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Abstract: Fungi are indispensable components of the biota of any region. Their presence and distribution are of paramount importance to flora and fauna, and their ecological function may be responsible for the presence or absence of many other species, particularly plants.

Database records on fungi from South-West Asia were consulted to estimate the completeness of mycological exploration of the region. Unsurprisingly, some groups are well represented in certain areas, whereas others are lacking from SW Asian data altogether. In this paper an attempt is made to prioritise both taxonomic and geographical focal points in order to maximise the use of resources for the exploration of SW Asian mycota. Ecologically significant fungi are illustrated. At the same time, a plea is sent to botanists and other natural history professionals to take note of the fungi near or on (or in) the specimens they are collecting. Another plea is sent to mycologists to overcome regional isolation and to seek collaboration and regular exchange of experiences and progress with as many local and regional peers as possible.

Key Words: Symbiosis, mutualism, saprophytism, parasitism, diversity, lichen desert

Introduction

The mycota represents the sum of fungal taxa of a region, equivalent to the term "flora" for plants. The present essay follows the modern delimitation of the term to include members of the true Fungi (Kendrick, 2001; Cannon & Kirk, 2007), and only in passing members of the traditional groups, now assigned to Chromista and Protozoa. Hawksworth (1991, 2001) estimated the number of fungal taxa of a region to approach 6 times that of the species of flowering plants. If this estimate proved correct for SW Asia, the number of fungal taxa in the region would exceed 100,000, since Boulos et al. (1994) estimated the number of vascular plant species (most of which are flowering plants) of the region to amount to some 23,000. A recent publication (Mouchacca, 2005) lists 246 novel (between 1940 and 2000) taxa for the arid Middle East. Currently, preliminary checklists exist for only a few countries and specific groups of fungi (e.g., Turkey: Sesli & Denchev, 2005 for Myxomycota and macromycetes, Solak et al., 2007 for macromycetes; for lichens and lichenicolous fungi of the whole region: Feuerer, 2007). One of the greatest challenges for research is that there is little coordination of effort in the area, and the true extent of the flora and mycota (and fauna) can only be guessed from geographically limited reports. One of the most urgent problems appears to be a lack of local and regional collaboration between institutions. The Plant Life of South-West Asia symposia have greatly increased communication and could be understood as galvanising much needed collaboration. Now they also include mycota. However, the extent of teamwork is still far from ideal.

Materials and Methods

Various on-line databases and basic search engine results were used to show the extent of mycological publication. Of particular value were the USDA Fungal Databases (Farr et al., 2007) and Google Scholar™ (2007). The results were edited to remove references to off-target taxonomic (such as "Turkey tail", *Trametes*

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versicolor) or non-geographical (or off-target) entries, such as personal names (e.g., "Jordan") or geographical homonyms in other parts of the world (e.g., Lebanon, Pennsylvania USA). Furthermore, herbarium specimen records from Edinburgh (E) and Kew (K) were used to provide additional local validity for the methods above. Fungal citations were also compared with known floristic diversity as published by Boulos et al. (1994). The definition of South-West Asia was accepted as in Heywood and Davis (1994). Some special fungi of the region are illustrated courtesy of local collaborators and colleagues.

Results and Discussion

a) Regional significance: Using Google Scholar™, a total of 49,500 hits was generated for the region using the key word "fungi" in addition to the country names. After deleting non-target hits (mainly the personal name "Jordan"), this number was reduced to 39,100. Individual countries are represented as shown in the Table. Israel showed the highest number of hits, whereas Bahrain came out least mentioned with 451 hits.

When this result is correlated with the number of taxa reported for floristic diversity (taken from Heywood and Davis, 1994), a ratio of hits per higher plant taxon of between 8.5 for Israel and 0.4 for Yemen can be calculated (Figure 1). There appears to be a fairly constant ratio of 1.3+/-0.9 hits for most of the South-West Asian countries. Notable exceptions are Kuwait and Israel with 7.1 and 8.5 hits respectively. For Kuwait this can be attributed to high numbers of medical mycological publications together with a relatively small floristic diversity. For Israel, it can be argued that there is a greater component of English publications as well as there being a very well established mycological research community in this country. Mycological collections at E and K(M) are not fully databased but are best represented from Turkey, Israel, and Iran.

When considering plant pathogenic fungi, the situation is similar, but with Israel and Iran swapping places and Kuwait being mentioned least with only 4 citations (Farr

Table. Edited hits by country.

country	edited hits
Israel	19,012
Turkey	17,680
Iran	7487
Iraq	4020
Saudi Arabia	3730
Syria	3606
Lebanon	3558
Jordan	3549
Afghanistan	2841
Kuwait	2000
Oman	1661
Yemen	1440
UA Emirates	746
Qatar	558
Bahrain	451

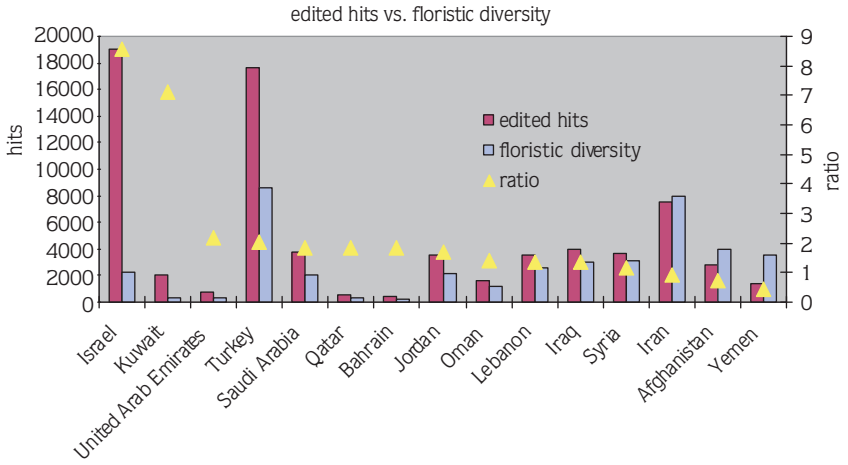

Figure 1. Correlation between fungal citations and floristic diversity.

et al., 2007), a not altogether surprising result with the low number of floristic diversity. The ratio between citations and floristic diversity again is highest for Israel (0.39) but lowest for Oman (0.01).

b) Taxonomic distribution and hot spots: This analysis could only be carried out on the USDA dataset of plant pathogenic fungi (Farr et al., 2007), as further analysis of citations from Google proved impracticable. Figure 2 shows the distribution of the major taxonomic groups (Phyla) of fungi in the region. Ascomycota are the dominant phylum, representing Erysiphales (powdery mildews), Taphrinales, and others. These are followed by Basidiomycota, representing Uredinales (rusts), Ustilaginales (smuts), and others. As most "Deuteromycota" are thought to belong to Ascomycota in the wider sense, this further increases the predominance of Ascomycota. Oomycota (downy mildews), Myxomycota (slime moulds), Zygomycota (bread moulds), and Chytridiomycota (water moulds) only represent relatively few citations.

When analysing regional hot-spots, Ascomycota are most frequently cited in Turkey, reflecting strong interest in mildews and ascomycete macromycetes in this country, whereas Basidiomycota, "Deuteromycota", and Oomycota are most prominent in Iran, reflecting a strong research base in plant pathology in that nation. Not surprisingly, fungi of arid regions are particularly important ecologically, as illustrated by the desert truffle *Terfezia boudieri* Chatin (Figure 3) and the desert lichen communities of Dhofar (Figure 4).

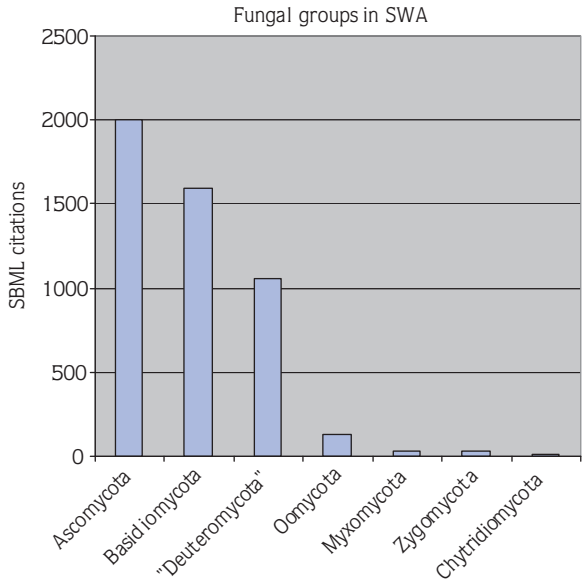

Figure 2. Distribution of citations of fungal phyla in South-West Asia.

As well as actual collection records, Feurer (2007) published numbers of expected taxa for lichens and lichenicolous fungi for each country. According to this, the countries of South-West Asia are explored at various degrees, with Yemen being known at 87% (mainly because of the good coverage of Socotra) and Iran at 6% (partly due to the expectation of finding around 1000 species there). Whilst there are no comparable data for other groups of fungi, it is reasonable to postulate similar coverage for the remaining fungal taxa, keeping in mind that the very good coverage for Socotran lichens is the exception. Currently, around 1000 species of lichens and

Figure 3. Terfezia boudieri Chatin, the Desert Truffle; courtesy D. Yağız.

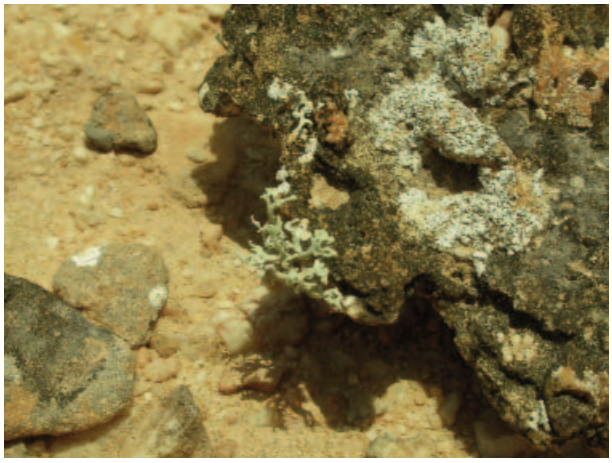

Figure 4. Desert lichen community of Dhofar; courtesy A Miller.

lichenicolous fungi are expected for Turkey alone (Feuerer, 2007). This compares with ca. 2000 species of macromycetes (Solak et al., 2007) and 180 species of myxomycetes (Sesli & Denchev, 2005).

Conclusions

The mycota of South-West Asia are only known at between 10% and 30% of their estimated final diversity. Checklists are only available for a few groups, and mycological associations and societies are either non-existent or poorly functioning. In order to remedy this, efforts should be made by regional mycologists to organise regional mycological exploration and recording with an aim to produce checklists for all fungal taxa. Better communication between regional specialists and with the wider mycological community would be desirable. A forum, such as PLoSWA is ideal to bring the regional mycological knowledge together and explore future efforts. Judging from the data presented here, the most diverse areas to explore are expected to be Turkey, Iran, and Iraq, with the desert regions least diverse but by no means less interesting.

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