

FUNCTIONALBIO

Functional biodiversity in forests: diversity of soil decomposers and predatory and parasitic arthropods

PROJECT TEAM

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BACKGROUND

In forests, growth and decomposition are the two most important ecosystem functions. Plants supply the majority of growth within the ecosystem, while fungi and soil fauna are the main drivers of decomposition. Soil arthropods play a major role in decomposition and nutrient cycling within forests, and also help inoculate roots with mycorrhizae. Mycorrhizae are important within forest ecosystems as the associations they form with the roots of many tree species assist in the assimilation of nutrients. Within the forest system, there is far greater biodiversity below-ground than above-ground, for example there are approximately 1000 species of soil invertebrates in a single square metre of a beech forest. Also the biodiversity of macrofauna are of considerable importance in soil systems.

The taxa selected for study (fungi, soil microarthropods, parasitoid wasps, bugs (Hemiptera), and nematodes) were chosen specifically because of their potential usefulness as indicators in forest systems, and because they are additional taxa that significantly broaden the ecological scope of the assessment of biodiversity in Irish forests.

OBJECTIVES

The objectives of this research project are to:

- assess the biodiversity of mites, Collembola, bugs and parasitic wasps in canopies;
- assess the below ground animal biodiversity;
- compile an inventory of macrofungal basidiomycetes and ascomycetes;

- assess abundance of fruiting bodies of edible forest fungi;
- relate diversity to forest type;
- relate the efficiency of fungal biodiversity indicators to other biodiversity indicators in Irish forests;
- develop methodologies to assess biodiversity in forests;
- draw up recommendations to enhance biodiversity in plantation forests.

PROGRESS

Canopy sampling by tree climbing trees is now complete and has yielded a large number of species.

The samples processed thus far have yielded three species new to science. These come from the genus *Zercon*. The descriptions have been accepted for publication and will appear in early 2009. These findings are of a great ecological and faunistic importance because *Zercon* species are not commonly found in arboreal habitats, suggesting a sharp distinction between arboreal and soil species.

The genus *Licneremaeus* (Acari: Oribatida) has been recorded for first time in Ireland and Scanning Electron Microscopy (SEM) was used to confirm the identifications of *Xenylla brevicauda*, and its presence in Ireland which has been disputed. Discussions with taxonomists are ongoing.

A literature review of the Acari and Collembola species found in Irish forests is ongoing. This will be the basis for the biodiversity inventory.

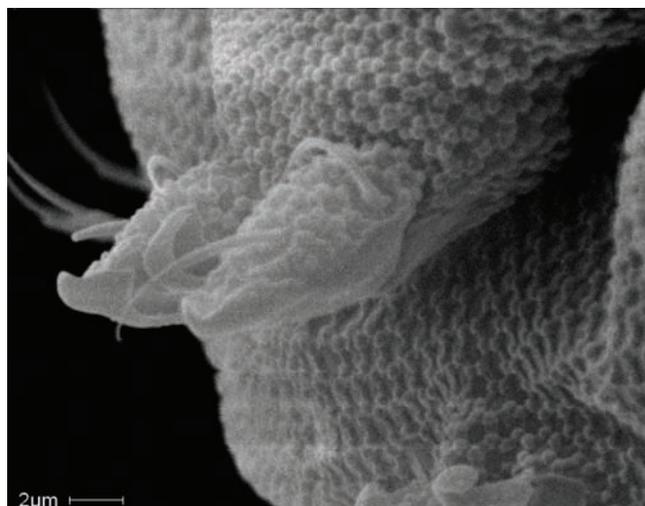
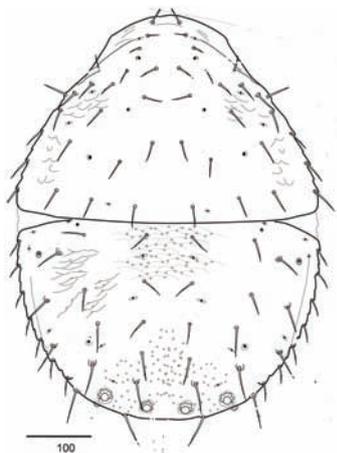


Image of the springing organ of the Collembola species *Xenylla brevicauda* taken using SEM.



Zercon hibernia Moraza, Arroyo and Bolger, sp. nov. (from Moraza, Arroyo and Bolger 2009) collected in Kinnity Oak Forest in 2007.



Licneremaeus sp.

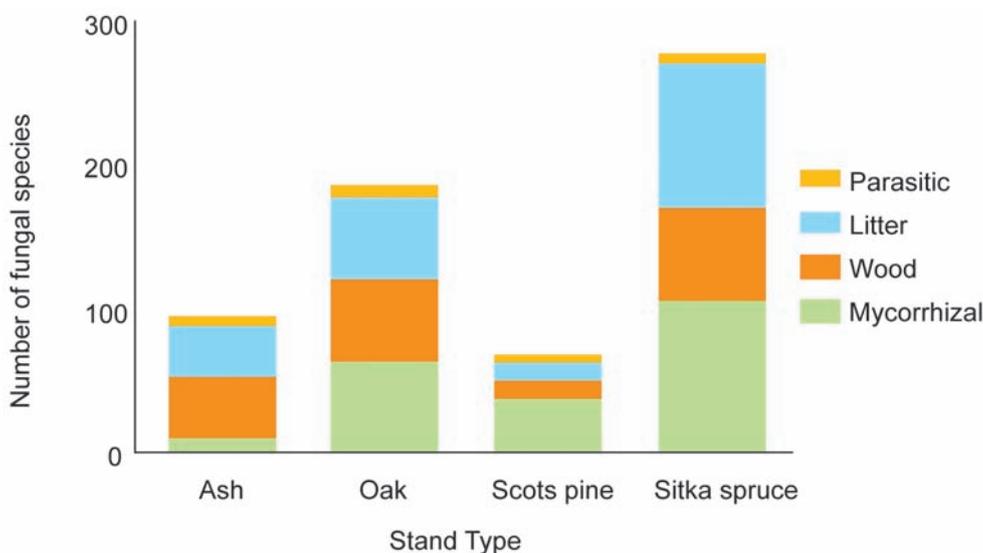


Figure 1: Fungal functional group breakdown in forest stands of different type.

Four study sites were fogged in August 2007. Three study sites were fogged in August and September 2008. The remaining 18 study sites will be fogged in summer 2009 and completed by end July 2009.

Soil cores were collected in 2007 and 2008 and a number have been processed for mite and collembolan species. A subset has been processed for nematodes.

From a total of 3,544 fruit bodies counted 354 species of fungi have been identified. The data from two year’s sampling indicate that:

- the mycoflora differ between stands of different type. Ash sites were found to a very different and impoverished assemblage of macrofungi compared to that of the other tree species (Figure 1);
- oak sites had the most diverse macrofungal assemblages on average, but more species were found on Sitka spruce sites. This may be due to more Sitka spruce sites being investigated.

ACTIVITIES PLANNED

Activities planned for 2009 include nematode fieldwork, fogging fieldwork, and laboratory work for samples.

Literature review for all Acari and Collembola species found in research projects and theses is ongoing. Verification of species identities in difficult groups will be necessary.

Analysis of mycorrhizal populations in forest sites will be analysed and the PCR protocol will be refined. The remaining site variables will be collected, such as vegetation data, photosynthetic active radiation (PAR), and the soils of each site will be classified according to their physical and chemical attributes.

Another sampling for fungi will take place in summer and autumn 2009.

OUTPUTS

Moraza, M.L., Arroyo, J. and Bolger, T. 2008. Three new species of mites (Acari: Zerconidae) from canopy habitats in Irish forests. *Zootaxa* (in press).

Arroyo, J. and Bolger, T. An overview at the Oribatid mite fauna (Arachnida, Acari) inhabiting the canopy of a young Sitka spruce plantation in Ireland. *Environ 2008 Dundalk IT*.

A commentary on the project appeared in *Science Spin* (Issue 23).