A First Survey of Mushroom Diversity in four Maryland National Parks

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Introduction: The Magnitude of Fungal Diversity

Global fungal diversity has been estimated at between 1.5 and 5.1 million species (1,2), making fungi among the most diverse groups of organisms on our planet. There are approximately 20,000 described species of macroscopic fungi or "mushrooms", which mostly correspond to basidiomycetes (3). The total number of mushroom forming species has been estimated at between 53,000 and 110,000 (4). This would suggest that only 18% to 38% of all the mushrooms have been documented. Also, because they are often cryptic with rare fructifications of short duration and because it may be difficult to accurately identify them, little information is available about geographic range and habitat specificity (endemicity).

The formation of checklists for future comparison is vital to our understanding of changing fungal diversity. They can supply information such as the range of a species. Each mushroom (as wells as all organisms) exhibit habitat preferences. These preferences in conjunction with historical factors define a species range. By knowing whether a species occurs only in a restricted geographical area versus being widespread, conservation efforts can be better informed and directed. The world is currently undergoing drastic changes. Although there is argument regarding the magnitude and causes of this change (such as pollution, habitat destruction and climactic change), there is little doubt that it is occurring. By forming checklists we create the possibility of future studies to determine changes in species ranges, population levels, extirpations and extinctions.

Checklists can also add value to the recreational experience of park visitors. Mushroom species lists can be added to park websites, giving visitors the opportunity to explore what species they might expect to see, or to compare and identify mushrooms that they have seen in the parks. With proper photography, notation and curation (in museum collections) checklists provide valuable information to the parks and their visitors.

The Scope of this Project

Collections were made by Damon Dewsbury, Alison Fischer, Leena Rizvi and Terri Mclennon-Porter between October 4th and 11th of 2006 with the purpose of forming a preliminary checklist of mushrooms for Catoctin Mountain Park, Chesapeake & Ohio Canal National Historical Park, Antietam National Battlefield and Harpers Ferry National Historical Park. There is currently no comprehensive list of macrofungi for the National Capital Region and this was the first such effort to broadly sample fungi from these parks. Care was taken to sample from as many habitat types as possible. Samples were taken from Tulip poplar/Oak dominated stands, Sycamore dominated areas (adjacent to the Potomac river), Hickory/Oak/Paw-Paw stands and two conifer dominated stands (White Pine and Tabletop Pine). Collections were made of all fungi with visible fruiting bodies. Collections were digitally assigned numbers, photographed (with a scale marker as in fig.1 and 5), tissue was taken and placed in buffer for future DNA work and the specimens were dried for preservation.

The Collections

During this one week of fieldwork, 172 collections were made representing at least 155 distinct species. These species represented 76 genera of mushrooms. The majority came from the Phylum basidiomycota (168 collections). Four collections belonged to the phylum Ascomycota.

As well as taxonomic and phylogenetic diversity, our collections represented multiple morphotypes: coralloid (fig.1), gilled (figs.2 to 14), pore surfaced (figs.15 to 18), jelly fungi (fig.19) and gasteromycete (or "puffball") (fig.20). Collections varied in their ecological roles: wood decayers (figs.4,5, 7,8,9,15 to 20), forest floor saprophytes (figs.10 to 14), potential tree parasites (fig.6) and mycorrhizal fungi (fig.2 and 3). Several edible mushrooms were found (figs.6,12,15 and 20) as well as some potentially deadly ones (fig.2 and fig.5).

All collections are being databased and sequenced for the ribosomal large subunit (rLSU) and internal transcribed spacer (ITS) DNA regions as part of their curation. Dr. Stephenson has created a webpage to house the photos from this project (5) and these photos as well as the database will eventually be linked to NCR park webpages.

Discussion

The collecting done during this project was a significant step towards forming a checklist of macrofungi for the National Capital Region such as that available for the Great Smoky Mountain National Park (6).

This project did not exhaust the collecting possibilities for these parks. Studies such as that by Porter et al. (7), where 134 basidiomycete species were found in a 5000m^2 during 2 years of collecting in a hemlock dominated stand, or that by Straatsma et al. (8) which sampled a 1500m^2 area for 21 years and recovered 408 species (with the author expecting more species with a continued study) show a relatively high species richness in temperate forests. The Great Smoky Mountains National Park (a very species rich region) has an estimated 1800 species. Using this as an upper limit and judging by the sampling effort of this project, we might conservatively estimate that the National Capital region might contain between 300 and 500 macrofungi species. Many fewer species were found during this study due to sampling duration and the amount of area surveyed, but also because the assemblage of fungi present changes drastically throughout the warm season. The relation between habitat and fungal species richness is not concretely established. This study was an important step towards a checklist of macrofungi in the National Capital Region. It was a source of valuable information for the scientific community and will give a rich source of information for park visitors in the near future.

Literature

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Fig.1 - *Clavicorona pyxidata* - some "coral" fungi are excellent edibles, but difficult for many amateur mycologists to tell apart

Fig.2 - *Amanita aff. Vaginata* - potentially deadly, yet beautiful when intact

Fig.3 - *Russula aff. Maculata* - one of many red *Russulas*, some of which cause stomach upset

Fig.4 - *Mycena aff. Pura* - although corresponding to *M.pura*, without DNA evidence it is impossible to positively identify many *Mycenas*

Fig.5 - *Galerina autumnalis* - an unassuming but potentially deadly mushroom. It is possible for novices to mistake this for a Honey mushroom (fig.6) due to its growth on wood and ring

Fig.6 - *Armillaria aff. mellea* - the Honey Mushroom, so named for the vast variation in its colouration

Fig.7 - *Panellus stipticus* - historically used as a blood clotter. One of several mushrooms which glow in the dark (mostly the gills)

Fig. 8 - *Mycena spp.* - one of many beautiful, miniscule and impossible to identify *Mycena* species. A good example of why DNA sequencing will prove invaluable

Fig.9 - *Rhodotus palmatus* - a somewhat rare wood decay fungus with brilliant fructifications. The cap is covered by a reticulate network

Fig.10 - *Psathyrella aff. gracilis* - Remarkably fragile with a dark purple spore deposit

Fig.11 - *Hygrocybe nitida* - although usually small, many *Hygrocybe* species are intensely coloured

Fig.12 - *Lepista nuda* - the Wood Blewit. A delicious edible which grows in leaf litter but may be confused with some poisonous *Cortinarius* species

Fig.13 - *Hygrocybe psittacina* - the Parrot Waxy Cap

Fig.14 - *Marasmius pulcherripes* - miniscule and growing directly out of fallen leaves

Fig.15 - *Polyporus squamosus* - the Dryads Saddle. A common edible, but hardly choice

Fig.16 - *Polyporus badius* - the blackfooted polypore. This is a large specimen

Fig.17 - *Ganoderma aff. Lucidum* - this is cloesly related or the same as the Ling-chi used in traditional chinese medicine

Fig.18 - *Pycnoporus cinnabarinus* - a striking polypore which is relatively common

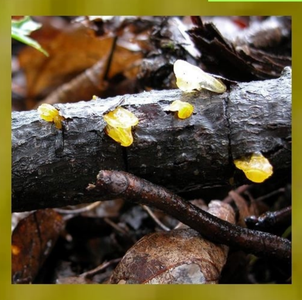

Fig.19 - *Tremella mesenterica* - a common jelly mushroom.

Fig.20 - *Lycoperdon pyriforme* - spores "puff" out of dried fruiting bodies when ditrurbed. Edible when young and often in great quantity

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