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A CHECKLIST OF THE FLESHY FUNGI OF
HANCOCK COUNTY, OHIO, AS
RELATED TO SOIL ASSOCIATIONS

by

Fred J. Crates

This thesis is recommended for approval by the student's thesis
committee.

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Chairman

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Approved by _____, Dean of Graduate Studies.

(date)

Submitted in Partial Fullfillment of the Requirements for the
Degree of Master of Arts.

Northern Michigan University

Marquette, Michigan

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I also wish to thank my wife, Kathleen, for her continued understanding and encouragement and my young son, James, for his patience.

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Introduction

In the fall of 1965 an unusually large crop of fleshy fungi was observed in the area near Findlay, Ohio, thus stimulating the author to learn more about the varieties of fungi that occur in Hancock County. After some collecting and study, it seemed desirable to compile a check list for the county. A listing of the species of fleshy fungi from Hancock County, Ohio, serves a two-fold purpose. First, it contributes to the total biological understanding of the area and of the state. Secondly, it provides a teaching aid to science instructors.

When this check list was started, the author discovered a publication describing the specific location of various soil types within the county (1). It was decided to check for a possible relationship between the distribution of fungi and the kinds of soil present. It is common knowledge that certain mushroom forms grow more readily in association with woody plants; therefore the identification of various woody plants was necessary. The Woody Plants of Ohio by Braum (2) proved valuable in this task.

PHYSIOGRAPHIC FEATURES OF
HANCOCK COUNTY

The assemblage of a collection of fleshy fungi indigenous to Hancock County, Ohio, required a general survey of basic physiographical characteristics of the area before the actual collecting began. Such background material was obtained by examining aerial photographs, summarizing climatological statistics, conducting road surveys of significant collecting stations and analyzing available soil studies.

The emphasis on greater productivity per farming unit and the utilization of virtually all tillable areas on each farming unit brought about drastic changes in the ecology of the area. Early histories of Hancock County describe large forested regions, whereas today only nine per cent of the country is wooded. These woodlots range in size from one to one hundred acres and many are pastured.

Marsh conditions are absent and wet areas have been reduced by artificial drainage. Two natural drainage systems occur within Hancock County. One, the Blanchard River drainage system, encompasses about three quarters of the county whereas the remaining northern quarter comprises some of the headwaters of the Portage River (1).

Level lacustrine-influenced areas comprise the northern third of the country. The eastern portion is gently sloping ground moraine whereas the southern and western regions show sloping Fort Wayne end moraine formations (1).

The average frost-free season totals 159 days. Killing frosts occur into early May and reoccur by early October. The average July temperature is 74.2 degrees and the average January temperature is 27.1 degrees (1). Spring, summer, and fall rainfall average 28.85 inches. Winter precipitation, much of which occurs as snow, averages 7.11 inches for a total average annual rainfall of 35.96 inches (1).

MATERIALS AND METHODS

No check list is known for the fleshy fungi of Hancock County. The Mushrooms, Edible and Otherwise by Hard (3), resulted from his collections in northwestern Ohio. This was an important source, as was Graham's Mushrooms of the Great Lakes Region (4). Identification of fleshy fungi was based largely on the keys in Smith (5) and Christensen (6). Large or confusing groups, such as the family Polyporaceae, required a detailed account of species characteristics as presented by Overholts (7), whereas certain species of the genera Mycena and Peziza were identified from publications by Smith (8) and Seaver (9) respectively.

Collecting sites were selected after a careful study of an Inventory of Ohio Soils (1), which contained a survey of the location and types of soil existing in Hancock County. The sixty soil types were grouped into eight soil associations and their locations were identified on maps. Collection sites were selected by marking woodlots, streams, ditches, and meadows on aerial photographs of the county. A collection based on such a pattern would thus not only provide a checklist of fleshy fungi but also indicate a possible relationship between a particular species and a soil type. Thirty-five sites were then established from which the collections were regularly made (10).

A collecting site was sampled by making a random movement through the area followed by a systematic movement along the borders and central area on a succeeding visit. After several visitations the area was covered completely at least two times.

When a specimen was located, details of the habitat and a description of the specimen were recorded. A Nikkorex camera with an F2 lens was used to take photographs each time a species new to the survey was located. Each specimen was cataloged and wrapped in waxed paper for transport.

Laboratory procedures included the taking of additional photographs, attempts to make spore prints for each species, drying in a chamber constructed from an old refrigerator (Fig. 1), and storage in paper sacks with crystals of paradichlorobenzene added.

Locations of Collecting Sites

- Area #1 A 45 acre woodlot located on the south side of State Route 15 and 23 in section 6 of Amanda Township. A Blount-Pewamo Association.
- Area #2 A 20 acre woodlot located on the south corner of Township Road 193 in section 5 of Amanda Township. A Blount-Pewamo Association.
- Area #3 A 70 acre woodlot located on the west side of County Road 11 and Township Road 204 in section 13 of Biglick Township. A Blount-Pewamo Association.
- Area #4 A 20 acre woodlot located on Township Road 204 near Township Road 265 in section 13 of Biglick Township. A Blount-Pewamo Association.
- Area #5 A 20 acre woodlot located off of Township Road 204 along the New York Central Railroad tracks in section 31 of Marion Township. A Sloan-Eel Association.

6.

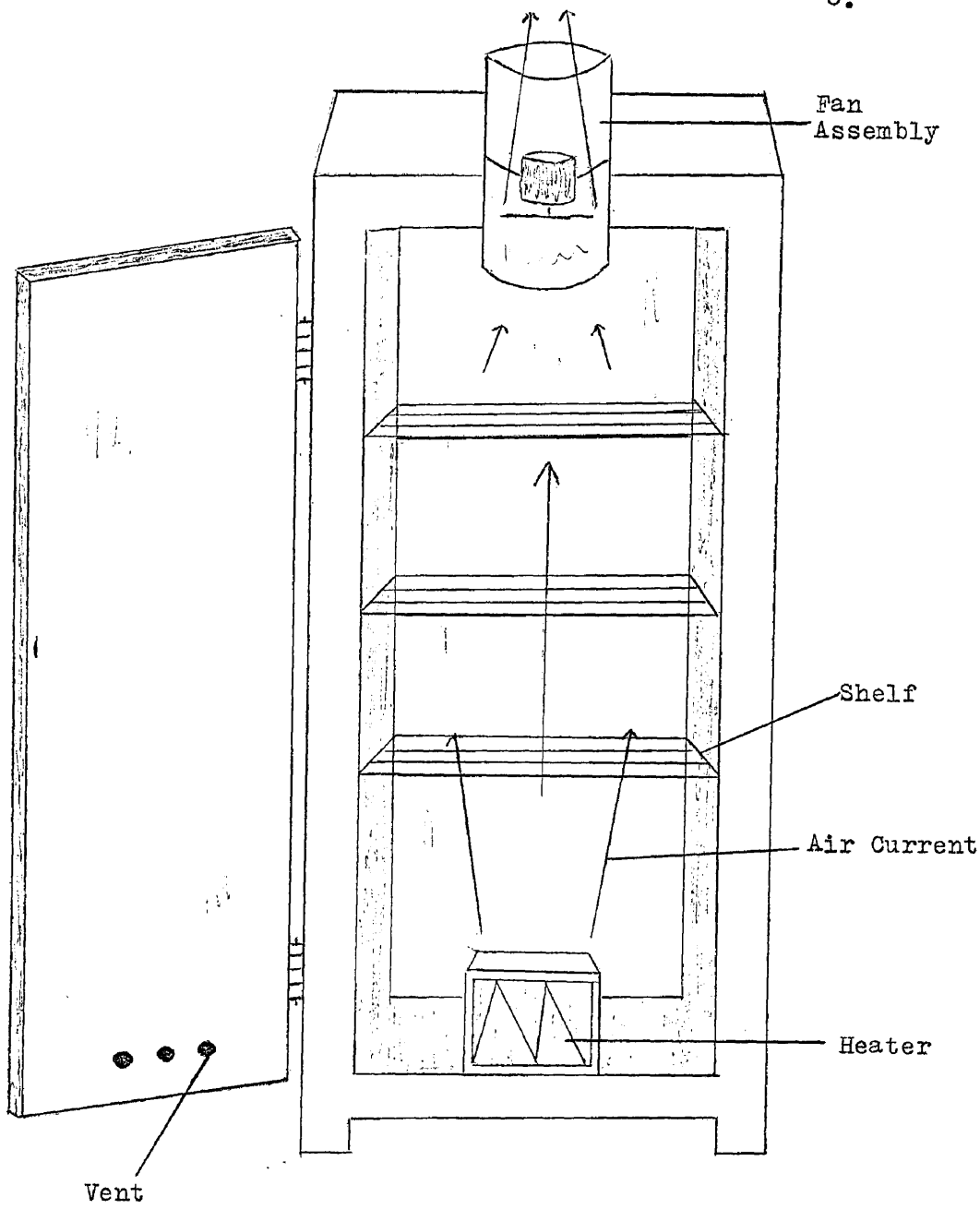


Fig. 1. . Diagram of refrigerator converted to use for drying fleshy fungi.

- Area #6 A 15 acre woodlot located on Township Road 227 and Township Road 180 in section 32 of Marion Township. A Blount-Pewamo Association.
- Area #7 A 30 acre woodlot along County Road 236 between State Routes 15 and 224 in section 16 of Marion Township. A Digby-Sward-Ottokee Association.
- Area #8 A 40 acre woodlot located on Township Road 194 just off of County Road 4 in section 32 of Amanda Township. A Blount-Pewamo Association.
- Area #9 A 30 acre woodlot located on County Road 153 just off of Township Road 191 in section 7 of Delaware Township. A Blount-Pewamo Association.
- Area #10 A 40 acre woodlot located on County Road 8 and State Route 37 in section 22 of Jackson Township. A Lenawee-Aboite-Haskins Association.
- Area #11 A 10 acre woodlot located on Township Road 227 in section 32 of Marion Township. A Blount-Pewamo Association.
- Area #12 A 4 acre tract located on Township Road 227 in section 30 of Marion Township. A Hoytville-Nappanee-Mermill-Haskins Association.
- Area #13 A 65 acre woodlot located between County Road 26 and Township Road 25 in section 30 of Jackson Township. A Mermill-Millgrove-Haskins Association.
- Area #14 A 40 acre woodlot located off of County Road 236 in section 15 of Marion Township. A Hoytville-Nappanee-Mermill-Haskins Association.

- Area #15 A 20 acre woodlot located on County Road 201 in section 52 of Jackson Township. A Blount-Pewamo Association.
- Area #16 A 180 acre man-made marsh area known as the clay pits, located on County Road 204 in section 31 of Marion Township. A Blount-Pewamo Association.
- Area #17 A 5 acre woodlot located on County Road 264 and County Road 3 in section 35 of Biglick Township. A Millsdale-Randolph-Milton Association.
- Area #18 A tract of muck soil one mile long and one greater mile in width under total cultivation. Located on Township Road 265 in section 27 of Biglick Township. A Linwood-Tawas-Muck Association.
- Area #19 A 30 acre woodlot located on Township Road 185 between State Road 30 and County Road 2 in section 34 of Delaware Township. A Millsdale-Randolph-Milton Association.
- Area #20 A 20 acre woodlot located on Township Road 114 in section 5 of Allen Township. A Hoytville-Nappanee-Mermill-Haskins Association.
- Area #21 A 20 acre woodlot located on either side of County Road 236 and bordering Rocky Ford Creek in section 15 and 16 of Cass Township. A Sloan-Eel Association.
- Area #22 A 90 acre woodlot on Township Road 229 in section 18 of Allen Township. A Sloan-Eel Association.
- Area #23 A 20 acre woodlot on Township Road 260 in section 22 of Washington Township. A Belmore-Digby-Seward-Ottokee Association.

- Area #24 A 20 acre woodlot located on Township Road 97 in section 28 of Pleasant Township. A Blount-Pewamo Association.
- Area #25 A 5 acre woodlot on State Route 113 in section 27 of Pleasant Township. A Belmore-Digby-Seward-Ottokee Association.
- Area #26 A 50 acre tract on County Road 117 in section 29 of Pleasant Township. A Hoytville-Nappanee-Mermill-Haskins Association.
- Area #27 A 100 acre woodlot located on Township Road 120 in section 9 of Blanchard Township. A Blount-Pewamo Association.
- Area #28 A 10 acre woodlot on County Road 16 and County Road 96 in section 6 of Blanchard Township. A Blount-Pewamo Association.
- Area #29 A 10 acre woodlot located on County Road 117 in section 6 of Pleasant Township. A Hoytville-Nappanee-Mermill-Haskins Association.
- Area #30 A 40 acre woodlot located on County Road 76 in section 36 of Liberty Township. A Blount-Pewamo Association.
- Area #31 A 35 acre woodlot located on Township Road 27 in section 22 of Van Buren Township. A Blount-Pewamo Association.
- Area #32 A 70 acre woodlot located on Township Road 65 in section 28 of Van Buren Township. A Blount-Pewamo Association.
- Area #33 A 40 acre tract located on Township Road 48 in section 3 of Eagle Township. A Millsdale-Randolph-Milton Association.

- Area #34 A 15 acre woodlot located on County Road 41 in section 17 of Union Township. A Belmore-Digby-Seward-Ottokee Association.
- Area #35 A creek bank area located on Township Road 52 in section 28-29 of Orange Township where the Little Riley Creek crosses Township Road 52. A Sloan-Eel Association.
- Area #36 The city of Findlay, the county seat of Hancock County and the largest community therein, is located upon four soil associations. Northern Findlay is located on the Belmore-Digby-Seward-Ottokee Association and the Lenawee-Abcote-Haskins Association. Central Findlay is a Sloan-Eel Association and South Findlay is a Blount-Pewamo Association. Species collected from these parts of the city were assigned to their respective soil associations.

RESULTS

How frequently a species occurred in the county was difficult to judge considering the size of the area in which the investigations were made and because the chance of locating each species at the time it fruited was not likely. Frequent trips to specific areas, however, justified designating certain species as being rare, common, or frequent.

In August through October, 1965, what apparently were ideal conditions of precipitation (average 10.42") and temperature (average 10.4°C) brought about a proliferation in many species of fungi in Hancock County. During these months certain species were collected which did not appear again. Such was the case with all of the species of Russula and Lactarius and also with Hygrophorus conicus, Mutimum elegans, Verpa bohemica, Phallus revenellii, and Amanita rubescens. The average number of visitations to collecting sites was seven. The term common was applied to species which were found only two to four times. Species occurring more than four times were called abundant. Commonly occurring forms included Laccaria ochropurpurea, Morchella hybrida, Hericium caput-ursi, Coprinus micaceus and Strobilomyces floccopus. The species Polyporus versicolor, Ganoderma applanatus, Pleurotus ostreatus, Morchella esculenta, and Peziza scutellata were considered as abundantly occurring forms.

The abundance of Morchella esculenta was further attested to by a local resident who contributed 530 specimens to the collection between April 28 and May 24, 1966. The precise location of the collection was not revealed. The contributor, when comparing his 1966 collections to that of previous years, considered it a very bad year for morels.

Two species, G. applanatus and P. versicolor, were found in a variety of soil associations; however, it should be pointed out that these forms grew from wood and they often occurred a distance above the soil. G. applanatus preferred the trunks of dead American elm (Ulmus americana), which were found in abundance in each soil association except the Linwood-Tawas-Muck. Polyporus versicolor, another species found in all but the muck association, was observed growing on several species of dead woody plants, including black ash (Fraxinus nigra), black walnut (Juglans nigra), beech (Fagus grandifolia) and species of the genera Acer and Quercus. Also growing directly from wood were other less cosmopolitan forms including Peziza scutellata, Hericium caput-ursi, Pleurotus ostreatus, Pleurotus ulmarius, Mycena alkalina, Mycena laejana, Armillaria mellea, Irpex carneus, Panus rudis and all species of the genera Polyporus, Tremelles, and Lycoperdon. In most instances it was impossible to identify from which species of wood they grew because the host plants were fragmentated and decayed; however, Pleurotus ulmaris was found growing only on live box elder (Acer negundo).

I. Taxonomic List of Fleshy Fungi from Hancock County, Ohio, based on the scheme proposed by Smith and Shaffer (11). The authorships were taken from publications by Graham (4), Overholts (7), Smith and Shaffer (11), Smith (12), and Clements and Shear (13).

Ascomycetes

Xylariaceae

Xylaria polymorpha Pers.

Sarcoscyphaceae

Sarcoscypha coccinea (Jacq.) Ck.

Urmula craterium (Schw.) Fries

Pezizaceae

- Peziza badia (Pers.) Fkl.
P. scutellata (L.) Bondiex
P. semitosa (Burk and Curt) Seav.

Halvellaceae

- Helvella caroliniana (Schw) Fries
H. underwoodii Seav.
Verpa bohemica
Merchella angustioeps Peck.
M. crassipes (vent.) Pers.
M. esculenta Fries
M. hybrida (Sowerb.) Pers.

Basidiomycetes

Tremellaceae

- Tremella sp. Fries
Clavaria sp. Fries

Cantharellaceae

- Cantharellus cibarius Fries

Hydnaceae

- Hericium canit-ursi (Fr.) S.P. Gray

Polyporaceae

- Ipex carneus Berk. and Curt.
Ganoderma applanatus Fries
Polyporus arcularius (Batsch.) Fries
P. frondosus Fries
P. lucidus Fries
P. micipes Fries
P. squamosus Fries

Polyporus sulcatus (Bull.) Fries

P. versicolor Fries

Tricholomataceae

Panus rudis Fries

Pleurotus ostreatus (Fr.) Quel.

P. ulmarius (Fr.) Quel.

Armillaria mellea Quel't Champ

Laccaria ochropurpurea Berk

Mycena alkalina (Fr.) Quel't

M. laejana (Saccardo.) Berk

Hygrophoraceae

Hygrophorus conicus Fries

Amanitaceae

Amanita rubescens S.F. Gray

Volvariaceae

Pluteus cervinus Fries

Lepiotaceae

Lepiota americana Peck

L. naucinia (Fr.) Gray

Agaricaceae

Agaricus campestris Fries

Coprinaceae

Coprinus atromentarius Fries

C. comatus Fries

C. ebulosus Fries

C. micaceus Fries

Russulaceae

Lactarius delioleus (Fries) S.F. Gray

L. insulus Fries

Lactarius torminosus Fries

Russula emitica Kauffman

R. virescens Fries

R. volemus Fries

Boletaceae

Strobilomyces floccopus Fries

Boletus edulis Fries

Lycoperdaceae

Lycoperdon sp. Persoon

Calvatia caelata (Bull.) Morg.

C. gigantea Lloyd

Phallaceae

Mutinus elegans Fries

Phallus revenellii Coker and Couch

P. impudicus (L.) Fries

II. Alphabetical List of Fleshy Fungi from Hancock County, Ohio

Agaricus campestris

Amanita rubescens

Armillaria mellea

Boletus edulis

Cantharellus cibaria

Calvatia gigantea

Clavaria sp.

Coprinus atrementarius

Coprinus comatus

Coprinus ebulosus

Coprinus micaceus

Ganoderma applanatus

Helvella caroliniana

Helvella underwoodii

Hericium caput-ursi

Hygrophorus conicus

Irpex carneus

Laccaria ochropurpurea

Lactarius deliciosus

Lactarius insulus

Lactarius torminosus

Lepiota americana

Lepiota naucinia

Lycoperdon sp.

Morchella angusticeps

Morchella crassipes

Morchella esculenta

Morchella hybrida

Mutinus elegans

Mycena alkalina

Mycena laejana

Panus rudis

Peziza badia

Peziza scutellata

Peziza semitosa

Phallus imbricatus

Phallus ravenelii

Pleurotus cervinus

Pleurotus ostreatus

Pleurotus ulmarius

Pluteus cervinus

Polyporus arularius

Polyporus frondosus

Polyporus lucidus

Polyporus picipes

Polyporus squamosus

Polyporus sulphureus

Polyporus versicolor

Russula emitica

Russula virescens

Russula virescens

Russula volemus

Sarcoscypha coccinea

Strophomyces floccopus

Tremelles Sp.

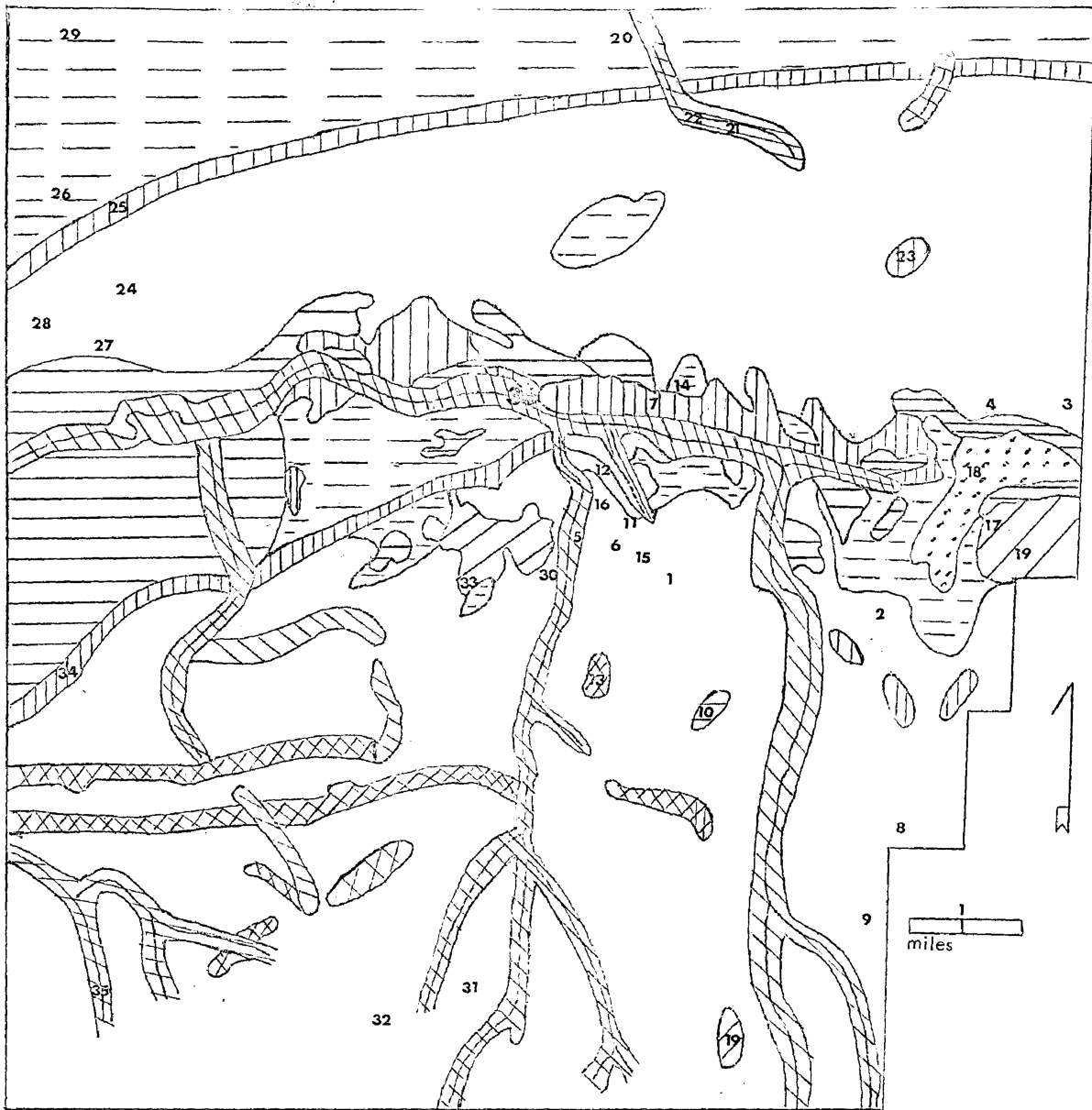
Urnula craterium

Verpa bohemica

Xylaria polymorpha

There are eight soil associations in the county (Fig. 2) described briefly as follows (1):

1. Belmore-Digby-Seward-Ottokee Association: This association consists of well-drained to imperfectly drained, gently sloping, sand soils. They occur primarily in old beaches, ridges, and knolls.
2. Blount-Pewamo Association: This association consists of imperfectly to very poorly drained soils.
3. Hoytville-Nappanee-Merrill-Haskins Association: This association consists of imperfectly to very poorly drained soils.











- | | | | |
|---|---------------|---|---------------|
|  | association 1 |  | association 5 |
|  | association 2 |  | association 6 |
|  | association 3 |  | association 7 |
|  | association 4 |  | association 8 |

Fig. 2 Soil associations in Hancock County, Ohio, (numbers refer to collecting sites). Redrawn from Inventory of Ohio Soils (1).

4. Lenawee-Aboite-Haskins Association: This association consists of imperfectly to very poorly drained soils.
5. Linwood-Tawas-Muck Association: This association consists of nearly level organic soils.
6. Mermill-Millgrove-Haskins Association: This association consists of imperfectly to very poorly drained soils.
7. Millsdale-Randolph-Milton Association: This association consists of well drained to very poorly drained soils underlain with limestone bedrock.
8. Sloan-Eel Association: This association consists of moderately poor to very poorly drained soil. They have a high moisture supplying capacity.

IV. Relation of Species Distribution to Soil Associations.

Only the Linwood-Tawas-Muck failed to provide specimens. The Sloan-Eel Association and Mermill-Millgrove-Haskins association produced relatively few specimens. The most prolific collecting areas were the Hoytville-Nappanee-Mermill-Haskins Association, the Blount-Pewamo Association, and the Belmore-Digby-Seward-Ottokee Association in increasing order respectively. These three Associations rarely provided specimens in the northeastern portion of their range, which could indicate the presence of additional soil factors that may inhibit the growth of many fleshy fungi.

Two species, Ganoderma applantus and Polyporus versicolor, were found in all of the soil associations except the Linwood-Tawas Muck.

Four less widely distributed species were found in four associations, as indicated by numbers of the soil associations after each name.

<u>Irpex carneus</u>	2-3-4-8
<u>Pleurotus ostreatus</u>	1-3-4-7
<u>Polyporus arcularius</u>	2-3-4-8
<u>Sarcoscypha coccinea</u>	3-4-7-8

Nine species were found in two associations, as indicated.

<u>Clavaria sp.</u>	3-4
<u>Coprinus comatus</u>	1-2
<u>Coprinus ebulosus</u>	3-7
<u>Coprinus micaceus</u>	2-4
<u>Laccaria ochropurpurea</u>	1-4
<u>Morchella esculenta</u>	1-2
<u>Morchella hybrida</u>	2-6
<u>Peziza semitosa</u>	2-3
<u>Strobilomyces floccopus</u>	1-4

The remaining identified species appeared in only one specific soil association.

BELMORE - DIGBY - SEWARD - OTTOKEE ASSOCIATION

Species Collected:

Boletus edulis
Coprinus comatus
Coprinus atremantarius
Ganoderma applanatus
Hygrophorus conicus
Laccaria ochropurpurea
Lactarius deliciosus
Lactarius insulsus

Lactarius torminosus
Morchella esculenta
Phallus impudicus
Pleurotus ostreatus
Pleurotus ulmarius
Polyporus versicolor
Russula emitica
Russula virescens
Russula volemus
Strobilomyces floccopus

BLOUNT - PEWAMO ASSOCIATION

Species Collected:

Agaricus campestris
Clavatia caelata
Clavatia gigantea
Coprinus comatus
Coprinus micaceus
Ganoderma applanatus
Irpex carneus
Lepiota americana
Lepiota naucinia
Morchella esculenta
Morchella hybrida
Mycena alkalina
Peziza badia
Peziza semitosa
Pluteus cervinus
Polyporus arcularius
Polyporus frondosus

Polyporus versicolor

Russula sp.

Urnula craterium

HOYTVILLE - NAPPANEE - MERMILL - HASKINS ASSOCIATION

Species Collected:

Amanita rubescens

Armillaria mellea

Cantharellus cibaria

Clavaria sp.

Coprinus ebulosus

Ganoderma applanatus

Helvella caroliniana

Irpeex carneus

Morchella angusticeps

Mycena laejana

Panus rudis

Peziza scutellata

Peziza semitosa

Pleurotus ostreatus

Polyporus arcularius

Polyporus lucidus

Polyporus picipes

Polyporus squamosus

Polyporus versicolor

Sarcoscypha coccinea

Tremelles sp.

Verpa bohemica

Xylaria polymorpha

LENAWEE - ABOITE - HASKINS ASSOCIATION

Species Collected:

Coprinus micaceus
Clavaria sp.
Ganoderma applanatus
Hericium caput-ursi
Irpex carneus
Laccaria ochropurpurea
Lycoperdon sp.
Phallus ravenelii
Pleurotus ostreatus
Polyporus arcularius
Polyporus sulphureus
Polyporus versicolor
Sarcoscypha coccinea
Strobilomyces floccopus

MERMILL - MILLGROVE - HASKINS ASSOCIATION

Species Collected:

Morchella hybrida
Ganoderma applanatus
Polyporus versicolor

MILLSDALE - RANDOLPH - MILTON ASSOCIATION

Species Collected:

Coprinus ebulosus
Ganoderma applanatus
Helvella caroliniana
Helvella underwoodii

Morchella crassipes
Pleurotus ostreatus
Polyporus versicolor
Sarcoscypha coccinea

SLOAN - EEL ASSOCIATION

Species Collected:

Ganoderma applanatus
Irpex carneus
Mutinus elegans
Peziza badia
Polyporus arcularius
Polyporus versicolor
Sarcoscypha coccinea

SUMMARY

Numerous species of fleshy fungi are indigenous to Hancock County, as indicated by the collection and identification of 58 species. Sixty soil types, grouped into eight associations, are present in the county. Carefully selected collection sites and frequent visitations to each site revealed a pattern of soil selectivity among many species of fungi. Some forms of fleshy fungi were collected from woody plants while the remaining species grew from the soil. Various species of woody plants appeared only in certain soil associations, which indicates soil selectivity in those plants. Such selectivity in turn may explain the distribution of some fleshy fungi showing a specificity of host. An average of seven visitations to thirty-six collecting sites yielded some species of fleshy fungi only once. Species termed common appeared twice to four times and forms which were observed five or more times were judged as abundant. Continued collecting is expected to add to the list of species and yield data which may further explain species-soil selectivity among fleshy fungi.

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