1735

INTERNAL REPORT 14

ECOLOGICAL SURVEY OF FUNGI ACTIVE IN WESTERN CONIFEROUS FOREST SOILS

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During Biome 1, our primary objective was identification of the dominant fungi involved in litter decomposition. Two survey methods were used: (1) a survey of macrofungi occurring on Watershed 2 based on fruiting bodies collected and cultures; and (2) a survey of microfungi on decomposing foliage based on cultures isolated from Douglas-fir and hemlock needles from Watersheds 1 and 2. These surveys pass through similar phases--field collection, identification, culturing, and evaluation--although methodology is quite different for the two surveys. These surveys are expected to be completed during the coming wet season (1971-72), but similar studies must be done for microfungi on other major components of litter, such as twigs, wood fragments, and lichens.

Culture work is necessary for two reasons. Most fungi are encountered in nature as vegetative mycelia, and their identification requires comparison with mycelia of known identity. Studies of rates of decomposition of specific elements of litter (whether on molecules or plant parts) will require cultures of the major decomposers to ensure uniformity of inoculum.

Evaluation of the surveys consists in ranking the species identified on the basis of frequency and density and on association either with a specific element of litter, on a specific stage in decomposition, or on a specific vascular plant species.

Progress Expected in 1971

1. Contribution to a check list of cryptogamic species from the Andrews, which will include mosses and liverworts (Sawbridge), lichens (Tracy and Pike), and macro- and microfungi (Rhoades, Wicklow, Denison, Carrol, and Trappe).
2. Collection of cultures of major decomposer species from cultures isolated directly from fruiting bodies found on the Andrews and known cultures from culture collections elsewhere of species found on the Andrews.
3. Brief descriptions and illustrations of species important on the Andrews (No "manuals" comparable to Hitchcock exist for the fungi), which will include descriptions of vegetative features as well as fruiting bodies and estimates of "role" of each species.
4. Voucher specimens deposited at OSU and National Fungus Collections (Beltsville).

Projections for the Future

1. Complete microfungi survey with extension to other major litter components.
2. Make litter-bag studies of disappearance of litter components, which includes seasonal activity and annual totals.
3. Identify substrates (molecules) of major litter decomposers.

4. Study effect of microclimate on rates of decomposition of major decomposers on major substrates, in field and laboratory.
5. Develop description of successional stages in breakdown of major litter components, which includes changes in chemical composition of litter element and changes in microorganism populations.
6. Test estimates of seasonal rates and annual totals of fixed carbon or nitrogen released as gas or water-soluble compound.
7. Develop and test models for filamentous fungi and bacterial unicells of storage and exchange capacity of living populations.

SUPPLEMENTAL REPORT

Epiphyte Communities

Although the project on epiphyte communities will not exist officially until 1 January 1972, it has been an active one during the past two summers, supported partly by IBP, but with additional support from NSF-URP.

The primary objective is to provide estimates of fixed carbon and fixed nitrogen, in kgm/hectare, attributable to epiphyte populations. A secondary objective has been a catalog of epiphyte species on the Andrews. A third objective, added this season, has been direct measurement of above ground biomass of the individual trees on which epiphytes are being studied.

For a variety of reasons, epiphytes must be studied on live, standing trees. A major part of the project, therefore, has been development and improvement of techniques for climbing and working in tall trees. This phase is now complete and being written up for publication. Six trees are now "rigged" and can be climbed. Three of these are Douglas-fir on the buffer zone between Watersheds 2 and 3. They are considered "training trees", to be used in training climbers and in developing techniques.

The other three trees, two Douglas-fir and a hemlock, on Watershed 10, are among 38 trees selected as part of a sampling plan for the entire watershed.

The first of these trees has been completely sampled as follows:
(1) The tree is rigged for climbing.
(2) The climber ascends and takes two kinds of data, (a) Epiphyte data from the trunk, which consists of cover data from 10 by 25-cm quadrant at 1 m intervals up four vertical transects, and (b) branch system data. Each branch system, roughly 150/tree, is scored for diameter of main trunk, height, compass direction, maximum diameter, length of branches > 5 cm diameter, area of horizontal projection of twigs and foliage, density of twigs and foliage, total bryophytes, total Lobaria (the major N-fixing lichen),and total lichens.
(3) The branch system data are tabulated. Each branch system has an absolute "importance" number calculated. Based on the size and complexity (that is, 1, 2, or more "tops") of the tree, a judgment is made as to how many branch systems must be sampled (2-6, but usually 3 or 5). A "drawing" is made with the odds biased in favor of branch systems with a high "importance value."
(4) The selected branches are sampled as follows: (a) branches > 5 cm are laid off in 10 cm lengths, (b) diameter is measured at each

decimeter, (c) each 5th decimeter is picked clean of epiphytes and scored for cover to include crustose species, and (d) branches < 5 cm are numbered, and each fifth one is removed for direct measurement of twig, foliage, and epiphyte biomass.

Progress Expected

Biome 1. (1) Description of access techniques (paper in Preparation); (2) description of epiphyte communities on old-growth Douglas-fir (paper in preparation); and (3) contribution (epiphytes) to check list of cryptogams of Andrews (See Litter Decomposition).

Biome 2. (1) Description of growth forms on old-growth Douglas-fir; (2) epiphyte biomass, fixed carbon, and fixed N, both per tree and per hectare for Watershed 10; and (3) description of epiphyte communities on western hemlock and western red cedar.

INTERNAL REPORT 15

BASIDIOMYCETES IN THE PRIMARY DECOMPOSITION OF FOREST FLOOR LITTER

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INTRODUCTION

Decomposition is known to be a vital step in the cycling of energy and nutrients within a coniferous forest ecosystem. Little is known, however, about the specific organisms that play major roles in the primary processes of decomposition.

Fungi of the basidiomycete class have been closely associated with decaying forests. Members of this group of fungi especially have been found to degrade cellulose and lignin, the primary components of trees. Little information, outside of observations on occurrence, has specifically been reported on basidiomycetes functioning as primary decomposers within a forest ecosystem.

Waksman (1916, 1917, 1944) conducted studies on the fungi present in soil. Warcup (1950, 1951) described several basidiomycetous fungi isolated from a grassland soil. Warcup and Talbot (1962, 1963) continued work on soil-inhabiting basidiomycetes.

Other workers have not been as successful as Warcup in demonstrating basidiomycetes in soil. Hodges (1962) reported isolating no basidiomycetes from southern forest tree nursery soils. Brandsberg (1966) recently published a thesis on the fungi associated with the decomposition of coniferous litter. He reported no basidiomycetes among the fungi identified. He did isolate and identify an Oedocephalum sp., which has been reported by Batshi (1952) as being a conidial stage of Fomes annosus. Members of the genus Oedocephalum, however, are also commonly found as the conidial stages of other basidiomycetes and discomycetes.

Several studies have been conducted on methods of inducing basidiomycetes to fruit in culture. Tamblyn and DeCosta (1958) developed a technique for producing fruiting bodies of wood-decaying basidiomycetes. Warcup and Talbot (1962) also described methods, one of which is a variation of Tamblyn's and DeCosta's technique. Another somewhat more complicated technique is described by Parkinson and Williams (1961). The technique is to remove the spores of the heavily sporulating fungal species from the soil by washing and then plating out the remaining soil. By this method, they have obtained basidiomycetes in culture.

These reports serve to illustrate the paucity of good methods to isolate and identify basidiomycetes as significant forest decomposers. Our study was undertaken to determine the place of basidiomycetous fungi as primary decomposers within a coniferous forest ecosystem.