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Short Communication

Taxonomic gap in wood-inhabiting fungi: identifying understudied groups by a systematic survey

N. ABREGO*,[1], I. SALCEDO[1]

Dept. Plant Biology and Ecology (Botany), Fac. of Science and Technology, University of the Basque Country (UPV/EHU), PO Box 644, E-48080 Bilbao, Spain

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ABSTRACT

Despite advances in phylogenetic research and the number of ecological studies focusing on wood-inhabiting fungi, these species still represent a taxonomically poorly known group of organisms. In this study, our overall aim was to detect and characterize the understudied wood-inhabiting fungal groups in the beech forests of Navarre (northern Spain). We present a list of 326 wood-inhabiting fungal species, out of which 36 % are first regional records. Comparing the already recorded fungal species in this territory and the list of firstly recorded species, we found that field-mycologists tend to focus on certain fungal groups, and in general rare species are less frequently encountered. Particularly, species with corticioid fruit body type have been especially overlooked in this territory. We attribute the high proportion of new regional records to the use of a systematic sampling design.

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Introduction

Despite advances in phylogenetic research (e.g. Hibbett et al., 2007) and increasing conservation interest in fungi (e.g. Heilmann-Clausen et al., 2015), wood-inhabiting fungi are still taxonomically poorly known (see e.g. Hawksworth, 2001). Some groups of fungi are evidently better studied than others, both regarding taxonomy and distribution. Among wood-inhabiting macrofungi, research has mainly focused on species with polyporoid fruit body type. Nevertheless, in terms of numbers of species, corticioids dominate over the polyporoids, and also other groups such as agaricoids and species from the phylum *Ascomycota* have high numbers of wood-inhabiting fungi (Stokland et al., 2012).

The Iberian Peninsula is one of the key areas where there is research on wood-inhabiting fungal taxonomy. With the establishment of the project "Flora Micológica Ibérica" (Tellería, 2002), many studies involving regional checklists of

* *Corresponding author.*
E-mail address: nerea.abrego@ehu.es (N. Abrego).
[1] Tel.: +34 946015355; fax: +34 94 601 3500.
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aphylloporoid fungi were published between 1990 and 2007 in the Iberian Peninsula (e.g. Tellería, 1990; Melo et al., 1998; Dueñas, 2002; Melo et al., 2007). Navarre, located in the northern part of the Iberian Peninsula, comprises one of the most forested regions within this territory, where beech-dominated forests are the predominant forest type. García-Bona (2000) published a mycological catalog including ca. 1 200 fungal species for Navarre, representing 26 % of the total fungal species richness of the Iberian territory (Tellería, 2002). Despite the fact that the forests of Navarre have been recognized for their biodiversity of wood-inhabiting fungal species, only a few taxonomical studies have been published recently (Salcedo et al., 2004; Heilmann-Clausen and Walleyn, 2007).

In this paper, our overall aim is to detect and characterize the understudied wood-inhabiting fungal groups in the beech forests from Navarre. Specifically, our aim is to address the following two questions. First, are species recorded as new to the region evenly distributed over fungal groups defined by fruit body types? Second, we ask if the firstly recorded species are characterized by ecological or morphological traits that can be expected to influence their observation probability.

Materials and methods

Study area

This study was carried out in Navarre, located in the northern part of Spain. This territory has a temperate climate, and covers two biogeographical regions: the Atlantic regions in the Northwest, and the Alpine region in the Northeast. In the study area beech-dominated forest is the predominant forest type, covering ca. 61 000 ha. Forest management has a long history in Navarre, although there also is a network of permanently protected areas.

Sampling methods

As described in more detail by Abrego and Salcedo (2013, 2014) the inventories were conducted using 230 sample plots which were randomly located across the beech forests of Navarre. Within each 10 m × 10 m sample plot, all dead wood pieces larger than 0.2 cm diameter were examined for the presence of all saproxylic macromycetes (those with fruit bodies larger than 1 mm and pyrenomycetes with cortical stromata). Each sample plot was visited once, and fieldwork was conducted during the autumns of 2011 and 2012, from late Sep. to early Nov.

Species identification and classification

Microscopic identification was carried out in the laboratory when necessary. The identification was done following both general identification guides and specific literature (see Appendix 1 for more details of the species identification procedure). The nomenclature of fungal species was updated according to *Index Fungorum* (2014).

To check if recorded species were new regional records, a list of wood-inhabiting fungal species that were previously known to occur in Navarre was compiled (the literature consulted is summarized in Appendix 2).

Data analysis

Logistic regression was used to test what factors affected the probability that a species is a new record to Navarre. Taxonomical group and some traits of the species were used as explanatory variables. The taxonomical group was modeled as a categorical variable, classified as the order of each species according to *Index Fungorum* (2014) and *Mycobank* (2014). Traits included were: fruit body type, fruit body size, fruit body life span, fructification rate in small dead wood pieces, commonness in Navarre and commonness in the Iberian Peninsula outside Navarre. Fruit body type was included as a categorical variable (the fruit body type categories are shown in Table 1). Fruit body size was categorized on a scale 1–3 based on the identification literature and observations in field, on whether the species produces typically: (1) thin fruit bodies (less than 1 cm thick) that usually cover small spots in dead wood; (2) one thick fruit body (thicker than 1 cm) or fruit bodies that usually cover extended areas (more than 20 %) on dead wood pieces; or (3) many thick fruit bodies (>1 cm per typical dead wood piece). Fruit body size was included as a categorical covariate. Life span was included as a categorical variable, classified to the three categories of annual, annual/biennial and perennial fruit bodies. Fructification rate in small dead wood pieces was included as a continuous variable and was calculated from our dataset. The total number of occurrences for each species was first calculated and then the fraction of these that occurred in dead wood pieces with

Table 1 – Summary of the number of species and percentage of new regional records for different fruit body types

Life-form	Number of species	Number of occurrences	Number of new regional records	Percentage of the new regional records (%)
Ascomycetes	24	4100	7	6
Agaricoids	34	334	4	3
Corticioids	194	2796	85	73
Polyporoids	61	781	15	13
Ramarioids	6	28	2	2
Tremelloids	7	86	4	3
Total	326	8125	117	

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