

COMMUNITIES OF MUSHROOMS.

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One that has observed the newspaper accounts of mushroom poisoning may have wondered why certain localities should have a great number of casualties while other localities are practically free from cases of mushroom poisoning. The reason for this is to be found in the study of the relationship between the topography of the land and the plant associations. Many of the cases of mushroom poisoning that come to our notice in the Chicago area occur from specimens gathered in the dune region. It is here that the *Quercus velutina* (Black oak) predominates and associated with this tree is a member of the *Quercus velutina* (Black oak) mushroom community called the Destroying Angel or Death Cup (*Amanita phalloides*). Nearly all of our very serious cases of poisoning in this area are the result of eating this one species.

Mushrooms may be classified into communities which are related to a corresponding association of higher plants. The dunes region, located adjacent to Lake Michigan, contains a succession of associations from the most xerophytic to the climax forest. Each of these has in it a community of mushrooms. The successional stages on the beach contain no mushrooms as the exposure is too great and the change too rapid to permit successful growth and reproduction. The higher plants are successful on the upper beach where the presence of *Calamovilfa longifolia* and *Ammophila arenaria* cause the moving sand to pile up and produce fore dunes. On these fore dunes along with these grasses is to be found a gregarious mushroom commonly spoken of as the "Lover of the Sand Binding Grass" (*Psilocybe ammophila*) and another called "Lover of the Sand" (*Psilocybe arenulina*). The presence of these mushrooms apparently in the midst of bare sand indicates that some organic material is present in the sand. By moving back farther into the dunes to a place where the sand has stopped moving and pine trees have established themselves, another community composed of four or five species is to be found. This community is generally dominated by the *Clavaria muscoides* (Dingy

coral), *Lepiota cristata* (Small Scaly Mushroom) and *Clitocybe pinophila* (the Pine Loving Mushroom). Among these may often be observed the American *Boletus* (*Boletus americanum*), Granulated pored *Boletus* (*B. granulatus*) and rarely *Lepiota cinnabarinus*. If the pines have stood for a very long time *Marasmius androsaceus* (Pine needle *Marasmius*) and *Mycena vulgaris* will be found to have joined the community.

As pines do not succeed themselves the time eventually comes when they are replaced by an association of Black oak (*Quercus velutina*). Places where this has already happened may be found a little farther back from the lake. Here may be recognized a sandy soil with but little covering or in a very much protected spot a sandy soil with a thick covering of dead leaves. The communities of fungi are variable due to the differences in the amount of leaf covering present. The less protected locality where the leaf covering is very thin has a community composed of *Geaster hygrometricus* (Earth star), *Tylostoma campestris* (the Stalked Puff Ball), *Scleroderma flavidum* (Tough skinned Puff Ball), and *Polyporus cinnamomeus* (Silky Central Stemmed Polypore). Here areas become stabilized, but the protecting dune which by sheltering the area from the wind made possible the stabilization, shifts and the surface is again subject to wind action. The community that can live here is able to find subsistence in changing conditions. Stabilization becomes more permanent, gradually the leaf mould accumulates, and the humus is plentiful. The community of mushrooms increases in number and kind until the former community can no longer be recognized as a component part of the new community. This advanced stage, Black Oak community of mushrooms contains that beautiful yet dangerous monarch of mushrooms, the Destroying Angel or Death Cup (*Amanita phalloides*). This one species has been responsible for more human trouble than all of the other species combined and has claimed its toll of human life wherever the Black oak, Chestnut or other oaks that occupy the corresponding physiographic landscape exist. Others in this community are *Hydnum zonatum* (The zoned Toothed Mushroom), *Tricholoma acre*, *T. transmutans*, *T. terriferum*, *Clitocybe ochropurpurea*, *T. personatum*, *Boletus felleus* and *B. edulis*. In the protected

ravines away from the moving dunes where stabilization has long existed the association of trees is dominated by the Red Oak (*Q. rubra*) with an occasional Sugar Maple present to indicate that the next association is in the initial stage. Here the leaf mould is abundant and the herb life is an association of climax species. The community of mushrooms here found is exceedingly large. The sandy subsoil tends to insure an ever present supply of abundant moisture. Moisture and humus supply operate together as determining factors to augment the development of abundant carpophores. The number of fungi during a rainy autumn is tremendous. Among these may be enumerated *Clitocybe maxima*, *C. caespitosa*, *Entoloma jubatum*, *Hydnum aurantiacum*, *H. repandum*, *Geaster rufescens* and *Inocybe repandum* (Fiber head).

In either the xerarch or the hydrarch succession the number of fungi increases as the succession advances toward the climax stage. The dune succession presents the xerarch in which it may be noted that the humus supply becomes greater as we advance from one community to another of the series. A similar series of facts is in evidence in other xerarch successions such as the rock series or the change from a very open to a dense forest.

The bog succession is much richer in fungi than the swamp. The succession of vascular plant associations consists of a fringe of *Decodon verticillatus* (Whorled Loosetrife); *Sphagnum*, with other plants such as sundew and the pitcher plant; bog shrubs; Tamarack trees; Yellow Birch, Red Maple; and the climax Sugar Maple. These associations come in succession in time and quite often are arranged in place order due to the different degree of advancement of the habitats. In Cedar lake, Lake Villa, Ill., for instance the zonation of associations is quite distinct composed of the fringe of *Loosestrife* well out in the lake perhaps 200 feet from shore. The next association forming a zone perhaps 100 feet wide is composed of *sphagnum* with other plants growing on the mat formed by the *sphagnum*. The entrance of shrubs on the *sphagnum* mat marks a third association. The communities of fungi do not here separate from each other with the same sharp zonation as is true of the vascular plants, in fact they seem to be determined more by the presence of the factors pro-

duced by the growth of the sphagnum rather than to the advance of conditions to a place where another vascular plant association may develop. On this mat of sphagnum is found a community of fungi composed of *Omphalia fibula*, *Galera hypnorum*, *Hygrophorus miniatus* variety *sphagnophilus*, *Entoloma nidosum*, *Hebeloma crustuliniforme* form *sphagnophilum* and that most beautiful and colorful plant the *Boletus spectabilis* with its red and golden colors. All these seem to be related to the mat of sphagnum which forms most of the soil material for the growth of plants both vascular and nonvascular. The succeeding zone which contains Tamaracks (*Larix laricina*) contains two other fungi, *Russula fallax* and *Lactarius* sp. Cedar lake bog contains young tamaracks only. The indications here are that many years must elapse before the filling in of the lake by the accumulation of sphagnum in the form of peat will be sufficient for the advance to the Red Maple-Yellow Birch association. This stage of the successional advance has been reached in the Mineral Springs bog and with it has come a community of mushrooms containing some that belong in the preceding group and are to be associated with the Tamarack such as *Boletus spectabilis*, and the Vermilion Wax Gill (*Hygrophorus miniatus*) and in addition to these that have continued from the former community are *Lactarius helvus*, *Cantharellus aurantiacus* (Golden Vase), *Calvatia saccatus* (Bog Puff Ball), *Hygrophorus speciosus* (Beautiful Wax Cap) *Collybia aquosa*, *Mycena sanguinolenta* (Red milk *Mycena*), *Gomphidius maculatus* (Spotted Bolt) *Lactarius camphoratus* (Camphor Mushroom), and *Hygrophorus chlorophanus* (Yellow Wax Mushroom). The advance to the climax community finds a tremendous number of fungi as well as the remnants of bygone communities. These remnants furnish a most interesting means for the estimation of the past history of a habitat. If for instance we find in a climax forest the Yellow Wax Mushroom, Camphor Mushroom and Golden Vase, along with the usually expected climax forms. It seems justifiable to believe that they are remnants of a habitat that is different from the present one and that the habitat has developed to the climax through the bog series (hydrarch) rather than through a xerarch series.

A listing of the climax community shows the species of mushrooms to be much the same regardless of whether the climax has come through the one (xerarch) or the other (hydrarch) series. The percentage is doubtless as high as 80% but the differences between the two communities, the other 20% is of great interest from the standpoint of ecological development. Too little has been done on the problem of the estimation of past development from the differences to make any very sweeping conclusions. A few years further study of such relationships may bring forth more adequate data. In the forest at Tremont, Beech and Sugar maple are among the predominating trees but the association contains a community of fungi not only of the climax type but additional species associated with other stages of the bog successional series. Such evidence points toward a development through the hydrarch series in spite of the fact that the forest is adjacent to a xerarch dune series.

The two successions described serve to illustrate the successional advance of mushroom communities. Similar description of other successions would also show parallel successional advance of mushroom communities.