FLESHY FUNGI OF THE WISCONSIN RAPIDS AREA

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ABSTRACT

A four-month study was conducted in the Wisconsin Rapids, Wisconsin area, located in Wood County, in the central section of Wisconsin, to collect, preserve, and identify the fleshy fungi of the area. Four areas served as collection sites. Two of these areas were natural forest communities, one area was within the city, and the other area was a pine plantation.

Collections were made every two or three days by taking a random sample from these areas. Specimens were photographed in their natural habitats, and then preserved for identification.

The collection of fungi included specimens from the Ascomycetes and the Basidiomycetes. Most of the specimens were collected after periods of high humidity, or in damp areas. Shaded habitats and damp environments were found to contain the most abundant types of specimens.

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INTRODUCTION

Wisconsin Rapids is located in the central part of Wisconsin. This area is unique in the fact that south of Wisconsin Rapids there is a sandy dune area.

The Wisconsin River divides the city of Wisconsin Rapids and as a result of this division the soil deposition varies. The south side of the river has deposits of sand while the north side of the river contains loam type soils.

Quercus ellipsoidalis (E. J. Hill) and Pinus banksiana (Lamb.) are the dominant species of woody plants found on the south side of the Wisconsin River. A variety of deciduous trees and pines are found on the north side of the Wisconsin River.

The purpose of this study is to investigate the types of Agaricales, Polyporales, Lycoperdales, Sclerodermatales, Phallales, and the Genus Morchella of the class Ascomycetes.

Areas of investigation will include: 1) identification of specimens native to this area, 2) a timetable of their occurance, 3) ecological aspects relative to some of the specimens collected, and 4) preservation of specimens collected.

LITERATURE REVIEWS

The exact number of mushrooms that exists in the United States varies from one reference to another. According to Smith (1958) there are some 3,000 species of mushrooms, of which only four are considered to be foolproof safe for eating. These four specimens have been cited for the beginner because of their unique features for identification. The common names of these "foolproof four" are: the morel, the puffball, the meadow mushroom, and the oyster mushroom.

Ignorance in the identification of fungi can lead to various degrees of illness or poisoning, or even death. The first recorded poisoning as mentioned by Vishniac (1957) occurred in the 5th century B.C. in the mountainous Greek Island of Icaria. A mother, her daughter and two sons all died after eating a variety of mushrooms. Perhaps they ate a member of the Amanita group. Alexopolous (1962) stated a toxic substance known as muscarin can cause death in man and animals.

Ford (1923) and Fischer (1918) reported mushroom poisoning to be the result of the inability of individuals to properly distinguish edible from poisonous mushrooms, and to the variable reactions in human physiology in that some can and others cannot eat a certain mushroom without some reaction.

Some mushrooms are poisonous when fresh and are rendered nonpoisonous when cooked. Often within one genus there are poisonous and nonpoisonous species which can easily be mistaken for each other.

The treatment of persons affected by mushroom poisoning is mostly symptomatic and supportive in nature. Few antidotes exist; and for these antitoxins to be effective, they must be administered within a short time of the onset of the symptoms.

Mushrooms not normally poisonous can become poisonous when they are combined with alcohol. Vishniac (1957) states the account of the mushroom Coprinus micaceus (Fr.) when combined with alcohol leads to a sudden redness of the face. Then the face becomes violet with the color spreading to other parts of the body. A pulse rate of 150 beats per minute occurs with severe gastric disturbances. Usually this situation is not fatal. If the individual takes another drink of alcohol, the same symptoms will reoccur. Usually a period of two to three days is needed to abstain from alcohol intake without repeating the symptoms mentioned earlier.

Some of the most toxic mushrooms belong to the genus Amanita. Fischer (1918) gives the following account dealing with the symptoms in an individual who ate from the poisonous Amanita phalloides (Fr.), commonly referred to as the destroying angel, death cup, deadly amanita, or the white amanita. Symptoms appear in the form of a sudden severe seizure of extreme abdominal pain, vomiting, and diarrhea. Blood mucus and undigested

food appear in the vomit and stools. Excessive thirst develops. Spasms of pain alternates with periods of quiet. Loss of strength occurs resulting in prostration and restlessness. Death may follow in 48 hours after a large ingestion of the fungus. Death is preceded by a coma. Frequent periods of quiet promises a favorable prognosis. The patient should not attempt to do much activity, noting that activity can bring on another attack which could lead to a coma and death.

Substances which cause the toxic affect of poisonous mushrooms have been studied by many scientists. In a review by Ramsbottom (1953) he mentions crystallized substances taken from Amanita phalloides. One of these substances has been biochemically identified as amanitine (C_{30} $H_{45(-47)}$ O_{12} N_7 S) which causes hypoglycemia, a condition which results in the lowering of the sugar in the blood. Another substance, phalloidine (C_{30} H_{39} O_9 N_7 S), has a degenerate effect upon the kidney, liver, and the muscles of the heart.

Ramsbottom (1953) also mentions that a serum, antiphalloidian can be used to counter the effect of phalloidine if given a short time after the symptoms are noticed.

The need for biochemical and physiological research in the area of mushroom toxidicity leaves a large gap in the role of these substances and their effect upon man and animals. The complexity of solving these effects will undoubtedly depend upon many facets of study involving ecological aspects as well as many facets of biochemistry and physiology.

As pointed out by Smith (1949), an example of this complexity contains an account of Helvella esculenta (Fr.) and its toxic nature. Helvella esculenta contains the water soluble compound helvellic acid. Helvellic acid can be rendered harmless by heating or drying. Some cases of poisoning have occurred when cooked Helvella has been eaten. This tends to indicate that a second toxic substance can also be found in this mushroom.

Mushroom poisoning is scientifically called mycetismus; and according to Ford (1923), there are five categories of mycetismus. 1) Mycetismus Gastrointestinalis causes nausea, vomiting and diarrhea. 2) Mycetismus Choleriformis also causes gastrointestinal symptoms appearing 10-15 hours after ingestion. Amanita phalloides and related species of mushrooms contain a poison which causes intense suffering and kidney complications. VanderVeer and Farley (1935) cite a method of treatment for those individuals suffering from phalloidine poisoning as follows: fresh uncooked stomach and brain tissue of rabbits fed to those patients suffering from phallodine poisoning resulted in definite improvement. 3) Mycetismus Nervous also results in violent gastrointestinal disorders which occur within two or three hours after eating poisonous fungi. Symptoms include profuse perspiration and salivation, convulsive movement of muscles, and often the entire body. This type of poisoning acts upon nerve terminals. Atropin administered early and in large doses is an effective antidote.

4) Mycetismus Sanguinareus affects the red blood corpuscles. Helvella esculenta known as the false morel is noted for causing this type of effect. 5) Mycetismus Cerebralis appears as disturbances in vision, signs of exhileration, and a staggering gait. These symptoms appear about four or five hours after consumption and disappear in about 24 to 48 hours. Mushrooms chiefly responsible for this type of reaction are Panaeolus paplionaceus (Fr.) and Panaeolus campanulatus (Fr.).

A toxin known as muscarin produced by the mushroom Amanita muscaria (Fr.) can be fatal to man and animals. Alexopolous (1962) states the effect of muscarin can be controlled with the use of atropin.

Taylor (1949) also mentions that degrees of effect can be caused by using parts of Amanita muscaria as follows: edible if the veil is peeled off, hallucinogenic if eaten in small quantities, and deadly poisonous when eaten in larger quantities.

Fabing (1957) reports the use of the chemical bufotine (an hallucinogenic indole compound) which warrants consideration as a possible step toward solving the mystery of schizophrenia. Fabing (1957) has suggested the possibility that schizophrenia is associated with abnormal indole synthesis.

Hallucinogenic aspects of mushrooms have been known for some time in the Siberian tribes as reported by Taylor (1949). In another account of hallucinogenic effects of mushrooms, Wasson (1957) relates the influence of these mushrooms upon

himself. He explains the influence of these mushrooms as creating or stimulating the illusion of visions which were mostly associated with the landscape, particularly giving him the sensation of floating along above the surface of the earth.

Wasson (1961) relates that mushrooms stimulate the psychic responses and are used in ritualistic ceremonies by Indians of Mexico. They believe in the power of these visions to help them make decisions about many aspects of their lives. They also use these mushrooms in a sacred manner that includes a rite in which the mushrooms are blessed and the distressed individual usually drinks chocolate before eating the smoked sacred mushrooms.

Heim (1958) in an expedition to Mexico found and identified five varieties of hallucinogenic mushrooms which stimulate certain psychic responses.

Wasson (1959) also speculated upon the effect of these same hallucinogenic mushrooms and early man. Noting the effect these mushrooms have on the inhabitants of today, he wonders if these mushrooms could possibly have implanted the idea of God into primitive man. Through the psychic effects of these mushrooms, early man might have become aware of the idea of a supreme being.

Mushrooms can be found in a wide range of habitats. Smith (1949) categorizes some of thses habitats as associated with dung, coniferous or deciduous trees, or dead trees. Krieger (1935) classifies some of the habitats of mushrooms as follows according to where they can be found:

HABITAT	MUSHROOM
On mossy rocks	Lycoperdon calyptriforme
In gravelly soil	Boletus subluteus
In clayey soil	Inocybe rigidipes
In alluvial soil	Lepiota alluvinus
On grassy ground	Amanita muscaria
Along streets and roads	Coprinus micaceus
On burned ground	Omphalia fibuloides
On dung and manure	Coprinus comatus
Near Arbor Vitae	Collybia fuliginella
Near Balsam Fir	Pleurotus mitis
Near Hemlock	Collybia abundans
Near Pine	Lactarius indigo
Near Spruce	Lactarius sordidus
Near Tammarack	Hygrophorus laricinus
Near Alder	Russula palustris
Near Basswood	Hebeloma velatum
Near Beech	Pholiota limonella
Near Gray Birch	Boletus scaber
Near White Birch	Entoloma jubatum
Near Yellow Birch	Pholiota luteofolia
Near Chestnut	Clitocybe illudens
Near Elm	Pleurotus ulmarius
Near Hickory	Mycena luteophallens
Near Red Maple	Lentinus approximans

(continued)

HABITAT	MUSHROOM
Near Sugar Maple	Naucoria firma
Near Mulberry	Pleurotus campanulatus
Near Oak	Pleurotus ostreatus
Near Poplar	Cortinarius alboviolaceus
Near Willow	Pleurotus salicinus
In swamps	Lactarius deliciosus
Associated with Polytrichium	Psathyra polytrichophila
Associated with Sphagnum	Entoloma clypeatum
Associated with ferns	Hygrophorus pecktanus
Associated with lichens	Clitocybe peltigerina
Associated with other mushrooms	Volvaria loveiana or Clitocybe nebularis

Smith (1958) mentions temperature, humidity, and water as important environmental factors affecting the development of mushrooms. Referring to the mushroom hunter, he states, "one must know the seasonal pattern of the mushrooms and the weather during the period concerned."

Seasonal occurrence is used by Smith (1958) to list species related to habitat. (Tables 1, 2, 3)

Polypores are annual fungi which form bracket-like structures on trees. These fungi are sometimes referred to as "punks" or "conchs."

Identification of these fungi involves the understanding of the type of tree upon which the polypore is found. Krieger (1935) sites the following examples of polypores and their association:

Polyporus frondosus on the base of oaks.

Polyporus roseus on evergreens.

Polyporus rimosus on locust.

Polyporus betulinus on birch.

Polyporus sulphureus on oak, chestnut, locust, maple, walnut, pine, hemlock, spruce, and apple.

Polyporus schweinitzii on the roots of hemlock, spruce, and pine.

TABLE 1. Mushrooms found during late winter and during the spring.

SPECIMEN	HABITAT				
	Deciduous	Coniferous	Open	Dung	Wet
Agaricus edulis			X		
Collybia Velutipes	X				
Coprinus micaceus	DX*				
Coprinus atramentarius	DX				
Coprinus quadrifidus	DX				
Helvella gigas					X
Lentinus lepideus		X			
Marasmius oreades			X		
Morchellas angusticeps	X	X			
Morchella crassipes	X				
Morchella esculenta	X				
Pluteus cervinus (saw dust piles)					
Pleurotus ostreatus	DX				

*DX denotes decayed wood

According to Smith (1958). This data was rearranged in tabular form according to season and habitat.

TABLE 2. Mushrooms found during late spring and during the summer.

SPECIMEN	HABITAT				
	Deciduous	Coniferous	Open	Dung	Wet
Boletus aurantiacus	X				
Boletus variipes	X				
Boletinus pictus		X			
Cantharellus cibarius	X				
Cantharellus cinnabarinus	X		X		
Hydnum repandum	X	X			
Lactarius corrugis	X				
Lactarius delicosus					X
Lactarius volemus	X				
Lepiota procera	X				
Pluteus cervinus	DX*		X		
Polyporus sulphureus	X	X			
Polyporus umbellatus	X				

*DX denotes decaying wood.

According to Smith (1958). This data was rearranged in tabular form according to season and habitat.

TABLE 3. Mushrooms found during late summer and during the fall.

SPECIMEN	HABITAT				
	Deciduous	Coniferous	Open	Dung	Wet
Agaricus augustus			X		
Agaricus campestris			X		
Agaricus crocodilinus			X		
Agaricus edulis			X		
Armillaria mellea	DX*				
Armillaria ponderosa		X			
Boletus aurantiacus	X	X			
Boletus edulis		X			
Boletus sp. (viscid caps)		X			
Boletinus cavipes		X			
Calvatia gigantea					X
Cantharellus cibarius	X	X			
Coprinus atramentarius	DX				
Coprinus comatus			X		
Coprinus micaeus	DX				
Gomphidius rutilus		X			
Hericeum (all species)	X	X			
Hydnum repandum	X	X			
Hygrophorus russula	X				
Lactarius deliciosus		X			
Lactarius sanguifluus		X			
Lepiota procera			X		

TABLE 3 (continued)

SPECIMEN	HABITAT				
	Deciduous	Coniferous	Open	Dung	Wet
Marasmius oreades			X		
Naematoloma capnoides		DX			
Naematoloma sublateritum	DX				
Pholiota squarrosoides	DX				
Pluteus cervinus	DX				
Polyporus fondosus	DX				
Polyporus sulphureus	X	X			
Rozites caperata	X	X			
Sparassis radicata		X			
Tricholoma personatum	X	X		X	

*DX denotes decaying wood

According to Smith (1958). This data was rearranged in table form according to season and habitat.

Puffballs are globular-shaped fungi with most of these species between one to five centimeters in diameter. Lycoperdon described by Smith (1951) has 18 species within this genus. Alexopolous (1962) states that puffballs are compact fruiting structures which have two distinct membranes (peridia) which protect the main body of the fungus which is known as the (gleba).

Smith (1958) describes the habitat of Lycoperdon perlatum Persoon as being found where trees have been uprooted, exposing fresh mounds of dirt near the base of the tree. This puffball is found in late summer and fall.

Calvatia gigantea Persoon is described by Smith (1958) as being found in wet areas with rich ground. Seasonally, they are most common during late summer and fall.

Scleroderma aurantium Persoon, a hard-skinned puffball with a dark gleba, is often found on rotting logs or in soil rich in humus (Smith, 1958). The season of occurrence for this puffball is during the summer and fall.

Stinkhorns belonging to the order Phallales are comparatively rare in their occurrence. Alexopolous (1962) describes the stinkhorns as developing from an egg-like structure. This egg-like structure develops a stalk which bears a foul smelling attractant for flies. These short-lived fungi are found during the summer or fall in association with rotting wood, sawdust, woodchips, or decaying vegetation around hedges (Smith, 1958).

METHODS AND MATERIALS

Collection of fungi associated with this paper began in the spring of 1971 and continued into the summer of 1971. Collections were made every two to three days. Most favorable collections took place within 24 hours after a rainfall.

Areas which were surveyed were: 1) Wood County in the area of Highway Z and Nepco Lake; 2) Wisconsin Rapids in the area of Dewey Street, Lincoln Street, and Sixth Street; 3) Wood County in the area of Highway 13 and Larry Avenue; and 4) Grand Rapids in the area of the Thalacker subdivision.

The procedures for collecting varied. In most cases where specimens were few in number, a photograph was taken immediately, and then the specimen was preserved. If a number of specimens could be found, a spore print would be made, and a variety of mushroom stages would then be collected and preserved.

Photographs were taken with a Kodak Ektagraphic Visualmaker which consists of a Kodak Instamatic 304 Camera that uses Kodak Kodachrome 126 film and flash cubes. The camera and attachments were mounted on two stands: one stand allowed a field of vision 3 by 3 inches and the other stand, 8 by 8 inches. The camera stand frames the specimen to be photographed, and it also contains a light reflector which directs the light from the flash cube to the subject being photographed.

Spore prints were made using plastic petri dishes with a newspaper disc placed upon the bottom plate. This disc was wetted, and the cut cap of the mushroom was then placed upon the disc. The stipe was also placed in the dish for future keying.

Some of the fleshy fungi were preserved in FAA in a 25 : 1 : 5 : 20 ratio of ethyl alcohol, glacial acetic acid, formaldehyde, and distilled water.

Polypore specimens were dried and then placed in Riker mounts with a few crystals of paradichlorobenzene.

DESCRIPTION OF STUDY AREAS

Central Wisconsin collection sites included four areas in and around the city of Wisconsin Rapids, Wisconsin (Fig. 1)

Site #1 is located along the northwest side of Nepco Lake on County Highway Z. This area is made up of a mixed forest with the dominant species being oak and pine (Fig. 2). This site borders the Alexander Field Airport and is influenced by Two Mile Creek which flows through the area.

Site #2 is located approximately 1½ miles northeast of site #1 on Two Mile Creek. White pine predominates along the creek (Fig. 3), while jack pine is abundant in the sandy area above the creek.

Site #3 is located along Duck Creek which flows through a low area bordered by oak (Fig. 4).

Site #4 includes city lawns, park areas, and Wisconsin River bank areas (Fig. 5).

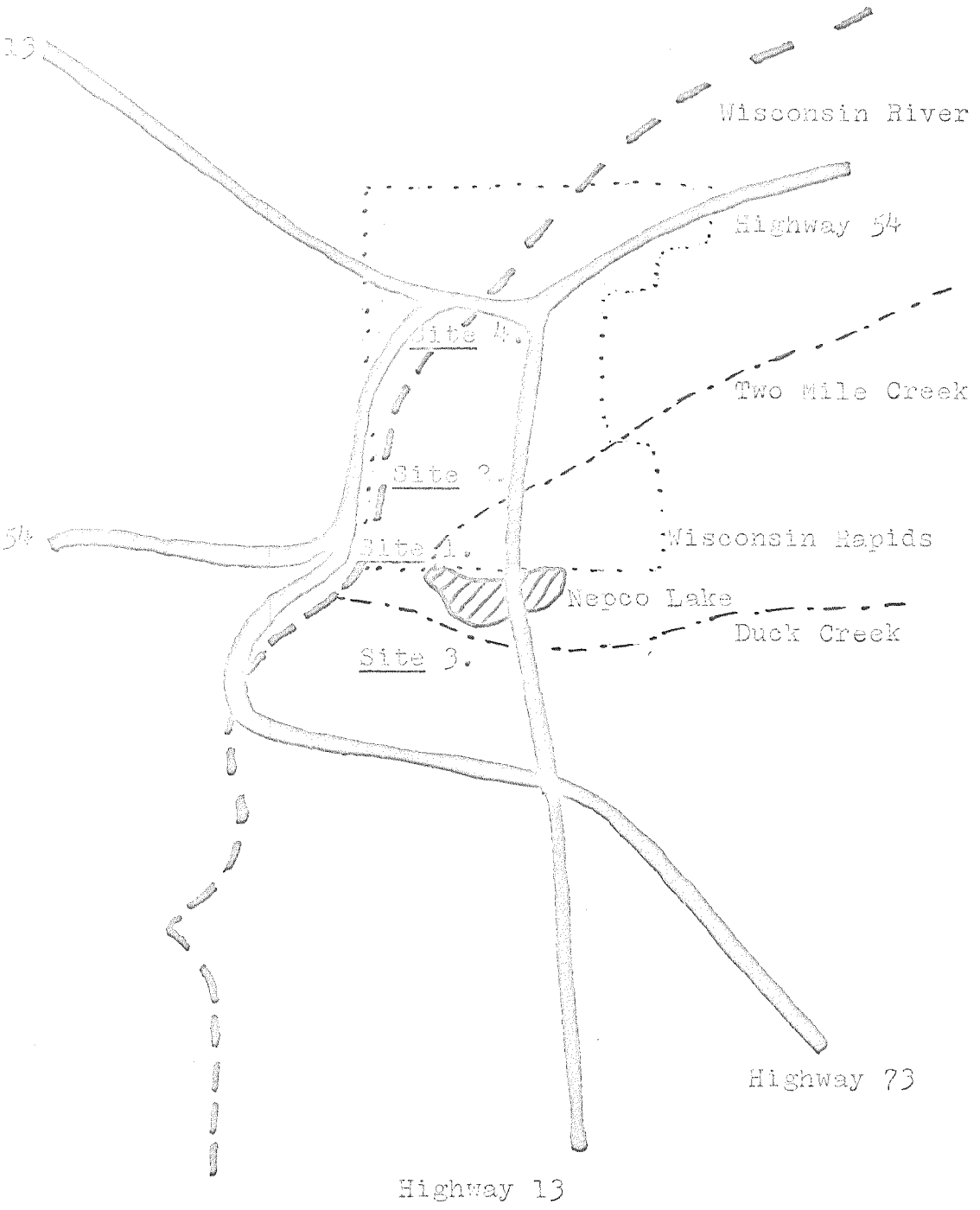
13
Wisconsin River
Highway 54
Site 4.
Two Mile Creek
Site 2.
54
Site 1.
Wisconsin Rapids
Nepco Lake
Duck Creek
Site 3.
Highway 73
Highway 13

Figure 1.

Figure 2.

Figure 3.

Figure 4.

Figure 5.

RESULTS AND DISCUSSION

A total of thirty species of fleshy fungi were collected and identified. Nineteen of these species were members of the Agaricales, seven species of Polyporales, two species of Lycoperdales, one species of Sclerodermatales, and one species of Phallales (Table 4).

The seasonal abundance of fleshy fungi varieties favored the summer collection period over the spring collection period by a ratio of two to one.

Open areas such as those found in a city park as compared to an area of dense undergrowth, favored the collection of fleshy fungi by a ratio of three to one.

Poisonous mushrooms found in central Wisconsin were: Amanita muscaria (Fig. 6), Amanita phalloides (Fig. 7), Amanita verna, Helvella esculenta, and Russula foetans. In 1958, Smith included these species in his list of poisonous mushrooms of the central states (Table 5).

Naramius oreades and Russula atropurpurea were the two most abundant species in the number of specimens observed and collected. In terms of the total numbers of specimens collected, these two species represent about twenty-five and thirteen per cent respectively.

TABLE 4. Specimens collected in central Wisconsin

SPECIES AND SPORE TYPE	SITE	SEASON	HABITAT
White spores			
Amanita muscaria	4	Sm*	riverbank
Amanita verna	4	Sm	oak forest
Amanita phalloides	1	Sm	oak forest
Cantharellus cibarius	1	Sm	wet lands
Collybia platyphylla	4	Sm	riverbank
Lepiota americana	1	Sm	oak forest
Marasmius oreades	4	Sm	lawn area
Marasmius rotula	2	Sp**	rotting log
Omphalia campanella	2	Sm	rotting log
Russula aeruginea	4	Sm	riverbank
Russula atropurpurea	4	Sm	under oaks
Russula borealis	4	Sm	under oaks
Russula foetans	4	Sm	under oaks
Tricholoma melaleucum	4	Sm	rotting stump
Yellow-brown spores			
Bolbitius tenner	4	Sm	lawn
Pink spores			
Pluteus cervinus	2	Sm	rotting log
Black spores			
Coprinus ephemereus	4	Sm	lawn
Coprinus micaceus	4	Sp	base of elm
Panaeolus solidipes	4	Sm	garden

TABLE 4. (continued)

SPECIES AND SPORE TYPE	SITE	SEASON	HABITAT
Polyporaceae			
Favolus canadensis	3	Sm	dead oak
Polyporus albellus	2	Sm	dead oak
Polyporus arcularis	4	Sm	dead birch
Polyporus cinnabarinus	3	Sp	oak tree
Polyporus obtusus	3	Sp	living oak
Polyporus perennis	1	Sm	solitary
Polyporus versicolor	2	Sm	rotting log
Boletaceae			
Boletus sp.	3	Sp	under oak
Clavariaceae			
Clavaria stricta	2	Sp	rotting log
Thelophoraceae			
Thelophora terrestris	2	Sp	under jackpine
Phallaceae			
Mutinus ravenelli	4	Sp	hedge area
Lycoperdaceae			
Geaster mammosus	2	Sp	under jackpine
Lycoperdon gemmatum	4	Sm	lawn area
Ascomycetes			
Halvella esculenta	2	Sp	under jackpine
Morchella esculenta	1	Sp	marsh area
Xylaria polymorpha	2	Sp	rotting log

TABLE 4. (continued)

Explanation of sites:

1--Nepco Lake area

2--Thalacker area

3--Boy Scout area

4--City area

Explanation of seasons:

**Sp--spring (5-17-71 to 6-21-71)

*Sm--summer (6-22-71 to 7- -71)

TABLE 5. Poisonous mushrooms found in the central states

1. Amanita cothurnata
2. Amanita muscaria
3. Amanita soreta
4. Amanita verna
5. Clitocybe illudens
6. Helvella esculenta
7. Helvella infula
8. Hygrophorus conicus
9. Lactarius trivialis
10. Lactarius vellereus
11. Naemetoloma fasiculare
12. Russula foetans
13. Stropharia coronilla

According to Smith (1958).

M. oreades persists for weeks or months, having a reviving nature which is stimulated by rainfall. M. oreades was found in lawns and along roadside areas. R. atropurpurea was always found in close proximity to oak trees. Russula borealis (Fig. 8), R. foetans, and R. aeruginea (Fig. 9) were found to be associated with oak trees.

The least abundant of all specimens collected were Lepiota americana (Fig. 10) and Boletus cyanescens (Fig. 11). These two species represented only three per cent of the total specimens collected. The low frequency in distribution of these species could possibly be attributed to collection when these species had not reached seasonal development. When the flesh of these mushrooms is bruised L. americana turns from tan to orange, and B. cyanescens turns from white to blue.

Very few mushrooms were observed in association with dung except Panaeolus solidipes (Fig. 12). This mushroom was very abundant in a garden that had been heavily manured. Coprinus ephemereus, Stropharia stercoraria, S. semiglobata, Galera antipus, and Clitocybe caespitosa are associated with dung and compost as stated by Christensen (1965).

The stinkhorn Mutinus caninus (Fig. 13) was found after a warm rainy day along a city hedge. Specimens exhibiting various stages of development were collected.

Puffballs were most apparent during mid-summer. Lycoperdon umbrinum (Fig. 14) was found scattered and in grassy areas of site #1.

The mushroom Coprinus micaceus was observed on several occasions near the base of a rotting elm tree. Periodic crops of this mushroom occurred every three or four weeks at site #1. Warm temperature and abundant rainfall influence the appearance of this mushroom.

Heard (1970) recorded the rhythmic spore release of Coprinus sp. during a period in July in which maximum spore discharge occurred at midnight and then declined rapidly as the relative humidity decreased. The decline of spore discharge was attributed to the loss of water in the pileus and hymenium, resulting in the loss of turgor pressure needed to initiate spore discharge.

Robbins (1950) in a study of the growth requirements of the Basidiomycetes indicated the successful growth of mushrooms with the addition of vitamins.

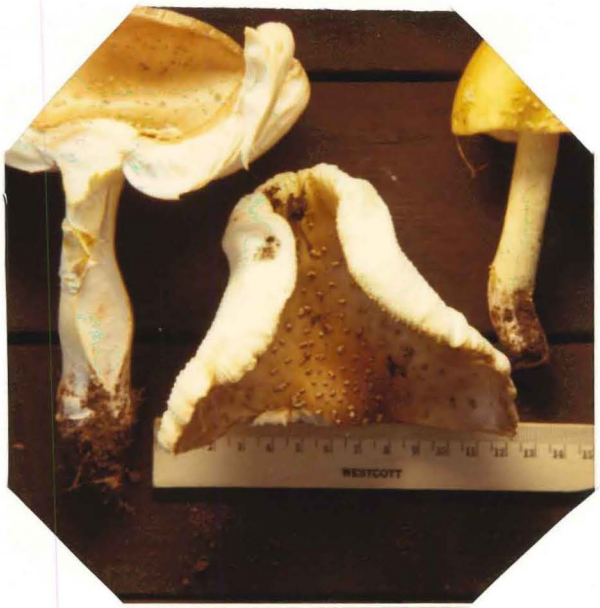

Figure 6.

Figure 7.

Figure 8.

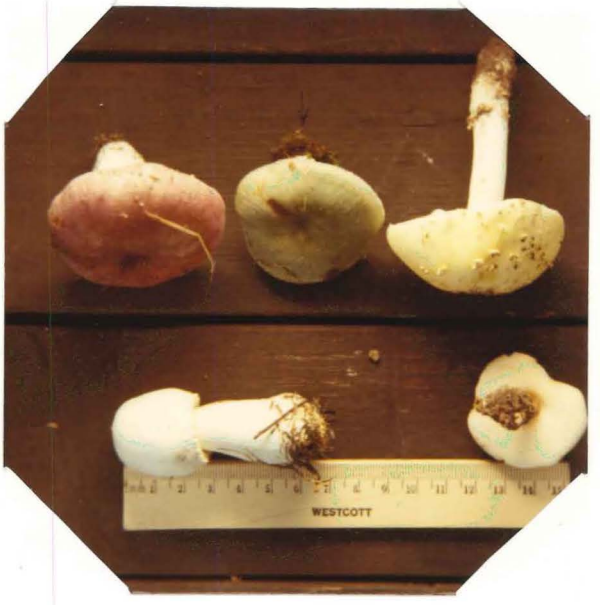

Figure 9.

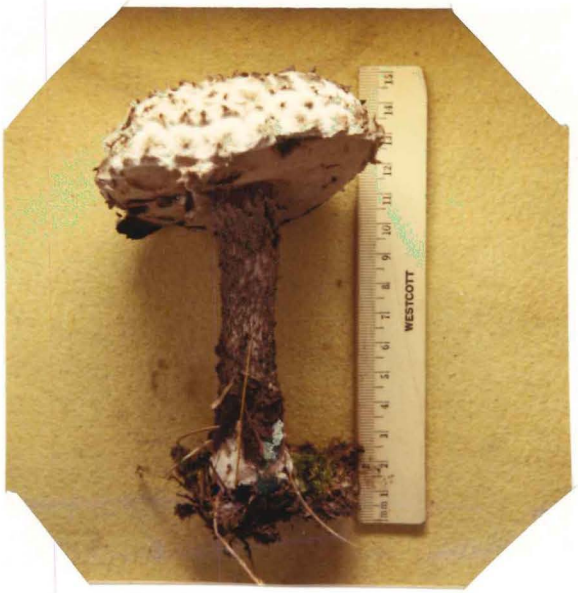

Figure 10.

Figure 11.

Figure 12.

Figure 13.

Figure 14.

SUMMARY

The purpose of this survey was to investigate the types of fleshy fungi and their habitats in central Wisconsin. Specimens were collected, preserved, photographed, and then identified.

Poisonous mushrooms of the Amanita group were found in central Wisconsin.

The investigator had the best success looking for mushrooms during the summer in open, moist areas with oak trees.

Mushrooms that were most commonly found during the summer included species from Russula, Coprinus, Marasmius, and Polyporus.

A variety of habitats were examined with the conclusion that definite types of mushrooms can be found in a particular habitat. Seasonal factors, specifically temperature and rainfall, influence the habitat; the habitat in turn influences the presence or absence of mushrooms.

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