr>
<tr>
<td>D. trachysporum G. Lister</td>
<td>PANDO, 1997b (Se)</td>
</tr>
<tr>
<td>Echinostelium brooksii K.D. Whitney</td>
<td>LLISTOSELLA &amp; AGUASCA, 1986 (B)</td>
</tr>
<tr>
<td>E. coelecephalum T.E. Brooks &amp; H.W. Keller</td>
<td>PANDO, 1997b (Cu)</td>
</tr>
<tr>
<td>E. colliculusom K.D. Whitney &amp; H.W. Keller</td>
<td>LLISTOSELLA &amp; AGUASCA, 1986 (B)</td>
</tr>
<tr>
<td>E. fragile Nann.-Bremek.</td>
<td>Wrigley, 1987 (M)</td>
</tr>
<tr>
<td>E. minutum De Bary</td>
<td>Wrigley, 1987 (M); PANDO, 1997b (CR)</td>
</tr>
<tr>
<td>Enerthenema papillatum (Pers.) Rostaf.</td>
<td>CARILLA &amp; GRACIA, 1991 (Hu)</td>
</tr>
<tr>
<td>Lamproderma scintillans (Berk. &amp; Broome) Morgan</td>
<td>OLTRA, 1995 (V)</td>
</tr>
<tr>
<td>Licea castanea G. Lister</td>
<td>PANDO, 1997b (Cu)</td>
</tr>
<tr>
<td>L. denudescens H.W. Keller &amp; T.E. Brooks</td>
<td>PANDO, 1997b (Cu, Se)</td>
</tr>
<tr>
<td>L. kleistobolus G.W. Martin</td>
<td>LLISTOSELLA &amp; AGUASCA, 1986 (B)</td>
</tr>
<tr>
<td>L. minima Fr.</td>
<td>PANDO, 1997b (Se)</td>
</tr>
<tr>
<td>L. nannengae Pando &amp; Lado</td>
<td>Wrigley, 1987 (M); PANDO, 1997b (Z)</td>
</tr>
<tr>
<td>L. parasitica (Zukal) Martin</td>
<td>PANDO, 1997b (Cu)</td>
</tr>
<tr>
<td>L. perexigua T.E. Brooks &amp; H.W. Keller</td>
<td>Wrigley, 1987 (M); PANDO, 1997b (Cu)</td>
</tr>
<tr>
<td>L. scyphoides T.E. Brooks &amp; H.W. Keller</td>
<td>Wrigley, 1987 (M); PANDO, 1997b (Cu, Se)</td>
</tr>
<tr>
<td>Macbrideola cornea (G. Lister &amp; Cran) Alexop.</td>
<td>CARILLA &amp; GRACIA, 1991 (Hu); PANDO, 1997b (CR, Z)</td>
</tr>
<tr>
<td>M. oblonga Pando &amp; Lado</td>
<td>Wrigley, 1987 (M)</td>
</tr>
<tr>
<td>M. synsporos (Alexop.) Alexop.</td>
<td>LLISTOSELLA &amp; AGUASCA, 1986 (B)</td>
</tr>
<tr>
<td>Paradiacheopsis fimbrata (G. Lister &amp; Cran)</td>
<td>PANDO, 1997b (Cu, Se)</td>
</tr>
<tr>
<td>Perichaena vermicularis (Schwein.) Rostaf.</td>
<td>PANDO, 1997b (Se)</td>
</tr>
<tr>
<td>Physarum auriscalpium Cooke</td>
<td>Wrigley, 1987 (M); PANDO, 1997b (Z)</td>
</tr>
<tr>
<td>Ph. cinereum (Batsch) Pers.</td>
<td>PANDO, 1997b (Cu)</td>
</tr>
<tr>
<td>Ph. compressum Alb. &amp; Schwein</td>
<td>Wrigley, 1987 (M); PANDO, 1997b (Cu, Se)</td>
</tr>
<tr>
<td>Ph. decipiens M.A. Curtis</td>
<td>CARILLA &amp; GRACIA, 1991 (Hu); PANDO, 1997b (Cu)</td>
</tr>
<tr>
<td>Ph. leucophaeum Fr.</td>
<td>Wrigley, 1987 (M)</td>
</tr>
<tr>
<td>Ph. nutans Pers.</td>
<td>LLISTOSELLA &amp; AGUASCA, 1986 (B)</td>
</tr>
<tr>
<td>Ph. oblatum T. Macbr.</td>
<td>PANDO, 1997b (Cu, Se)</td>
</tr>
<tr>
<td>Ph. pusillum (Berk. &amp; Curt.) G. Lister</td>
<td>PANDO, 1997b (Se)</td>
</tr>
<tr>
<td>Ph. serpula Morgan</td>
<td>CARILLA &amp; GRACIA, 1991 (Hu)</td>
</tr>
<tr>
<td>Ph. straminipes Lister</td>
<td>CARILLA &amp; GRACIA, 1991 (Hu)</td>
</tr>
<tr>
<td>Trichia contorta var. karstenii (Rostaf.) Ing</td>
<td>OLTRA, 1997 (M)</td>
</tr>
<tr>
<td></td>
<td>PANDO, 1997b (Cu)</td>
</tr>
</tbody>
</table>

Key to Provinces Listed: B, Barcelona; Ce, Cáceres; Cu, Cuenca; CR, Ciudad Real; Ge, Gerona; Hu, Huesca; M, Madrid; Mu, Murcia; Se, Sevilla; V, Valencia; Z, Zaragoza.
METHOD

The trees chosen were large mature trees growing in various places in the Province of Madrid. Samples were taken from the North to North Western side of each tree at a height of 0.5-1.5 m, and put in labelled envelopes. They were then placed in moist chamber culture following the procedure used by Mitchell (1977), and watered every few days as required to maintain the humidity for the whole observation period of at least a month. The bark of 25 of the cultures was soaked and kept moist with deionised water or solutions at pH 3.0, 4.0, 5.0, and 6.0, and were kept for three months as they formed part of another study. Details of the number and type of fructification and incubation times were recorded, and permanent slides with Hoyer's medium or PVA, or boxed herbarium samples were made of each. Records are added of some taxa which were also found fruiting directly on the bark of the living trees.

All cited numbers refer to specimens kept in the author's collection (dwb). Locality, UTM grid reference, and the date of collection from the culture (day-month-year) are given for each.

RESULTS

Arcyria cinerea (Bull.) Pers.


In the cultures of bark from Madrid, El Retiro, this species was found fruiting alongside Echinostelium apitectum in all cultures.

Badhamia affinis Rostaf.


Badhamia follicola Lister


Badhamia macrocarpa (Ces.) Rostaf.


Badhamia panicea (Fr.) Rostaf.


Badhamia versicolor Lister


Badhamiopsis ainoaee (Yamash.) T.E. Brooks & H.W. Keller


This is the first record for Madrid Province. This species has also been recorded from Huesca, Segovia and Soria (Lado, 1993b).

Comatricha ellae Härk.


Comatricha laxa Rostaf.


Comatricha nigra (Pers, ex J.F. Gmel.) J. Schröt.


Echinostelium apitectum K.D. Whitney

From the numerous specimens (> 300 sporocarps) appearing, those examined all showed similar characters to those reported from Guadalajara (Pando & Lado, 1990; Pando, 1997a). The spores are smaller than those described by Whitney (1980) as they measured 6-8 µm. This character was also described for Iberian specimens by Oltra (1994) who found this species on other substrates in Valencia. The sporocarps have a white colour when they are fresh, but the pink to pinkish brown colour described by Whitney when they are completely dry. An interesting variety of form was observed. The spore-like covering of the columella was sometimes attached to the peridial collar but often separated from it by a portion of the columella. Some specimens had a rudimentary capillitium which pierced the spore-like body projecting above it as a tapering thread (fig. 1) in the same way as those described by Lado & Pando (1997).

This is the first record of this species for Madrid Province. It has only been recorded from Guadalajara, Huelva and Valencia in Peninsular Spain.

**Echinostelium elachiston** Alexop.

**Madrid:** Casa de Campo, 30TVK3576, 17-V-1997, dwb 1501.

Has only previously been recorded in Spain from Guadalajara (Lado & Pando, 1997).

**Echinostelium fragile** Nann.-Bremek.


**Echinostelium minutum** De Bary


**Enerthenema papillatum** (Pers.) Rostaf.


**Licea castanea** G. Lister


This was also collected already fruited from the bark of living *Quercus ilex* trees in Madrid: Las Rozas, dehesa de Navalcarbón, 30TVK2584, 30-IX-1997, dwb 1588.

**Licea deplanata** H.W. Keller & T.E. Brooks

**Madrid:** Las Rozas, dehesa de Navalcarbón, 30TVK2584, 20-V-1997, dwb 1505a.

This was also collected already fruited from the bark of living *Quercus ilex* trees in Madrid: Las Rozas, dehesa de Navalcarbón, 30TVK2584, 30-IX-1997, dwb 1582. It is probably more common than these records suggest, but it is inconspicuous on this substrate until the bark is completely dry, and so easily overlooked. This was commented on by ING (1997). The ornamental inner peridial layer however, is clearly visible in preparations by transmitted light (fig. 2).

This is the first record of this species for Madrid Province. It has been recorded from Cádiz, Cuenca, Jaén and Toledo in Peninsular Spain (Lado, 1993b; Pando, 1997b).

**Licea denudescens** H.W. Keller & T.E. Brooks

**Madrid:** Casa de Campo, 30TVK3575, 9-1-1995, dwb 1407.

This collection was listed in the abstract volume of ICSEM II (Wrigley de Basanta, 1996b) as *Licea belmontiana* Nann.-Bremek. Further examination and comparison with type specimens leads us to believe that this is *L. deplanata*, since the sporocarps have an angular appearance with very obvious dark shiny lines between peridial lobes when dry.
By transmitted light these can be seen as dark smooth margins to the lobes of dehiscence (fig. 3) without obvious papillae, but the spores are smooth with a large germinative pore (fig. 4).

This is the second Iberian record of this taxon. CABO (1995) reported it on Hedera helix (MA-Fungi 34043) from La Coruña, and it was previously only known from California on decayed leaves of Eucalyptus (KOWALSKI, 1970, 1972). This is the first time it has been collected on bark.

Licea kleistobolus G.W. Martin


Licea nannengae Pando & Lado


The collections were usually of numerous sporocarps and spread over a wide area. The translucent membranous inner layer of the peridium visible at the margins was a constant character, making this species readily distinguishable from the other small Liceas by transmitted light. The average incubation time of 45 days on this substrate was rather longer than that reported by PANDO & LADO (1988). This is the first record for Madrid Province. This taxon has previously been recorded from various other provinces (LADO, 1993b; PANDO, 1997b).

Licea parasitica (Zukal) G.W. Martin


This very common species was also found already fruited on the bark of living Quercus ilex trees from Madrid: Las Rozas, dehesa de Navalcarbón, 30TVK2584, 30-XI-1997, dwb 1589. Many of the pieces of bark collected for culture had mature or empty sporocarps.

Macbrideola cornea (G. Lister & Cran) Alexop.


Some specimens of Macbrideola cornea had vesicular expansions along the length of the capillitial filaments (figs. 5, 6) similar to those commented on by PANDO (1994). They were collected among typical specimens however, and showed otherwise typical characteristics of M. cornea, and so were assigned to this taxon. Also, following the arguments and observations reported by PANDO (1994), specimens with either abundant or scant capillitium previously separated into M. cornea and M. decapillata were all assigned to M. cornea.

This was also collected already fruited
Figs. 5-8.—Macrideola cornea (dwb 1265): 5, whole sporocarp; 6, vesicular expansions on the capillitial filaments. 7, M. oblonga (dwb 607): whole sporocarp with oblong shape and free spores. 8, M. synsporos (dwb 605): whole sporocarp with clustered spores.
from the bark of living *Quercus ilex* trees from Madrid: Las Rozas, dehesa de Navalcarbón, 30TVK2584, 30-XI-1997, dwb 1585, 1587.

**Macbrideola macrospora** (Nann.-Bremek.) Ing


This taxon has been recorded from Barcelona and Cáceres (LADO, 1993b). This is the first record for Madrid Province.

**Macbrideola oblonga** Pando & Lado


The sporocarps of this species are very common on this substrate and can appear within the first two days of a culture. Their characteristic oblong shape, wide hypothallus and their tree spores (fig. 7) are distinctive and aid in identification.

**Macbrideola synsporos** (Alexop.) Alexop.


**Perichaena corticalis** (Batsch) Rostaf.

**MADRID:** Casa de Campo, 30TVK3675, 14-VI-1997, dwb 1568, 1563, 1542. Las Rozas, dehesa de Navalcarbón, 30TVK2584, 26-V-1997, dwb 1533.

**Perichaena depressa** Lib.


This is the first record for Madrid Province. This taxon has been recorded from many other provinces in Spain on a variety of other substrates (LADO, 1993b).

**Perichaena vermicularis** (Schwein.) Rostaf.

**MADRID:** Casa de Campo, 30TVK3575, 14-III-1994, dwb 1294; ibidem, 21-III-1994, dwb 1299.

**Physarum compressum** Alb. & Schwein

**MADRID:** Casa de Campo, 30TVK3575, 22-XII-1994, dwb 1402.

This was also collected already fruited from the bark of living *Quercus ilex* trees from Madrid: Las Rozas, dehesa de Navalcarbón, 30TVK2584, 30-XI-1997, dwb 1584. It is common on this substrate, and the characteristic clustered spores (fig. 8) are often discernible under a good dissecting microscope in dry specimens. Spores of this species have been observed germinating while still together in the cluster.

**Physarum decipiens** M.A. Curtis


**Paradiacheopsis solitaria** (Nann.-Bremek.) Nann.-Bremek.


This taxon has been recorded from many other provinces in Spain on a variety of other substrates (LADO, 1993b).
Physarum leucophaeum Fr.

*MADRID:* Casa de Campo, 30TVK3575, 22-II-1994, dwb 1275.

Physarum nutans Pers.

*MADRID:* El Retiro, 30TVK4274, 24-VI-1997, dwb 1547.

Physarum pusillum (Berk. & Curt.) G. Lister


Physarum serpula Morgan


Physarum sp.


These records have not been assigned to a specific taxon until spore to spore cultures have been attempted to check the reliability of the observed characteristics. Macroscopically they are similar to *Physarum nudum* T. Macbr. as described by Martin & Alexopoulos (1969) but slightly larger. The sporocarps are scattered to grouped, sessile, 0.5-8 mm in diameter subglobose or pulvinate and pale tan in colour. Capillitium is scant and physaroid and the spores are 11.5-14 μm, lilac and minutely warted, sometimes with small clusters of warts. One very obvious characteristic common to all the specimens recorded was the lines of dehiscence of the sporocarps visible from the early stages of their development, and reminiscent of the score marks on freshly baked bread. A common feature of these sporocarps was also the scant lime. *Physarum nudum* T. Macbr. has previously been recorded from Guadalajara (Lado, 1993b).

Trichia contorta var. karstenii (Rostaf.) Ing.

*MADRID:* Las Rozas, dehesa de Navalcarbón, 30TVK2584, 13-V-1997, dwb 1479.

This was also collected already fruited from the bark of living *Quercus ilex* trees from Madrid: Las Rozas, dehesa de Navalcarbón, 30TVK2584, 30-XI-1997, dwb 1579, 1580, 1583. Specimens showed hemitrichoid capillitium with branches and fewer free tips. Most of the tips are blunt and the capillitium has irregular swellings as described by Lister (1894) for *Hemitrichia karstenii* Rostaf.

**DISCUSSION**

The fact that several species were collected in the field from bark as natural fruitings in situ, and from one of the same sites as bark samples collected for culture, supports the fact that these are species which grow normally on the bark of living trees, and are not mere opportunes of the favourable conditions of moist chambers (Brooks, 1967; Keller, 1971; Ing, 1994, 1997). *Dianema harveyi* Rex was not found in moist chamber culture but was collected already fruited from the bark of living *Quercus ilex* trees Madrid: Las Rozas, dehesa de Navalcarbón, 30TVK2584, 30-XI-1997, dwb 1586. It has previously been reported from the wood of *Q. ilex* and from other substrates in Madrid, Toledo, Guadalajara and Soria (Lado, 1993b).

The majority of the species previously recorded by others on the bark of living *Quercus ilex* trees in Spain (table 1), have also been recorded here. Missing taxa were mostly found in the more Eastern provinces of Spain, and may reflect different local conditions. Fourteen taxa have been added to the list of myxomycetes previously found on this substrate. Eight new records have been cited for Madrid Province, one being a second record for Spain.

The uniform methodology used for the 25 of the cultures from La Casa de Campo, Madrid (30TVK3575) enables some tentative comparisons of species frequency to be made,
and shows a typical frequency curve (fig. 9). It is possible that the pH treatment used for these cultures could have affected the results.

There is a marked frequency of the genus *Macbrideola* on this substrate. Four species were recorded. Two of these, *M. cornea* and *M. oblonga* were the most numerous species found in terms of records from different cultures, or collected from the same culture more than 5 days apart. The number of individual sporocarps was even higher.

The data on incubation times (fig. 10) are relative, as the exact culture conditions and the stage of development of each organism at the time of culture vary. Many may be in the form of microcysts or sclerotia which will probably activate more quickly than spores. This is most probably the reason for the rapid appearance of *Badhamiopsis ainoae* (average 10 days). A similar case was reported by LADO (1993a) for *Didymium sturgisii* and by PANDO (1994) who commented on the development of *D. anellus* from sclerotia in 24 hours. It is also possible that smaller sporocarps were missed the first time and longer incubation times reflect the next generation fruiting. In spite of this it is evident from the average data that the smaller true corticoles *Echinostelium apitectum* and *E. minutum* and the species of *Macbrideola*

![Diagram](image)

Fig. 9.—Relative frequency of various species from 25 cultures. (Note: To enable comparisons to be made between different species, the term record has been used to arbitrarily denote the appearances of the taxon in a culture separated by more than 5 days.)
Fig. 10.—Incubation times of some common species.

are the fastest to produce fruiting bodies in these moist chamber cultures, as pointed out by ING (1994), and that others (Perichaena depressa, Licea nannengae) take more than 40 days to develop. The collection of Licea deplanata took 79 days to appear. These times suggest possible modifications in the amount of time cultures are kept.

The species variety on this substrate can be seen from the 37 species from 12 genera that have appeared in these cultures. The taxa listed here have extended the number of species found on the bark of living Quercus ilex to 55.

ACKNOWLEDGEMENTS

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