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# A phytosociological study of Coprophilous ascomycete and Basidiomycete communities from Santaquin Canyon, Utah

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# A PHYTOSOCIOLOGICAL STUDY OF COPROPHILOUS ASCOMYCETE AND BASIDIOMYCETE COMMUNITIES FROM SANTAQUIN CANYON, UTAH

A Thesis
Presented to the
Department of Botany
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In Partial Fulfillment
of the Requirements for the Degree
Master of Science

by

A. Clyde Blauer

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This thesis, by A. Clyde Blauer, is accepted in its present form by the Department of Botany of Brigham Young University as satisfying the thesis requirement for the degree of Master of Science.

Typed by Dianne Steed

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# INTRODUCTION

The purpose of this research was to determine the structure of ascomycete and basidiomycete communities which grow and fruit on cow dung. Quantitative and qualitative phytosociological data were obtained, and successional patterns were studied in detail.

Cow dung was chosen as the substratum because large cow dung platters are plentiful, easily collected, and of adequate size to permit the placement of numerous small quadrats for sampling the fungal communities. Also, large platters can be divided into sections for incubation under different environmental conditions.

Previous investigations by Ellis and Everhart (1892), Wilson (1947), Lundquist (1960), Hanks (1963), and McKnight and Hanks (1964) have shown that cow dung is a natural substratum for many different coprophilous Ascomycetes and Basidiomycetes. Their investigations, however, were concerned primarily with taxonomy and distribution rather than the sociology of the fungi known to fruit on animal dung. In 1948 and 1963 Cooke made a review of the literature of fungus sociology and ecology. He gave references to several quantitative ecological studies on the larger fleshy fungi and on soil fungi, but made no reference to quantitative ecological studies on the coprophilous fungi. The author has been unable to find any reference to quantitative ecological studies concerning coprophilous fungi.

There are published reports on successional studies of microfungi on various substrata. Watting (1963) examined the micro-fungal succession of hawk pellets, but only a few Ascomycetes and no Basidiomycetes in the successional pattern were reported. Other researchers have examined the succession of micro-fungi growing on such substrata as decaying stems of _Dactylis glomerata_ (Webster, 1956, 1957, Webster and Nix, 1960) and _Agropyron repens_ (Hudson and Webster, 1958), leaf litter of _Carex paniculata_ (Pugh, 1958), ageing leaves of _Saccharum officinarum_ (Hudson, 1962), and hair in contact with soil (Griffin, 1960).

Concerning the succession of fungi on the dung of herbivorous animals, Massee and Salmon (1901) observed that when quite fresh dung from such animals were placed under a bell-jar, Phycomycetes develop first, then Hyphomycetes followed by Ascomycetes. Ingold (1953), reviewed the work by Massee and Salmon. Although Ingold accepted the same general pattern reported by Massee and Salmon, he added that Basidiomycetes follow Ascomycetes in the coprophilous fungal succession. Ingold further stated that while the successional stages are usually fairly definite they do overlap.

In the current study only the successional stages in the fruiting of the Ascomycetes and Basidiomycetes growing on cow dung were examined in detail. Phycomycetes and Hyphomycetes were not included in this report although they were seen fruiting early in the incubation period.

## METHODS AND MATERIALS

Large platters of dry, firm cow dung were collected October 3, 1964, from Santaquin Canyon, Utah County, Utah. The dung was stored in the laboratory at room temperature in air-tight metal containers until it was removed to be used in two experiments. The first experiment was begun on October 7, 1964. A section $3\frac{1}{2}$ inches wide was cut from the center of each of six platters. These were designated sections 1 through 6. Each section was then examined microscopically for the presence of dried ascocarps and basidiocarps, but none were found.

After this examination, the sections were submerged for three minutes in distilled water and then placed on moistened paper towels in plastic culture trays 17 inches long, $4\frac{1}{2}$ inches wide, $4\frac{1}{4}$ inches deep. The trays were covered with glass plates and the cultures were incubated at $21^{\circ} \pm 2^{\circ}$ C. under continuous illumination. A "Tempscribe" thermograph was placed in the incubation chamber by the side of the cultures to record the temperature during the incubation period. Throughout the experiment, additional distilled water was added to the trays each week to keep the cultures moist.

Six days after the start of the incubation period fifty quadrats, each 25 square millimeters, were spaced, as shown in Figure 1, in a regular checkerboard pattern on a central portion, 26 cm by 8 cm, of each of the six cultures. Insect mounting pins were inserted into the cultures at the corners of each quadrat to mark the boundries of the quadrats and to serve as reference points for locating the quadrats.

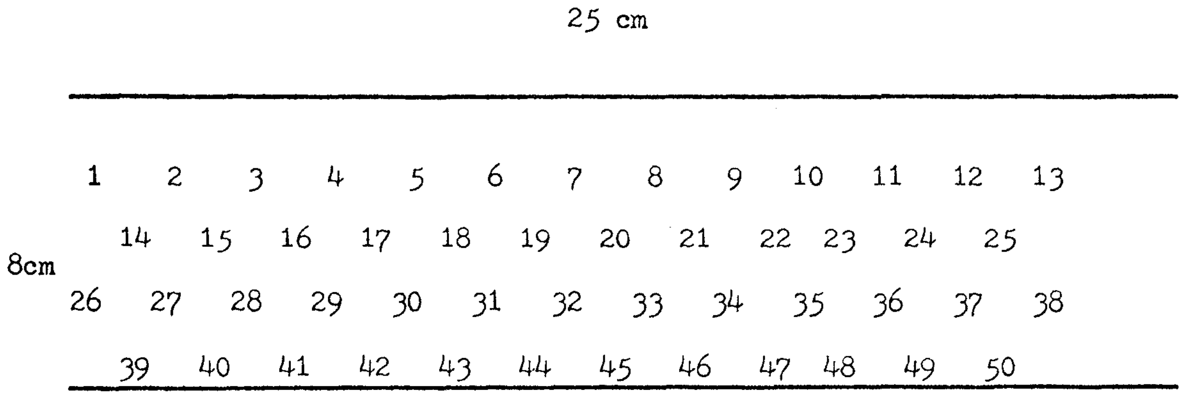

Fig. 1.--Number and arrangement of the fifty quadrats placed on each culture.

To aid in examination of the quadrats a grid micrometer was inserted into an eyepiece of a Bausch and Lomb "Stereozoom" dissecting microscope and the magnification was adjusted until the size of the grid image matched the size of the quadrats.

An examination of the cultures was made immediately after the quadrats were located and subsequently at weekly intervals for sixteen weeks. During each of the 16 examinations, presence, frequency, and density data were recorded.

Presence data were obtained by recording the ascomycete and basidiomycete species present on each culture after the species had been identified from their fruiting bodies. For identification the fruiting bodies were removed from the culture and all or part of them mounted on glass slides in a ten percent aqueous solution of glycerol. The fruiting bodies were crushed by applying pressure to the coverslip. Permanent microscope slides of most of the species were preserved. The slides were prepared as follows: As the water evaporated from the mounting medium it was replaced by solutions of gradually increasing concentrations of glycerol. The slides were then ringed with "Zut Slide Ringing Compound"[1] and labeled with the species name and collection number. Fruiting bodies of the same species also were harvested, placed in small paper packets, and deposited with the slides in the mycological herbarium of Brigham Young University. Whenever possible the fruiting bodies harvested for identification and preservation were collected outside the quadrats to avoid disturbing the quadrats.

Frequency and density data were obtained by recording the number of fruiting bodies produced by each species within each quadrat. The percentage frequency of each species was then determined by dividing the number of quadrats in which a species fruited by the total number of quadrats examined in the sample. Absolute density was determined for each species by counting the number of the species fruiting bodies in the quadrats examined. The relative density was determined for each species by dividing the number of its fruiting bodies by the total number of fruiting bodies of all species in the sample. In figuring the relative density and the percentage frequency any value less than 1.0% was denoted as a trace. Constancy was also determined for each species. This was done by figuring the percentage of cultures in whose quadrats the species fruited.

When the frequency and density data were obtained each week no distinction was made between the old fruiting bodies and the new ones. As long as the fruiting bodies were recognizable they were recorded each

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[1] Manufactured by Bennett's Paint Products, Salt Lake City, Utah.

week whether they had been recorded in previous weeks or not. Chart quadrats were drawn to show the relative sizes of the fruiting bodies of representative species (Figure 3). Coverage data could have been obtained by use of chart quadrats, but the method is too time consuming to be used efficiently.

The second experiment was started January 30, 1965. Eight cultures were incubated at different temperatures to determine what effect temperature might have on the succession and structure of the coprophilous ascomycete and basidiomycete communities. The eight cultures were obtained by cutting each of four large cow platters into two sections. Four of the eight sections were numbered 7a, 8a, 9a, and 10a. These will be referred to collectively, hereafter, as cultures 7a-10a. They were prepared, examined, and incubated at $21^{\circ} \pm 2^{\circ}$ C. as described for cultures 1-6 in the first experiment. The four remaining sections, 7b, 8b, 9b, and 10b, were also prepared and examined as were the cultures of the first experiment, but they were incubated under different temperatures. These cultures will be referred to collectively, hereafter, as cultures 7b-10b. Cultures 7b and 8b were incubated at $26^{\circ} \pm 2^{\circ}$ C. while cultures 9 b and 10b were incubated at $16^{\circ} \pm 2^{\circ}$ C.

Thus, in this study ten cultures (1-6 and 7a-10a) were incubated at $21^{\circ} \pm 2^{\circ}$ C. The general successional patterns and the general community structure of the Ascomycetes and Basidiomycetes reported in this paper are based only on the data obtained from these ten cultures. Variations in the patterns and structure due to temperature were found by incubating the four remaining cultures (7b-10b) at different temperatures. To study these variations as accurately as possible the data obtained from cultures 7b-10b were compared to only the corresponding data from cultures 7a-10a. It was assumed on the basis of Buller's report (1909) that cultures from the same dung mass should contain a more homogenous mixture of spores than cultures taken from different dung masses. Therefore, incubation of cultures from the same platter under different temperatures should provide a fairly equitable test for determining the effect of temperature on the fruiting of the fungal species which grow on these cultures.

The species which fruited on the 14 cultures incubated during this study have been divided into the following three arbitrary categories: major species, minor species, and rare species. The major species are those with an average maximum density of at least 7.5 fruiting bodies per culture. The minor species are those with an average maximum density of less than 7.5 fruiting bodies per culture. The rare species are those that fruited on the culture, but which did not fruit in any quadrats.

For the second experiment, "Tempscribe" thermographs were placed in both the 26° C. and the 16° C. incubation chambers, and a maximum-minimum thermometer was placed in the 21° C. chamber.

The keys used for identification of the ascomycete species were those prepared by Cain (1934), Seaver (1961), Hanks (1963) and McKnight and Hanks (1964). The basidiomycete species were identified by Dr. Kent H. McKnight.

# RESULTS

## General Data

Sixty species of fungi were found in this study (Table 2). In Table 1 the number of species in each genus, series, and class is given.

TABLE 1

THE NUMBER OF SPECIES IN EACH GENUS, SERIES, AND CLASS REPRESENTED ON THE FOURTEEN CULTURES INCUBATED DURING THIS STUDY

- Class: Ascomycetes (46)
  - Series: Plectomycetes (2)
    - Genus: Tripterospora (1)
    - Genus: Preussia (1)
  - Series: Pyrenomycetes (26)
    - Genus: Podospora (10)
    - Genus: Sordaria (2)
    - Genus: Sporormia (7)
    - Genus: Chaetomium (5)
    - Genus: Pleospora (1)
    - Genus: Bombardia (1)
  - Series: Discomycetes (18)
    - Genus: Ascobolus (4)
    - Genus: Ascophanus (8)
    - Genus: Saccobolus (4)
    - Genus: Peziza (1)
    - Genus: Lasiobolus (1)

- Class: Basidiomycetes (14)
  - Series: Hymenomycetes (14)
    - Genus: Coprinus (13)
    - Genus: Conocybe (1)

Seven species produced fruiting bodies at the three temperatures (26$^{\circ}$ C., 21$^{\circ}$C., and 16$^{\circ}$C.) used in this experiment (Table 2). These species were *Podospora piriformis*, *Podospora curvula*, *Coprinus* spp., *Podospora decipiens*, *Chaetomium globosum*, *Saccobolus kerverni* and *Podospora vestita*.

TABLE 2

THE CONSTANCY AND PRESENCE PERCENTAGES OF THE FUNGAL SPECIES FRUITING ON

CULTURES 1-10b

| Species | Constancy % | | Presence | Cultures on which the species fruited | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | At 21°C. | All Temp. | % All Temp. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | | 8 | | 9 | | 10 | |
| | | | | | | | | | | a | b | a | b | a | b | a | b |
| | | | | 21 | 21 | 21 | 21 | 21 | 21 | 21 | 26 | 21 | 26 | 21 | 16 | 21 | 16 |
| Podospora piriformis | 90% | 90% | 90% | x | x | x | x | x | x | x | x | | | x | x | x | x |
| Coprinus spp. | 80% | 80% | 90% | x | x | x | x | x | x | | *P | x | P | | | x | x |
| Ascobolus immersus | 80% | 80% | 80% | x | x | x | x | x | x | | | | | x | | x | x |
| Podospora curvula | 80% | 80% | 80% | | x | x | x | x | x | x | x | x | | x | x | | |
| Podospora decipiens | 70% | 70% | 70% | | | x | x | | x | x | x | x | | x | x | x | x |
| Ascobolus furfuraceous | 60% | 60% | 60% | x | x | | x | x | x | | | | | | | x | x |
| Ascophanus holmskjoldii | 60% | 60% | 60% | x | | x | x | x | x | | | | | | | x | |
| Ascophanus granuliformis | 60% | 60% | 60% | x | x | | x | | x | | | | | x | x | x | x |
| Podospora coronifera | 50% | 50% | 60% | | x | x | x | x | x | | | P | | | | | |
| Sporormia intermedia | 50% | 50% | 50% | | x | x | x | x | x | | | | | | | | |
| Saccobolus kerverni | 40% | 50% | 50% | | x | | | | | | x | x | x | x | | x | x |
| Chaetomium globosum | 40% | 40% | 40% | | | | | | | x | x | x | x | x | x | x | |
| Chaetomium sp. #2 | 40% | 40% | 40% | x | x | x | x | | | | | | | | | | |
| Sporormia minima | 40% | 40% | 40% | | | x | | | x | x | | | | x | | | |
| Podospora vestita | 40% | 40% | 40% | | | | | | | x | | x | x | x | x | x | |
| Ascophanus argenteus | 30% | 30% | 40% | | x | | x | | x | | | | | | | | P |
| Ascophanus ochraceous | 30% | 30% | 30% | | | | | | | x | | | | x | x | x | x |
| Saccobolus intermedius | 20% | 20% | 30% | | | | | | x | | | | P | | | x | |
| Podospora sp. #1 | 20% | 20% | 20% | | | x | | | x | | | | | | | | |
| Podospora sp. #2 | 20% | 20% | 20% | | x | | | x | | | | | | | | | |
| Bombardia caerulea | 20% | 20% | 20% | | x | | | | | | | | | x | | | |
| Podospora sp. #3 | 20% | 20% | 20% | | x | | | | x | | | | | | | | |
| Coprinus parvisporus | 20% | 20% | 20% | | | x | | | | | | | | | | x | |

TABLE 2--Continued

| Species | Constancy % | | Presence | Cultures on which the species fruited | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | At | All | % All | 1 | 2 | 3 | 4 | 5 | 6 | 7 | | 8 | | 9 | | 10 | |
| | 21° C. | Temp. | Temp. | | | | | | | a | b | a | b | a | b | a | b |
| | | | | 21 | 21 | 21 | 21 | 21 | 21 | 21 | 26 | 21 | 26 | 21 | 16 | 21 | 16 |
| Podospora pilosa | 10% | 10% | 20% | | | | | | x | | | | | P | | | |
| Sporormia australis | 10% | 10% | 20% | | | | | | | x | | | | | P | | |
| Coprinus pellucidus | 10% | 10% | 10% | | | x | | | | | | | | | | | |
| Sordaria fimicola | 10% | 10% | 10% | | | | | | | x | | | | | | | |
| Sordaria humana | 10% | 10% | 10% | | | | | | | x | | | | | | | |
| Coprinus sp. #2 | 10% | 10% | 10% | | | | | | | | | | | | | x | |
| Saccobolus neglectans | 10% | 10% | 10% | | | | | | | x | x | | | | | | |
| Sporormia vexans | 10% | 10% | 10% | | | | | x | | | | | | | | | |
| Sporormia kansensis | 10% | 10% | 10% | | | | | x | | | | | | | | | |
| Sporormia megalospora | 10% | 10% | 10% | | | | | x | | | | | | | | | |
| Saccobolus depauperatus | 10% | 10% | 10% | | | | | | | | | | | | | x | |
| Sporormia pascua | 10% | 10% | 10% | | | | | | x | | | | | | | | |
| Coprinus hexagonospora | 0 | 20% | 20% | | | | | | | | | | | | x | | x |
| Peziza granulata | 0 | 10% | 20% | | | | | | | | | P | | | | P | x |
| Coprinus cordisporus | 0 | 10% | 20% | | | | | | | | P | | | | | | x |
| Chaetomium sp. #1 | 0 | 10% | 20% | P | | | | | | | | | | | | | x |
| Ascophanus sp. #1 | 0 | 10% | 10% | | | | | | | | | | | | x | | |
| Ascophanus brunneus | 0 | 10% | 10% | | | | | | | | | | | | | | x |
| Ascobolus furfuraceous | 0 | 10% | 10% | | | | | | | | | | | | x | | |
| Tripterospora sp. #1 | 0 | 10% | 10% | | | | | | | | x | | | | | | |
| Conocybe bulbifera | 0 | 0 | 30% | | | | | | | P | | P | | P | | | |
| Coprinus fimetarius | 0 | 0 | 20% | | | | | P | | | | | | | | P | P |
| Coprinus sp. #3 | 0 | 0 | 20% | | | | | | | P | | | | | | | P |
| Podospora anserina | 0 | 0 | 20 | | | | | | | | | | P | | P | | |
| Pleospora sp. #1 | 0 | 0 | 10% | | | | | | | P | P | | | | | | |
| Coprinus sp. #1 | 0 | 0 | 10% | | | | | | P | | | | | | | | |

TABLE 2--Continued

| Species | Constancy % At 21°C. | All Temp. | Presence % All Temp. | Cultures on which the species fruited | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | | 8 | | 9 | | 10 | |
| | | | | | | | | | | a | b | a | b | a | b | a | b |
| | | | | 21 | 21 | 21 | 21 | 21 | 21 | 21 | 26 | 21 | 26 | 21 | 16 | 21 | 16 |
| Ascophanus argenteus v. | 0 | 0 | 10% | | | | | | P | | | | | | | | |
| Coprinus stercorarius | 0 | 0 | 10% | | P | | | | | | | | | | | | |
| Ascophanus carneus | 0 | 0 | 10% | | P | | | | | | | | | | | | |
| Lasiobolus equinus | 0 | 0 | 10% | | | | | | P | | | | | | | | |
| Ascophanus microsporus | 0 | 0 | 10% | | | | | | | | | P | | | | | |
| Chaetomium sp. #3 | 0 | 0 | 10% | | | | | | | | | | P | | | | |
| Coprinus sp. #4 | 0 | 0 | 10% | | | | | | | | P | | | | | | |
| Chaetomium murorum | 0 0 | 0 | 10% | | | | | | | | | | | | P | | |
| Preussia typharum | 0 | 0 | 10% | | | | | | | | | | | | P | | |
| Coprinus sp. #5 | 0 | 0 | 10% | | | | | | | | | | | | P | | |
| Coprinus ephemerus | 0 | 0 | 10% | | | | | | | | | | | | | | P |
| Total species/culture | | | | 8 | 16 | 13 | 12 | 13 | 20 | 14 | 11 | 10 | 7 | 13 | 14 | 17 | 17 |

*P-Present but not in quadrats

These are all species of constancy between 40%-90% (Table 2), and all but Saccobolus kerverni and Coprinus spp. are pyrenomycetes species.

Ten species produced fruiting bodies at 16° C. and 21° C. (Table 2). These species are Ascobolus immersus, Ascobolus furfuraceous, Ascophanus granuliformis, Ascophanus argenteus, Ascophanus ochraceous, Sporormia australis, Peziza granulata, Chaetomium sp. #1, Coprinus fimetarius, and Coprinus sp. #3. Of these species S. australis and Chaetomium sp. #1 are Pyrenomycetes, the two Coprinus species are Basidiomycetes, and the other six species are Discomycetes.

Three species, Saccobolus intermedius, Saccobolus neglectans, Pleospora sp. #1, produced fruiting bodies at 21° C. and 26° C. (Table 2).

Twenty-seven of the sixty different species shown in Table 2 produced fruiting bodies only on cultures incubated at 21° C. ; three species (Tripterospora sp. #1, Chaetomium sp. #3, Coprinus sp. #4) produced fruiting bodies only on cultures incubated at 26° C.; and eight species produced fruiting bodies only on cultures incubated at 16° C. These eight species were Ascophanus furfuraceous var. coronatus, Ascophanus brunneus, Coprinus hexagonosporus, Ascophanus sp. #1, Chaetomium murorum, Preussia typharum, Coprinus sp. #5, Coprinus ephemerus.

Of the species which fruited on cultures 1-10b, 6.7% had constancy ratings of 80% or 90%, 6.7% had constancy ratings of 60% or 70%, 11.6 had constancy ratings of 40% or 50%, 15.0% had constancy ratings of 20% or 30%, 31.7% had constancy ratings of only 10%, and 25.3% had constancy ratings of 0%. Thus 75.0% of these species were of low constancy, appearing in only three or less cultures. The rest of the species (25.0%) were of relatively regular occurrance since they fruited on four or more cultures.

Thirteen different genera of Ascomycetes and Basidiomycetes were represented on the ten cultures incubated at 21° C. (Table 3). Four of these genera, Ascophanus, Podospora, Sporormia, and Coprinus,

TABLE 3

THE NUMBER OF MAJOR, MINOR AND RARE SPECIES OF EACH GENUS WHICH FRUITED ON CULTURES INCUBATED AT 21° C.

| Genera | Major Species | Minor Species | Rare Species | Total Species |
|---|---|---|---|---|
| Ascobolus | 2 | 0 | 0 | 2 |
| Ascophanus | 3 | 1 | 3 | 7 |
| Bombardia | 0 | 1 | 0 | 1 |
| Chaetomium | 1 | 1 | 1 | 3 |
| Conocybe | 0 | 0 | 1 | 1 |
| Coprinus | 0 | 4 | 4 | 8 |
| Lasiobolus | 0 | 0 | 1 | 1 |
| Peziza | 0 | 0 | 1 | 1 |
| Pleospora | 0 | 0 | 1 | 1 |
| Podospora | 6 | 3 | 0 | 9 |
| Saccobolus | 1 | 3 | 0 | 4 |
| Sporormia | 0 | 7 | 0 | 7 |
| Sordaria | 0 | 2 | 0 | 2 |
| Total | 13 | 22 | 12 | 47 |

produced almost two-thirds of the species which fruited on these cultures. None of the Sporormia or Coprinus species, however, were major species.

In contrast to the genera Coprinus and Sporormia, the genus Podospora, which was represented by nine different species, had six of these species in the major category (Table 3). This is important since all the other genera combined only had seven species in the same category. Thus approximately half of the major species on these cultures were

Podospora species.

In Table 4 the percentage frequency of 43 ascomycete and basidiomycete species is presented for the sixteen weekly examinations of each culture. These species include only those which fruited in the quadrats placed on the cultures. The absolute density of the same species is presented in Table 5. The species are listed in both tables in the order of their fruiting sequence with the species fruiting during the first week of incubation at the head of each table. The species fruiting during each week thereafter are listed in consecutive order. This arrangement shows the successional pattern in the fruiting of the species. Only those cultures on which the species fruited are included in the tables.

Although general patterns in the fruiting of species can be observed in Tables 4 and 5, some variations do exist. For most species there is not only variation in the initiation of fruiting but also in duration and intensity of fruiting. In order to obtain a general summarized pattern for the fruiting of each individual species growing on the cultures incubated at 21° C., the percentage frequency and absolute density data obtained from these cultures were averaged for each species. The averaged percentage frequency and absolute density of these species are presented in Tables 6 and 7 respectively. From the average absolute density, the relative density of each species was determined as explained in the "Methods". The relative density of the species is presented in Table 8.

Of the 47 species fruiting on the cultures incubated at 21° C., thirteen are major species, twenty-two are minor species, and twelve

# TABLE 4

## THE WEEKLY PERCENTAGE FREQUENCIES OF THE SPECIES ON EACH OF THE CULTURES

| Species | Temp ° C. | Culture | Number of Weeks From Start of Incubation | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 |
| Ascobolus furfuraceous | 21 | 1 | 4 | | | | | | | | | | | | | | | |
| | 21 | 2 | 4 | 10 | 8 | 4 | | | | | | | | | | | | |
| | 21 | 4 | 10 | 14 | 8 | 10 | 6 | | | | | | | | | | | |
| | 21 | 5 | 22 | 20 | 24 | 14 | 8 | 2 | | | | | | | | | | |
| | 21 | 6 | 44 | 44 | 40 | 40 | 36 | 34 | 32 | 30 | 28 | 28 | 28 | 26 | 24 | 18 | 14 | 12 |
| | 21 | 10a | 46 | 48 | 40 | 28 | 20 | 16 | 8 | 6 | | | | | | | | |
| | 16 | 10b | 26 | 32 | 32 | 28 | 20 | 18 | 12 | 12 | 10 | 4 | | | | | | |
| Ascobolus immersus | 21 | 1 | 44 | 14 | 8 | 4 | 2 | | | | | | | | | | | |
| | 21 | 2 | 50 | 46 | 32 | 8 | 4 | 2 | | | | | | | | | | |
| | 21 | 3 | 12 | 8 | 2 | 2 | | | | | | | | | | | | |
| | 21 | 4 | 56 | 58 | 54 | 46 | 42 | 18 | | | | | | | | | | |
| | 21 | 5 | 66 | 72 | 60 | 56 | 48 | 44 | 30 | 18 | 12 | 12 | 8 | | | | | |
| | 21 | 6 | 44 | 28 | 4 | 2 | 2 | | | | | | | | | | | |
| | 21 | 9a | 2 | 6 | 2 | 4 | | | | | | | | | | | | |
| | 21 | 10a | 70 | 64 | 56 | 38 | 26 | 12 | 12 | 6 | 4 | | | | | | | |
| | 16 | 10b | | 6 | 14 | 10 | 10 | 8 | 2 | 2 | 2 | 2 | 2 | | | | | |
| Ascophanus holmskjoldii | 21 | 1 | | | | 2 | 2 | | | | | | | | | | | |
| | 21 | 3 | | | 2 | 4 | 2 | | | 2 | | | | | | | | |
| | 21 | 4 | | | | 6 | | | | | | | | | | | | |
| | 21 | 5 | 4 | 26 | 22 | 14 | 10 | 38 | 26 | 4 | 4 | 8 | 2 | | | | | |
| | 21 | 6 | 26 | 82 | 90 | 88 | 90 | 78 | 78 | 74 | 72 | 72 | 72 | 72 | 70 | 70 | 70 | 70 |
| | 21 | 10a | | | | | | | 2 | 6 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| Coprinus pellucidus | 21 | 2 | | | 6 | | | | | | | | | | | | | |
| | 21 | 3 | 2 | | | | | | | | | | | | | | | |

TABLE 4--Continued

| Species | Temp | Cul- | Number of Weeks From Start of Incubation | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | ° C. | ture | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 |
| Chaetomium globosum | 21 | 7a | | 14 | 16 | 18 | 20 | 12 | 12 | 6 | 8 | 8 | 6 | 6 | 6 | 6 | 6 | 6 |
| | 26 | 7b | 2 | 2 | 2 | 2 | 2 | 2 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 |
| | 21 | 8a | | 4 | 8 | 8 | 6 | 6 | 4 | 4 | 4 | 4 | 2 | 2 | 2 | 2 | 2 | 2 |
| | 26 | 8b | | | | | | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| | 21 | 9a | 4 | 14 | 24 | 18 | 20 | 18 | 18 | 16 | 16 | 14 | 14 | 14 | 12 | 12 | 12 | 12 |
| | 16 | 9b | | | | 2 | 2 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 |
| | 21 | 10a | | | | | | | 2 | 2 | | | | | | | | |
| Sordaria humana | 21 | 7a | 8 | 14 | 10 | 10 | 10 | 6 | 6 | 6 | 2 | | | | | | | |
| Sordaria fimicola | 21 | 7a | 6 | 8 | 8 | 6 | 2 | 2 | 4 | | | | | | | | | |
| Ascobolus furfuraceous v. coronatus | 16 | 9b | | 2 | 4 | 4 | 4 | | | | | | | | | | | |
| Chaetomium sp. #2 | 21 | 1 | | | | | | 2 | | | | 2 | | | | | | |
| | 21 | 2 | | | 2 | 2 | 2 | 2 | 2 | 2 | 2 | | | | | | | |
| | 21 | 3 | | | | | | | | | | 2 | | | 2 | | | |
| | 21 | 4 | | 2 | | | | | | | | | | | | | | |
| Coprinus spp. | 21 | 1 | | | 4 | 12 | | | 4 | 2 | 2 | 2 | | | | | | |
| | 21 | 2 | | 8 | | 4 | 2 | 2 | | | | | 2 | 8 | | 2 | | 2 |
| | 21 | 3 | | | | 4 | 6 | 6 | 4 | 2 | 2 | | | | | | | |
| | 21 | 4 | | | 6 | 10 | 10 | 2 | | | | | | 2 | | | 4 | |
| | 21 | 5 | | | | | | | 2 | 4 | 6 | 6 | | | | | | |
| | 21 | 6 | | | 6 | 8 | 4 | 2 | 2 | | 2 | | | | | | | |
| | 21 | 8a | | | | | | | | | | | | 2 | | | | |
| | 21 | 10a | | 2 | | | | | | | | | | | | | | |
| | 16 | 10b | | | | | | | 4 | 4 | | | | | | | | |

TABLE 4--Continued

| Species | Temp ° C. | Culture | Number of Weeks From Start of Incubation | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 |
| Podospora coronifera | 21 | 2 | | 64 | 96 | 98 | 98 | 98 | 98 | 98 | 98 | 98 | 96 | 94 | 52 | 12 | 2 | |
| | 21 | 3 | | | 40 | 60 | 66 | 70 | 70 | 74 | 64 | 54 | 52 | 28 | 10 | 6 | 2 | |
| | 21 | 4 | | | 4 | 24 | 32 | 16 | | | | | | | | | | |
| | 21 | 5 | | | 12 | 18 | 24 | 38 | 44 | 38 | 22 | 14 | | | | | | |
| | 21 | 6 | | 20 | 12 | 20 | 26 | 24 | 26 | 24 | 22 | 22 | 26 | 26 | 26 | 24 | 24 | 24 |
| Podospora decipiens | 21 | 3 | | | | 8 | | | | | | | | | | | | |
| | 21 | 4 | | | | 4 | 2 | | | | | | | | | | | |
| | 21 | 6 | | 2 | 4 | 8 | 8 | 2 | 2 | 2 | 2 | | | | | | | |
| | 21 | 7a | | | 20 | 22 | 22 | 20 | 22 | 16 | 20 | 12 | 4 | | | | | |
| | 26 | 7b | | 2 | 6 | 6 | 6 | 2 | 4 | | | | | | | | | |
| | 21 | 8a | | | | 2 | 2 | 2 | 2 | | | | | | | | | |
| | 21 | 9a | | | 6 | 6 | 8 | 6 | 6 | 4 | 2 | | | | | | | |
| | 16 | 9b | | | | | 2 | 4 | 6 | 6 | 8 | 4 | 6 | 6 | 6 | 4 | 4 | 4 |
| | 21 | 10a | | | 2 | 2 | 2 | 2 | 2 | | | | | | | | | |
| | 16 | 10b | | | | | | | | 2 | 2 | | | | | | | |
| Saccobolus kerverni | 21 | 2 | | 2 | 4 | | | | | | | | | | | | | |
| | 26 | 7b | | | | 2 | 4 | 2 | 4 | | 2 | | | | | | | |
| | 21 | 8a | | 18 | 20 | 20 | 22 | 22 | 14 | 10 | 8 | 8 | 8 | | | | | |
| | 26 | 8b | | 14 | 12 | 12 | 16 | 12 | 8 | 10 | 6 | 2 | 2 | | | | | |
| | 21 | 9a | | | | | | | 2 | 2 | | | | | | | | |
| | 21 | 10a | | 4 | 4 | | | | 2 | 2 | | | | | | | | |
| | 16 | 10b | | | 2 | 2 | 2 | | | | 2 | | | | | | | |

TABLE 4--Continued

| Species | Temp ° C. | Culture | Number of Weeks From Start of Incubation | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 |
| Podospora curvula | 21 | 2 | | | 4 | 6 | 6 | 10 | 6 | 6 | 6 | 9 | 10 | 8 | | | | |
| | 21 | 3 | | | | 12 | 14 | 12 | 8 | 6 | 6 | | | | | | | |
| | 21 | 4 | | | | 14 | 20 | | | | | | | | | | | |
| | 21 | 5 | | | 6 | 24 | 32 | 38 | 36 | 24 | 10 | 2 | | | | | | |
| | 21 | 6 | | | | 2 | 2 | 34 | 42 | 40 | 32 | 32 | 30 | 28 | 28 | 28 | 22 | 22 |
| | 21 | 7a | | 2 | 4 | 8 | 12 | 16 | 18 | 26 | 34 | 34 | 26 | 22 | 14 | 10 | 6 | 4 |
| | 26 | 7b | | | 4 | 2 | 2 | 4 | 4 | 6 | 4 | | | | | | | |
| | 21 | 8a | | | | 10 | 6 | 8 | 4 | 4 | 2 | | | | | | | |
| | 21 | 9a | | | | 2 | 4 | 4 | 4 | 6 | 6 | 6 | 6 | 6 | 4 | 4 | | |
| | 16 | 10b | | | | | | | 2 | 6 | 8 | 10 | 12 | 14 | 14 | 14 | 14 | 14 |
| Tripterospora sp. #1 | 26 | 7b | | 8 | 12 | 12 | 10 | 12 | 12 | 8 | 6 | 4 | 2 | 2 | | | | |
| Saccobolus intermedius | 21 | 6 | | | | | | | | 6 | 8 | 4 | 6 | | | | | |
| | 21 | 10a | | 8 | 6 | 6 | 6 | 6 | 2 | 2 | 2 | | | | | | | |
| Coprinus parisporus | 21 | 3 | | | 4 | | | | | | | | | | | | | |
| | 21 | 10a | | | | | | | | | 4 | 2 | | | | | | |
| Sporormia minima | 21 | 3 | | | | | 4 | 2 | | | | 2 | | | | | | |
| | 21 | 6 | | | | | | 2 | 2 | | | | | | | | | |
| | 21 | 7a | | | 2 | 2 | | | | | | | | | | | | |
| | 21 | 9a | | | 2 | | | | | | | | | | | | | |
| Coprinus sp. #2 | 21 | 10a | | | 30 | 26 | 20 | 30 | 16 | 10 | | | | | | | | |

TABLE 4--Continued

| Species | Temp ° C. | Culture | Number of Weeks From Start of Incubation |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
|  |  |  | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 |
| Ascophanus ochraceous | 21 | 7a |  |  |  |  | 18 | 12 | 10 | 12 | 16 | 10 | 10 | 12 | 14 | 14 | 12 | 12 |
|  | 21 | 9a |  |  |  |  |  |  |  |  | 2 |  |  |  |  |  | 2 | 2 |
|  | 16 | 9b |  |  |  |  |  | 10 | 32 | 40 | 42 | 44 | 40 | 36 | 38 | 34 | 36 | 32 |
|  | 21 | 10a |  |  |  |  |  | 2 | 2 | 2 |  | 2 |  |  |  |  | 4 |  |
|  | 16 | 10b |  |  |  | 6 | 10 | 16 | 10 | 14 | 16 | 14 | 14 | 12 | 6 | 6 | 8 | 6 |
| Podospora vestita | 21 | 7a |  |  |  |  |  | 4 | 8 | 12 | 10 | 12 | 20 | 24 | 32 | 32 | 42 | 44 |
|  | 21 | 8a |  |  |  |  |  |  | 4 | 4 | 12 | 18 | 24 | 24 | 28 | 20 | 22 | 20 |
|  | 26 | 8b |  |  |  | 12 | 20 | 34 | 34 | 36 | 42 | 42 | 42 | 42 | 42 | 42 | 42 | 42 |
|  | 21 | 9a |  |  |  | 2 | 2 | 2 | 2 | 6 | 6 | 6 | 8 | 10 | 12 | 12 | 12 | 14 |
|  | 16 | 9b |  |  |  |  |  |  |  |  |  |  |  |  | 4 | 6 | 6 | 8 |
|  | 21 | 10a |  |  |  |  |  |  |  |  |  |  |  |  | 2 | 4 | 4 | 2 |
| Saccobolus neglectans | 21 | 7a |  |  |  | 14 | 10 | 20 | 16 | 16 | 16 | 12 | 10 | 6 | 8 | 6 |  |  |
|  | 26 | 7b |  |  |  | 4 | 2 | 4 | 4 | 4 | 4 | 4 | 2 | 2 |  |  |  |  |
| Podospora piriformis | 21 | 1 |  |  |  |  |  |  |  |  | 2 | 4 |  |  |  |  |  |  |
|  | 21 | 2 |  |  |  |  |  |  |  |  |  |  |  | 2 |  |  |  |  |
|  | 21 | 3 |  |  |  | 8 | 16 | 14 | 14 | 10 | 6 | 8 | 6 | 12 | 6 | 6 | 6 | 2 |
|  | 21 | 4 |  |  |  |  |  |  |  |  |  |  |  |  |  | 2 | 4 | 4 |
|  | 21 | 5 |  |  |  |  |  | 2 | 2 | 4 | 6 | 10 | 2 | 2 | 2 |  |  |  |
|  | 21 | 6 |  |  |  |  |  |  |  |  |  |  |  |  | 2 | 2 | 2 | 2 |
|  | 21 | 7a |  |  |  |  |  |  |  |  |  |  | 2 | 2 |  | 2 | 4 | 2 |
|  | 26 | 7b |  |  |  |  |  |  |  |  |  |  |  |  | 2 |  |  |  |
|  | 21 | 9a |  |  |  |  |  |  |  |  | 2 | 2 | 2 | 2 |  | 2 | 2 | 6 |
|  | 16 | 9b |  |  |  |  |  |  |  |  |  |  |  |  |  | 4 | 6 | 6 |
|  | 21 | 10a |  |  |  |  | 6 | 28 | 44 | 58 | 64 | 56 | 52 | 56 | 54 | 54 | 52 | 48 |
|  | 16 | 10b |  |  |  |  |  |  |  | 4 | 6 | 8 | 12 | 24 | 50 | 46 | 52 | 50 |

TABLE 4--Continued

| Species | Temp ° C. | Culture | Number of Weeks From Start of Incubation | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 |
| Sporormia intermedia | 21 | 2 | | | | | | | | | | | | 4 | | | | |
| | 21 | 3 | | | | 6 | 2 | 4 | 6 | 6 | 8 | 2 | 2 | | | | | 2 |
| | 21 | 4 | | | | | | 2 | | | | | | | | | | |
| | 21 | 5 | | | | 2 | | | | | | | | | | | | |
| | 21 | 6 | | | | | 2 | | | 2 | | | | | | | | |
| Ascophanus granuliformis | 21 | 1 | | | | | | 2 | | | | | | | | | | |
| | 21 | 2 | | | | | | | 2 | | | | 2 | 2 | | | | |
| | 21 | 4 | | | | | 2 | 2 | | | | | | | | | | |
| | 21 | 6 | | | | 12 | 8 | 4 | 6 | 4 | 4 | 4 | | | | | | |
| | 21 | 9a | | | | | | | | | | | | 2 | | | | |
| | 16 | 9b | | | | | | 2 | | | | | | | | | | |
| | 21 | 10a | | | | | 2 | 4 | 2 | 6 | 4 | 4 | 4 | 6 | 2 | 2 | 2 | 2 |
| | 16 | 10b | | | | | 4 | 8 | 24 | 14 | 10 | 12 | 10 | 2 | 2 | 2 | 2 | 2 |
| Ascophanus argenteus | 21 | 2 | | | | | | 2 | | | | | | | | | | |
| | 21 | 4 | | | | 2 | | | | | | | | | | | | |
| | 21 | 6 | | | | | | 4 | | | | | | | | | | |
| Sporormia vexans | 21 | 5 | | | | | 2 | 4 | | | | | | | | | | |
| Podospora sp. #1 | 21 | 3 | | | | | | | | | | 8 | 10 | 14 | 10 | 8 | 6 | 2 |
| | 21 | 6 | | | | | | 12 | 20 | 22 | 22 | 22 | 22 | 20 | 20 | 20 | 18 | 18 |
| Sporormia kansensis | 21 | 5 | | | | | | 2 | | | | | | | | | | |
| Peziza granulata | 21 | 10a | | | | | | 2 | 2 | 2 | | | | | | | | |

TABLE 4--Continued

| Species | Temp ° C. | Culture | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
|  |  |  | Number of Weeks From Start of Incubation |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Podospora pilosa | 21 | 6 |  |  |  |  |  |  | 2 |  |  |  |  |  |  |  |  |  |
| Podospora sp. #2 | 21 | 2 |  |  |  |  |  |  |  |  |  |  |  | 2 |  |  |  |  |
|  | 21 | 5 |  |  |  |  |  |  | 8 | 12 | 16 | 14 | 4 |  |  |  |  |  |
| Sporormia megalospora | 21 | 5 |  |  |  |  |  |  |  | 2 |  |  |  |  |  |  |  |  |
| Ascophanus brunneus | 16 | 10b |  |  |  |  |  |  |  |  | 4 | 4 | 4 | 4 | 6 | 6 | 4 | 4 |
| Saccobolus depauperatus | 21 | 10a |  |  |  |  |  |  |  |  |  | 2 | 2 |  |  |  |  |  |
| Bombardia caerulea | 21 | 2 |  |  |  |  |  |  |  |  |  | 8 | 16 | 14 | 2 |  |  |  |
|  | 21 | 9a |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 2 |
| Coprinus hexagonosporus | 16 | 9b |  |  |  |  |  |  |  |  |  |  |  | 2 |  |  |  |  |
|  | 16 | 10b |  |  |  |  |  |  |  |  |  |  |  |  |  | 2 | 2 |  |
| Podospora sp. #3 | 21 | 2 |  |  |  |  |  |  |  |  |  |  |  | 2 |  |  |  |  |
|  | 21 | 6 |  |  |  |  |  |  |  |  |  |  |  | 4 | 2 | 2 | 2 | 2 |
| Sporormia australis | 21 | 7a |  |  |  |  |  |  |  |  |  |  |  |  | 2 | 2 | 2 | 2 |
| Coprinus cordisporus | 16 | 10b |  |  |  |  |  |  |  |  |  |  |  |  | 2 |  |  |  |
| Sporormia pascua | 21 | 6 |  |  |  |  |  |  |  |  |  |  |  |  |  | 2 |  |  |

TABLE 4--<u>Continued</u>

| Species | Temp ° C. | Cul-ture | Number of Weeks From Start of Incubation | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 |
| Chaetomium sp. #1 | 16 | 10b | | | | | | | | | | | | | | | 2 | 2 |
| Ascophanus sp. #1 | 16 | 9b | | | | | | | | | | | | | | | 2 | 2 |
| Quadrats distributed by insects | 21 | 1 | | 66 | 82 | 90 | 90 | 92 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 |
| | 21 | 2 | | | | | | | | | | | | | 98 | 100 | 100 | 100 |
| | 21 | 3 | | | | | | | | | | 74 | 90 | 96 | 98 | 100 | 100 | 100 |
| | 21 | 4 | | | 18 | 18 | 20 | 92 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 |
| | 21 | 5 | | | | | | | | 36 | 84 | 98 | 100 | 100 | 100 | 100 | 100 | 100 |

# TABLE 5

## THE WEEKLY ABSOLUTE DENSITY OF THE SPECIES ON EACH OF THE CULTURES

| Species | Temp ° C. | Culture | Number of Weeks From Start of Incubation | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 |
| Ascobolus furfuraceous | 21 | 1 | 3 | | | | | | | | | | | | | | | |
| | 21 | 2 | 2 | 6 | 4 | 2 | | | | | | | | | | | | |
| | 21 | 4 | 12 | 21 | 12 | 6 | 3 | | | | | | | | | | | |
| | 21 | 5 | 37 | 61 | 23 | 11 | 7 | 1 | | | | | | | | | | |
| | 21 | 6 | 48 | 45 | 43 | 40 | 32 | 31 | 30 | 28 | 25 | 24 | 24 | 22 | 21 | 17 | 12 | 10 |
| | 21 | 10a | 56 | 64 | 33 | 20 | 15 | 13 | 5 | 3 | | | | | | | | |
| | 16 | 10b | 25 | 25 | 22 | 19 | 14 | 10 | 6 | 6 | 5 | 2 | | | | | | |
| Ascobolus immersus | 21 | 1 | 195 | 28 | 12 | 7 | 1 | | | | | | | | | | | |
| | 21 | 2 | 56 | 46 | 16 | 5 | 3 | 1 | | | | | | | | | | |
| | 21 | 3 | 16 | 10 | 4 | 4 | | | | | | | | | | | | |
| | 21 | 4 | 347 | 305 | 252 | 218 | 173 | 26 | | | | | | | | | | |
| | 21 | 5 | 167 | 128 | 96 | 80 | 76 | 68 | 38 | 23 | 14 | 12 | 9 | | | | | |
| | 21 | 6 | 52 | 35 | 13 | 8 | 7 | | | | | | | | | | | |
| | 21 | 9a | 1 | 17 | 7 | 4 | | | | | | | | | | | | |
| | 21 | 10a | 168 | 117 | 74 | 39 | 25 | 12 | 9 | 3 | 2 | | | | | | | |
| | 16 | 10b | | 12 | 34 | 12 | 12 | 11 | 8 | 8 | 7 | 6 | 5 | | | | | |
| Ascophanus holmskjoldii | 21 | 1 | | | | 3 | 2 | | | | | | | | | | | |
| | 21 | 3 | | | 2 | 4 | 1 | | | 1 | | | | | | | | |
| | 21 | 4 | | | | 5 | | | | | | | | | | | | |
| | 21 | 5 | 10 | 45 | 18 | 12 | 7 | 27 | 14 | 2 | 2 | 4 | 1 | | | | | |
| | 21 | 6 | 130 | 373 | 387 | 354 | 315 | 262 | 238 | 221 | 216 | 207 | 203 | 198 | 186 | 179 | 165 | 165 |
| | 21 | 10a | | | | | | | 2 | 6 | 9 | 7 | 7 | 7 | 7 | 7 | 7 | 8 |
| Coprinus pellucidus | 21 | 2 | | | 4 | | | | | | | | | | | | | |
| | 21 | 3 | 1 | | | | | | | | | | | | | | | |

TABLE 5--Continued

| Species | Temp ° C. | Cul- ture | Number of Weeks From Start of Incubation |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
|  |  |  | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 |
| Chaetomium globosum | 21 | 7a |  | 40 | 46 | 50 | 50 | 44 | 34 | 18 | 20 | 19 | 16 | 16 | 17 | 17 | 17 | 17 |
|  | 26 | 7b | 8 | 6 | 3 | 4 | 3 | 3 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 |
|  | 21 | 8a |  | 16 | 37 | 36 | 18 | 15 | 11 | 7 | 7 | 7 | 3 | 4 | 4 | 4 | 4 | 4 |
|  | 26 | 8b |  |  |  |  |  | 4 | 4 | 4 | 6 | 4 | 4 | 4 | 4 | 4 | 4 | 4 |
|  | 21 | 9a | 38 | 141 | 204 | 226 | 227 | 232 | 226 | 209 | 197 | 185 | 181 | 181 | 176 | 176 | 176 | 176 |
|  | 16 | 9b |  |  |  | 5 | 10 | 4 | 4 | 4 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
|  | 21 | 10a |  |  |  |  |  |  | 1 | 1 |  |  |  |  |  |  |  |  |
| Sordaria humana | 21 | 7a | 10 | 30 | 22 | 21 | 16 | 9 | 9 | 7 | 3 |  |  |  |  |  |  |  |
| Sordaria fimicola | 21 | 7a | 56 | 60 | 60 | 55 | 38 | 38 | 24 |  |  |  |  |  |  |  |  |  |
| Ascobolus furfuraceus v. coronatus | 16 | 9b |  | 13 | 15 | 13 | 11 |  |  |  |  |  |  |  |  |  |  |  |
| Chaetomium sp. #2 | 21 | 1 |  |  |  |  |  | 1 |  |  |  | 1 |  |  |  |  |  |  |
|  | 21 | 2 |  |  | 1 | 1 | 1 | 1 | 1 | 1 | 1 |  |  |  |  |  |  |  |
|  | 21 | 3 |  |  |  |  |  |  |  |  |  | 2 |  | 1 |  |  |  |  |
|  | 21 | 4 |  | 2 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Podospora coronifera | 21 | 2 |  | 343 | 556 | 632 | 771 | 803 | 787 | 768 | 749 | 727 | 663 | 634 | 182 | 12 | 1 |  |
|  | 21 | 3 |  |  | 276 | 389 | 501 | 519 | 462 | 376 | 295 | 223 | 138 | 38 | 9 | 3 | 1 |  |
|  | 21 | 4 |  |  | 17 | 55 | 128 | 12 |  |  |  |  |  |  |  |  |  |  |
|  | 21 | 5 |  |  | 11 | 14 | 18 | 37 | 39 | 26 | 13 | 9 |  |  |  |  |  |  |
|  | 21 | 6 |  | 33 | 38 | 36 | 40 | 30 | 31 | 27 | 25 | 25 | 28 | 27 | 27 | 26 | 26 | 25 |
| Tripterospora sp. #1 | 26 | 7b |  | 44 | 43 | 47 | 35 | 25 | 23 | 20 | 15 | 11 | 9 | 8 | 5 |  |  |  |

TABLE 5--Continued

| Species | Temp ° C. | Culture | Number of Weeks From Start of Incubation |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
|  |  |  | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 |
| Coprinus spp. | 21 | 1 |  |  | 3 | 7 |  |  | 2 | 1 | 1 | 1 |  |  |  |  |  |  |
|  | 21 | 2 |  | 4 |  | 2 | 1 | 2 |  |  |  |  | 1 | 6 |  | 1 |  | 1 |
|  | 21 | 3 |  |  |  | 2 | 6 | 5 | 2 | 1 | 1 |  |  |  |  |  |  |  |
|  | 21 | 4 |  |  | 9 | 9 | 7 | 1 |  |  |  |  |  | 1 |  |  | 2 |  |
|  | 21 | 5 |  |  |  |  |  |  | 2 | 3 | 3 | 3 |  |  |  |  |  |  |
|  | 21 | 6 |  |  | 9 | 8 | 3 | 2 | 1 |  | 1 |  |  |  |  |  |  |  |
|  | 21 | 8a |  |  |  |  |  |  |  |  |  |  |  | 1 |  |  |  |  |
|  | 21 | 10a |  | 1 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  | 16 | 10b |  |  |  |  |  |  | 2 | 2 |  |  |  |  |  |  |  |  |
| Podospora decipiens | 21 | 3 |  |  |  | 8 |  |  |  |  |  |  |  |  |  |  |  |  |
|  | 21 | 4 |  |  |  | 2 | 1 |  |  |  |  |  |  |  |  |  |  |  |
|  | 21 | 6 |  | 2 | 4 | 6 | 6 | 1 | 1 | 1 | 1 |  |  |  |  |  |  |  |
|  | 21 | 7a |  |  | 24 | 27 | 29 | 26 | 26 | 20 | 23 | 11 | 7 |  |  |  |  |  |
|  | 26 | 7b |  | 2 | 6 | 6 | 7 | 2 | 3 |  |  |  |  |  |  |  |  |  |
|  | 21 | 8a |  |  |  | 1 | 1 | 2 | 2 |  |  |  |  |  |  |  |  |  |
|  | 21 | 9a |  |  | 17 | 35 | 44 | 35 | 23 | 19 | 1 |  |  |  |  |  |  |  |
|  | 16 | 9b |  |  |  |  | 5 | 12 | 18 | 22 | 23 | 15 | 19 | 15 | 14 | 13 | 12 | 12 |
|  | 21 | 10a |  |  | 4 | 3 | 3 | 3 | 3 |  |  |  |  |  |  |  |  |  |
|  | 16 | 10b |  |  |  |  |  |  |  | 3 | 1 |  |  |  |  |  |  |  |
| Saccobolus kerverni | 21 | 2 |  | 1 | 2 |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  | 26 | 7b |  |  |  | 1 | 4 | 2 | 7 |  | 1 |  |  |  |  |  |  |  |
|  | 21 | 8a |  | 144 | 171 | 157 | 128 | 105 | 100 | 66 | 55 | 54 | 53 |  |  |  |  |  |
|  | 26 | 8b |  | 72 | 55 | 40 | 47 | 22 | 24 | 15 | 10 | 6 | 3 |  |  |  |  |  |
|  | 21 | 9a |  |  |  |  |  |  | 1 | 1 |  |  |  |  |  |  |  |  |
|  | 21 | 10a |  | 6 | 4 |  |  |  | 3 | 1 |  |  |  |  |  |  |  |  |
|  | 16 | 10b |  |  | 1 | 1 | 1 |  |  |  | 1 |  |  |  |  |  |  |  |

TABLE 5--Continued

| Species | Temp ° C. | Cul-ture | Number of Weeks From Start of Incubation | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 |
| Podospora curvula | 21 | 2 | | | 3 | 4 | 6 | 10 | 7 | 7 | 7 | 8 | 7 | 5 | | | | |
| | 21 | 3 | | | | 13 | 15 | 8 | 6 | 4 | 4 | | | | | | | |
| | 21 | 4 | | | | 9 | 13 | | | | | | | | | | | |
| | 21 | 5 | | | 4 | 25 | 32 | 43 | 37 | 19 | 8 | 1 | | | | | | |
| | 21 | 6 | | | | 1 | 1 | 47 | 60 | 50 | 44 | 41 | 41 | 43 | 39 | 37 | 32 | 30 |
| | 21 | 7a | | 8 | 12 | 27 | 64 | 87 | 95 | 113 | 131 | 123 | 106 | 80 | 61 | 57 | 50 | 43 |
| | 26 | 7b | | | 8 | 1 | 6 | 2 | 4 | 9 | 3 | | | | | | | |
| | 21 | 8a | | | | 10 | 7 | 10 | 3 | 3 | 1 | | | | | | | |
| | 21 | 9a | | | | 2 | 6 | 17 | 17 | 21 | 22 | 23 | 17 | 19 | 18 | 13 | | |
| | 16 | 9b | | | | | | | 13 | 9 | 32 | 33 | 40 | 39 | 38 | 38 | 40 | 40 |
| Saccobolus intermedius | 21 | 6 | | | | | | | | 10 | 9 | 3 | 4 | | | | | |
| | 21 | 10a | | 16 | 12 | 10 | 14 | 13 | 1 | 5 | 2 | | | | | | | |
| Coprinus parvisporus | 21 | 3 | | | 2 | | | | | | | | | | | | | |
| | 21 | 10a | | | | | | | | | 2 | 1 | | | | | | |
| Sporormia minima | 21 | 3 | | | | | 5 | 1 | | | | 1 | | | | | | |
| | 21 | 6 | | | | | | 2 | 2 | | | | | | | | | |
| | 21 | 7a | | | 6 | 5 | | | | | | | | | | | | |
| | 21 | 9a | | | 9 | | | | | | | | | | | | | |
| Coprinus sp. #2 | 21 | 10a | | | 28 | 19 | 12 | 20 | 10 | 6 | | | | | | | | |
| Ascophanus ochraceous | 21 | 7a | | | | | 36 | 16 | 19 | 32 | 63 | 84 | 79 | 97 | 102 | 99 | 97 | 97 |
| | 21 | 9a | | | | | | | | | 2 | | | | | | 4 | 4 |
| | 16 | 9b | | | | | | 73 | 218 | 363 | 371 | 312 | 296 | 262 | 243 | 229 | 232 | 220 |
| | 21 | 10a | | | | | | 1 | 1 | 1 | | 1 | | | | | 2 | |
| | 16 | 10b | | | | 8 | 13 | 20 | 20 | 28 | 16 | 15 | 9 | 5 | 5 | 6 | 5 | |

TABLE 5--Continued

| Species | Temp ° C. | Culture | Number of Weeks From Start of Incubation | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 |
| Podospora vestita | 21 | 7a | | | | | | 4 | 10 | 25 | 28 | 37 | 80 | 101 | 129 | 143 | 192 | 186 |
| | 21 | 8a | | | | | | | 2 | 5 | 20 | 29 | 52 | 53 | 57 | 50 | 49 | 35 |
| | 26 | 8b | | | | 18 | 39 | 121 | 145 | 134 | 136 | 119 | 127 | 146 | 128 | 125 | 124 | 120 |
| | 21 | 9a | | | | 13 | 13 | 15 | 15 | 27 | 28 | 23 | 32 | 35 | 42 | 42 | 44 | 43 |
| | 16 | 9b | | | | | | | | | | | | | 3 | 4 | 19 | 19 |
| | 21 | 10a | | | | | | | | | | | | | 4 | 6 | 4 | 3 |
| Saccobolus neglectans | 21 | 7a | | | | 19 | 14 | 40 | 32 | 30 | 26 | 17 | 13 | 9 | 12 | 7 | | |
| | 26 | 7b | | | | 5 | 9 | 17 | 23 | 16 | 12 | 11 | 10 | 6 | | | | |
| Podospora piriformis | 21 | 1 | | | | | | | | | 1 | 2 | | | | | | |
| | 21 | 2 | | | | | | | | | | | | 1 | | | | |
| | 21 | 3 | | | | 5 | 16 | 10 | 20 | 9 | 6 | 6 | 6 | 9 | 4 | 3 | 3 | 1 |
| | 21 | 4 | | | | | | | | | | | | | | 4 | 21 | 25 |
| | 21 | 5 | | | | | | 1 | 4 | 8 | 8 | 13 | 1 | 2 | 1 | | | |
| | 21 | 6 | | | | | | | | | | | | | 3 | 2 | 2 | 2 |
| | 21 | 7a | | | | | | | | | | | 2 | 1 | | 1 | 2 | 1 |
| | 26 | 7b | | | | | | | | | | | | | 1 | | | |
| | 21 | 9a | | | | | | | | | 1 | 1 | 1 | 1 | | 1 | 2 | 8 |
| | 16 | 9b | | | | | | | | | | | | | | 2 | 8 | 8 |
| | 21 | 10a | | | | | | 13 | 67 | 114 | 153 | 162 | 148 | 144 | 143 | 123 | 118 | 112 |
| | 16 | 10b | | | | | | | | 8 | 10 | 10 | 15 | 32 | 61 | 80 | 92 | 88 |
| Sporormia intermedia | 21 | 2 | | | | | | | | | | | | 7 | | | | |
| | 21 | 3 | | | | 4 | 2 | 13 | 12 | 11 | 16 | 2 | 1 | | | | | 2 |
| | 21 | 4 | | | | | | 4 | | | | | | | | | | |
| | 21 | 5 | | | | 2 | | | | | | | | | | | | |
| | 21 | 6 | | | | | 3 | | | 1 | | | | | | | | |

TABLE 5--Continued

| Species | Temp ° C. | Cul- ture | Number of Weeks From Start of Incubation | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 |
| Ascophanus granuliformis | 21 | 1 | | | | | | 1 | | | | | | | | | | |
| | 21 | 2 | | | | | | | 2 | | | | 10 | 10 | | | | |
| | 21 | 4 | | | | | 8 | 6 | | | | | | | | | | |
| | 21 | 6 | | | | 29 | 28 | 23 | 24 | 15 | 15 | 12 | | | | | | |
| | 21 | 9a | | | | | | | | | | | | 1 | | | | |
| | 16 | 9b | | | | | | 2 | | | | | | | | | | |
| | 21 | 10a | | | | | 7 | 45 | 29 | 28 | 20 | 17 | 17 | 18 | 14 | 14 | 12 | 9 |
| | 16 | 10b | | | | | 58 | 80 | 109 | 64 | 45 | 42 | 31 | 20 | 14 | 14 | 14 | 14 |
| Ascophanus argenteus | 21 | 2 | | | | | | 4 | | | | | | | | | | |
| | 21 | 4 | | | | 3 | | | | | | | | | | | | |
| | 21 | 6 | | | | | | 23 | | | | | | | | | | |
| Sporormia vexans | 21 | 5 | | | | | 1 | 4 | | | | | | | | | | |
| Podospora sp. #1 | 21 | 3 | | | | | | | | | | 18 | 38 | 43 | 21 | 12 | 7 | 4 |
| | 21 | 6 | | | | | | 23 | 56 | 68 | 68 | 65 | 65 | 58 | 53 | 51 | 49 | 46 |
| Sporormia kansensis | 21 | 5 | | | | | | 4 | | | | | | | | | | |
| Peziza granulata | 16 | 10b | | | | | | 1 | 1 | 1 | | | | | | | | |
| Podospora pilosa | 21 | 6 | | | | | | | 1 | | | | | | | | | |
| Podospora sp. #2 | 21 | 2 | | | | | | | | | | | | 1 | | | | |
| | 21 | 5 | | | | | | | 13 | 17 | 29 | 24 | 2 | | | | | |

TABLE 5--Continued

| Species | Temp ° C. | Culture | Number of Weeks From Start of Incubation | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 |
| Sporormia megalospora | 21 | 5 | | | | | | 5 | | | | | | | | | | |
| Ascophanus brunneus | 16 | 10b | | | | | | | | | 2 | 2 | 2 | 2 | 3 | 3 | 2 | 2 |
| Saccobolus depaupertus | 21 | 10a | | | | | | | | | | 1 | 1 | | | | | |
| Bombardia caerulea | 21 | 2 | | | | | | | | | | 30 | 42 | 44 | 21 | | | |
| | 21 | 8a | | | | | | | | | | | | | | | | 1 |
| Coprinus hexagonosporus | 16 | 9b | | | | | | | | | | | | 1 | | | | |
| | 16 | 10b | | | | | | | | | | | | | | 1 | 1 | |
| Podospora sp. #3 | 21 | 2 | | | | | | | | | | | | 4 | | | | |
| | 21 | 6 | | | | | | | | | | | | 12 | 10 | 10 | 9 | 9 |
| Sporormia australis | 21 | 7a | | | | | | | | | | | | | 17 | 17 | 17 | 17 |
| Coprinus cordisporus | 16 | 10b | | | | | | | | | | | | | 1 | | | |
| Chaetomium sp. #1 | 16 | 10b | | | | | | | | | | | | | | | 4 | 4 |
| Ascophanus sp. #1 | 16 | 9b | | | | | | | | | | | | | | | 3 | 3 |
| Sporormia pascua | 21 | 6 | | | | | | | | | | | | | | 1 | | |

## TABLE 6

## THE AVERAGE PERCENTAGE FREQUENCIES AS DETERMINED WEEKLY OF THE SPECIES FRUITING ON THE TEN CULTURES INCUBATED AT 21° C.

| Species | Number of Weeks From the Start of Incubation | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 |
| *Ascobolus furfuraceous | 13.0 | 13.6 | 12.0 | 9.6 | 7.0 | 5.2 | 4.0 | 3.6 | 2.8 | 2.8 | 2.8 | 2.6 | 2.4 | 1.8 | 1.4 | 1.2 |
| *Ascobolus immersus | 34.4 | 29.6 | 21.8 | 16.0 | 12.4 | 7.6 | 4.2 | 2.4 | 1.6 | 1.2 | T | | | | | |
| *Ascophanus holmskjoldii | 3.0 | 10.8 | 11.4 | 11.4 | 10.4 | 11.6 | 10.6 | 8.6 | 8.6 | 9.0 | 8.4 | 8.2 | 8.0 | 8.0 | 8.0 | 8.0 |
| Coprinus pellucidus | T | | 1.2 | | | | | | | | | | | | | |
| *Chaetomium globosum | T | 3.2 | 4.8 | 4.4 | 4.6 | 3.6 | 3.6 | 2.8 | 2.8 | 2.6 | 2.2 | 2.2 | 2.0 | 2.0 | 2.0 | 2.0 |
| Sordaria fimicola | 1.2 | 1.6 | 1.6 | 1.2 | T | T | T | | | | | | | | | |
| Sordaria humana | 1.6 | 2.8 | 2.0 | 2.0 | 2.0 | 1.2 | 1.2 | 1.2 | T | | | | | | | |
| Chaetomium sp. #2 | | T | T | T | T | T | T | T | T | T | | T | | | | |
| Coprinus spp. | | 1.0 | 1.6 | 2.8 | 2.2 | 1.2 | 1.2 | T | 1.2 | T | T | 1.2 | | T | T | T |
| *Podospora coronifera | | 8.4 | 16.4 | 22.0 | 24.6 | 24.6 | 23.8 | 23.4 | 20.6 | 18.8 | 17.4 | 14.8 | 8.8 | 4.2 | 2.8 | 2.4 |
| *Podospora decipiens | | T | 3.2 | 5.2 | 4.4 | 3.2 | 3.4 | 2.2 | 2.4 | 1.2 | T | | | | | |
| *Saccobolus kerverni | | 2.4 | 2.8 | 2.0 | 2.2 | 2.2 | 1.8 | 1.4 | T | T | T | | | | | |
| *Podospora curvula | | T | 1.4 | 7.6 | 9.6 | 12.2 | 11.8 | 11.2 | 9.6 | 8.2 | 7.2 | 6.4 | 4.6 | 4.2 | 2.8 | 2.6 |

TABLE 6--Continued

| Species | Number of Weeks From the Start of Incubation | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 |
| Saccobolus intermedius | | T | T | T | T | T | T | T | 1.0 | T | T | | | | | |
| Coprinus sp. #2 | | | 3.0 | 2.6 | 2.0 | 3.0 | 1.6 | 1.0 | | | | | | | | |
| Sporormia minima | | | T | T | T | T | T | | | | T | | | | | |
| Coprinus parvisporus | | | T | | | | | | T | T | | | | | | |
| *Podospora piriformis | | | | T | 2.2 | 4.4 | 6.0 | 7.2 | 8.0 | 8.0 | 6.4 | 7.6 | 6.4 | 6.8 | 7.0 | 6.4 |
| Sporormia intermedia | | | | T | T | T | T | T | T | T | T | T | | | | T |
| *Ascophanus granuliformis | | | | 1.2 | 1.2 | 1.2 | 1.0 | 1.0 | T | T | T | 1.0 | T | T | T | T |
| Saccobolus neglectans | | | | 1.4 | 1.0 | 2.0 | 1.6 | 1.6 | 1.6 | 1.2 | 1.0 | T | T | T | | |
| *Podospora vestita | | | | T | T | T | 1.4 | 2.2 | 2.8 | 3.6 | 5.2 | 5.8 | 7.4 | 6.8 | 8.0 | 8.0 |
| *Ascophanus argenteus | | | | T | | T | | | | | | | | | | |
| Ascophanus ochraceous | | | | | 1.8 | 1.4 | 1.2 | 1.4 | 1.8 | 1.2 | 1.0 | 1.2 | 1.4 | 1.4 | 1.8 | 1.4 |
| Sporormia vexans | | | | | T | T | | | | | | | | | | |
| *Podospora sp. #1 | | | | | | 1.2 | 2.0 | 2.2 | 2.2 | 3.0 | 3.2 | 3.4 | 3.0 | 2.8 | 2.4 | 2.0 |
| Sporormia kansensis | | | | | | T | | | | | | | | | | |

TABLE 6--Continued

| Species | Number of Weeks From the Start of Incubation | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 |
| Podospora pilosa | | | | | | | T | | | | | | | | | |
| Podospora sp. #2 | | | | | | | T | 1.2 | 1.6 | 1.4 | T | T | | | | |
| Sporormia megalospora | | | | | | | | T | | | | | | | | |
| Bombardia caerulea | | | | | | | | | | T | 1.6 | 1.4 | T | | | T |
| Saccobolus depauperatus | | | | | | | | | | T | T | | | | | |
| Podospora sp. #3 | | | | | | | | | | | | T | T | T | T | T |
| Sporormia australis | | | | | | | | | | | | | T | T | T | T |
| Sporormia pascua | | | | | | | | | | | | | | T | | |

* Major Species

## TABLE 7

### THE AVERAGE ABSOLUTE DENSITY AS DETERMINED WEEKLY OF THE SPECIES FRUITING ON THE TEN CULTURES INCUBATED AT 21° C.

| Species | Number of Weeks from the Start of Incubation | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 |
| *Ascobolus furfuraceous | 15.8 | 19.7 | 11.5 | 7.9 | 5.7 | 4.5 | 3.5 | 3.1 | 2.5 | 2.4 | 2.4 | 2.2 | 2.1 | 1.7 | 1.2 | 1.0 |
| *Ascobolus immersus | 100.2 | 68.6 | 47.4 | 36.5 | 28.5 | 10.7 | 4.7 | 2.6 | 1.6 | 1.2 | T* | | | | | |
| *Ascophanus holmskjoldii | 14.0 | 41.8 | 40.7 | 37.8 | 32.5 | 28.9 | 25.4 | 23.0 | 22.7 | 21.8 | 21.1 | 20.5 | 19.3 | 18.6 | 17.2 | 17.3 |
| Coprinus pellucidus | T | | T | | | | | | | | | | | | | |
| *Chaetomium globosum | 3.8 | 19.7 | 28.7 | 31.2 | 29.5 | 29.1 | 27.2 | 23.5 | 22.4 | 21.1 | 20.1 | 19.7 | 19.7 | 19.7 | 19.7 | 19.7 |
| Sordaria fimicola | 5.6 | 6.0 | 6.0 | 5.5 | 3.8 | 2.4 | | | | | | | | | | |
| Sordaria humana | 1.0 | 3.0 | 2.2 | 2.1 | 1.6 | T | T | T | T | | | | | | | |
| Chaetomium sp. #2 | | T | T | T | T | T | T | T | T | T | | T | | | | |
| Coprinus spp. | | T | 2.1 | 2.8 | 1.7 | 1.0 | T | T | T | T | T | T | | T | T | T |
| *Podospora coronifera | | 37.6 | 89.8 | 112.6 | 145.8 | 140.1 | 131.9 | 119.7 | 108.2 | 98.4 | 82.0 | 60.0 | 21.8 | 4.1 | 2.8 | 2.5 |
| *Podospora decipiens | | T | 4.9 | 8.2 | 8.3 | 6.7 | 5.5 | 4.0 | 2.5 | 1.1 | T | | | | | |
| *Saccobolus kerverni | | 15.1 | 17.7 | 15.7 | 12.8 | 10.5 | 10.4 | 6.8 | 5.5 | 5.4 | 5.3 | | | | | |

TABLE 7--Continued

| Species | Number of Weeks from the Start of Incubation | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 |
| *Podospora curvula | | T | 1.9 | 8.2 | 14.0 | 23.5 | 22.5 | 21.7 | 21.7 | 19.6 | 17.1 | 14.7 | 11.8 | 10.7 | 8.2 | 7.3 |
| Saccobolus intermedius | | 1.6 | 1.2 | 1.0 | 1.4 | 1.3 | T | 1.5 | 1.1 | T | T | | | | | |
| Coprinus sp. #2 | | | 2.8 | 1.9 | 1.2 | 2.0 | 1.0 | T | | | | | | | | |
| Sporormia minima | | | 1.5 | T | T | T | T | | | T | | | | | | |
| Coprinus parvisporus | | | T | | | | | | T | T | | | | | | |
| *Podospora piriformis | | | | T | 1.6 | 2.4 | 9.1 | 13.1 | 16.9 | 18.4 | 15.8 | 15.8 | 15.1 | 13.4 | 14.8 | 14.9 |
| Sporormia intermedia | | | | T | T | 1.7 | 1.2 | 1.2 | 1.6 | T | T | T | | | | |
| Ascophanus granuliformis | | | | 2.9 | 4.3 | 7.5 | 5.5 | 4.3 | 3.5 | 2.9 | 2.7 | 1.4 | 1.4 | 1.4 | 1.2 | T |
| Saccobolus neglectans | | | | 1.9 | 1.4 | 4.0 | 2.1 | 2.0 | 2.6 | 1.7 | 1.3 | T | 1.2 | T | | |
| *Podospora vestita | | | | 1.2 | 1.3 | 1.9 | 2.7 | 5.7 | 7.6 | 8.9 | 16.4 | 18.9 | 23.2 | 24.1 | 28.9 | 26.7 |
| Ascophanus argenteus | | | | T | | 2.7 | | | | | | | | | | |
| *Ascophanus ochraceous | | | | | 3.6 | 1.7 | 2.0 | 3.3 | 6.5 | 8.5 | 7.9 | 9.7 | 10.2 | 9.9 | 10.3 | 10.1 |
| Sporormia vexans | | | | | T | T | | | | | | | | | | |
| *Podospora sp. #1 | | | | | | 2.3 | 5.6 | 6.8 | 6.8 | 8.3 | 10.3 | 10.1 | 7.4 | 6.3 | 5.6 | 5.0 |

TABLE 7--Continued

| Species | Number of Weeks from the Start of Incubation | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 |
| Sporormia kansensis | | | | | | T | | | | | | | | | | |
| Podospora pilosa | | | | | | | T | | | | | | | | | |
| Podospora sp. #2 | | | | | | | 1.3 | 1.7 | 2.9 | 2.4 | T | T | | | | |
| Sporormia megalospora | | | | | | | | T | | | | | | | | |
| Bombardia caerulea | | | | | | | | | | 3.0 | 4.2 | 4.4 | 2.1 | | | T |
| Saccobolus depauperatus | | | | | | | | | | T | T | | | | | |
| Podospora sp. #3 | | | | | | | | | | | | 1.6 | 1.0 | 1.0 | T | T |
| Sporormia australis | | | | | | | | | | | | | 1.7 | 1.7 | 1.7 | 1.7 |
| Sporormia pascua | | | | | | | | | | | | | | T | | |

*Major Species

T* - An average of less than 1.0 fruiting bodies per culture (Trace)

## TABLE 8

### THE AVERAGE RELATIVE DENSITY AS DETERMINED WEEKLY OF THE SPECIES FRUITING ON THE TEN CULTURES INCUBATED AT 21° C.

| Species | Number of Weeks From the Start of Incubation | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 |
| *Ascobolus furfuraceous | 11.2 | 9.1 | 4.4 | 2.8 | 1.9 | 1.6 | 1.3 | 1.3 | 1.0 | 1.1 | 1.1 | 1.1 | 1.5 | 1.5 | 1.1 | T |
| *Ascobolus immersus | 71.3 | 31.9 | 18.3 | 13.1 | 9.5 | 3.7 | 1.8 | 1.1 | T | T | T | | | | | |
| *Ascophanus holmskjoldii | 10.0 | 19.4 | 15.7 | 13.5 | 10.8 | 10.0 | 9.5 | 9.3 | 9.5 | 9.6 | 10.1 | 10.6 | 14.0 | 16.4 | 15.3 | 16.0 |
| Coprinus pellucidus | T | | T | | | | | | | | | | | | | |
| *Chaetomium globosum | 2.7 | 9.1 | 11.1 | 11.2 | 9.8 | 10.1 | 10.2 | 9.5 | 9.4 | 9.3 | 9.5 | 10.4 | 14.3 | 17.4 | 17.5 | 18.2 |
| Sordaria fimicola | 4.0 | 2.8 | 2.3 | 2.0 | 1.3 | 1.3 | T | | | | | | | | | |
| Soradaria humana | T | 1.4 | T | T | T | T | T | T | T | | | | | | | |
| Chaetomium sp. #2 | | T | T | T | T | T | T | T | T | T | | T | | | | |
| Coprinus spp. | | T | T | 1.0 | T | T | T | T | T | T | T | T | | T | T | T |
| *Podospora coronifera | | 17.5 | 34.7 | 40.3 | 38.6 | 48.6 | 49.3 | 48.4 | 45.4 | 43.4 | 39.5 | 36.0 | 15.8 | 3.6 | 2.5 | 2.3 |
| *Podospora decipiens | | T | 1.9 | 2.9 | 2.8 | 2.3 | 2.1 | 1.6 | 1.0 | T | T | | | | | |
| *Saccobolus kerverni | | 7.0 | 6.8 | 5.6 | 4.3 | 3.6 | 3.9 | 2.7 | 2.3 | 2.4 | 2.5 | | | | | |
| *Podospora curvula | | T | T | 2.9 | 4.6 | 8.1 | 8.4 | 8.8 | 9.1 | 8.6 | 8.1 | 7.6 | 8.6 | 9.4 | 7.3 | 6.7 |

TABLE 8--Continued

| Species | Number of Weeks From the Start of Incubation | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 |
| Saccobolus intermedius | | T | T | T | T | T | T | T | T | T | T | | | | | |
| Coprinus sp. #2 | | | 1.1 | T | T | T | T | T | | | | | | | | |
| Sporormia minima | | | T | T | T | T | T | | | T | | | | | | |
| Coprinus parvisporus | | | T | | | | | | T | T | | | | | | |
| *Podospora piriformis | | | | T | T | T | 3.4 | 5.3 | 7.1 | 8.1 | 7.5 | 8.4 | 10.9 | 11.8 | 13.1 | 13.7 |
| Sporormia intermedia | | | | T | T | T | T | T | T | T | T | T | | | | T |
| *Ascophanus granuliformis | | | | 1.0 | 1.4 | 2.6 | 2.1 | 1.7 | 1.5 | 1.3 | 1.3 | 1.5 | 1.0 | 1.2 | 1.1 | T |
| Saccobolus neglectans | | | | T | T | 1.4 | 1.2 | 1.2 | 1.1 | T | T | T | T | T | | |
| *Podospora vestita | | | | T | T | T | 1.0 | 2.3 | 3.2 | 2.9 | 7.8 | 9.7 | 16.8 | 21.2 | 25.6 | 24.6 |
| Ascophanus argenteus | | | | T | | T | | | | | | | | | | |
| *Ascophanus ochraceous | | | | | 1.2 | T | T | 1.3 | 2.7 | 3.8 | 3.8 | 5.3 | 7.4 | 8.7 | 9.1 | 9.3 |
| Sporormia vexans | | | | | T | T | | | | | | | | | | |
| *Podospora sp. #1 | | | | | | T | 2.1 | 2.7 | 2.9 | 3.7 | 4.9 | 5.2 | 5.4 | 5.6 | 5.0 | 4.6 |
| Sporormia kansensis | | | | | | T | | | | | | | | | | |
| Podospora pilosa | | | | | | | T | | | | | | | | | |

TABLE 8--Continued

| Species | Number of Weeks From the Start of Incubation | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 |
| Podospora sp. #2 | | | | | | | T | T | 1.2 | 1.1 | T | T | | | | |
| Sporormia megalospora | | | | | | | | T | | | | | | | | |
| Bombardia caerulea | | | | | | | | | | 1.3 | 2.0 | 2.3 | 1.5 | | | T |
| Saccobolus depauperatus | | | | | | | | | | T | T | | | | | |
| Podospora sp. #3 | | | | | | | | | | | | T | T | T | T | T |
| Sporormia australis | | | | | | | | | | | | | 1.2 | 1.5 | 1.5 | 1.6 |
| Sporormia pascua | | | | | | | | | | | | | | T | | |

* Major Species

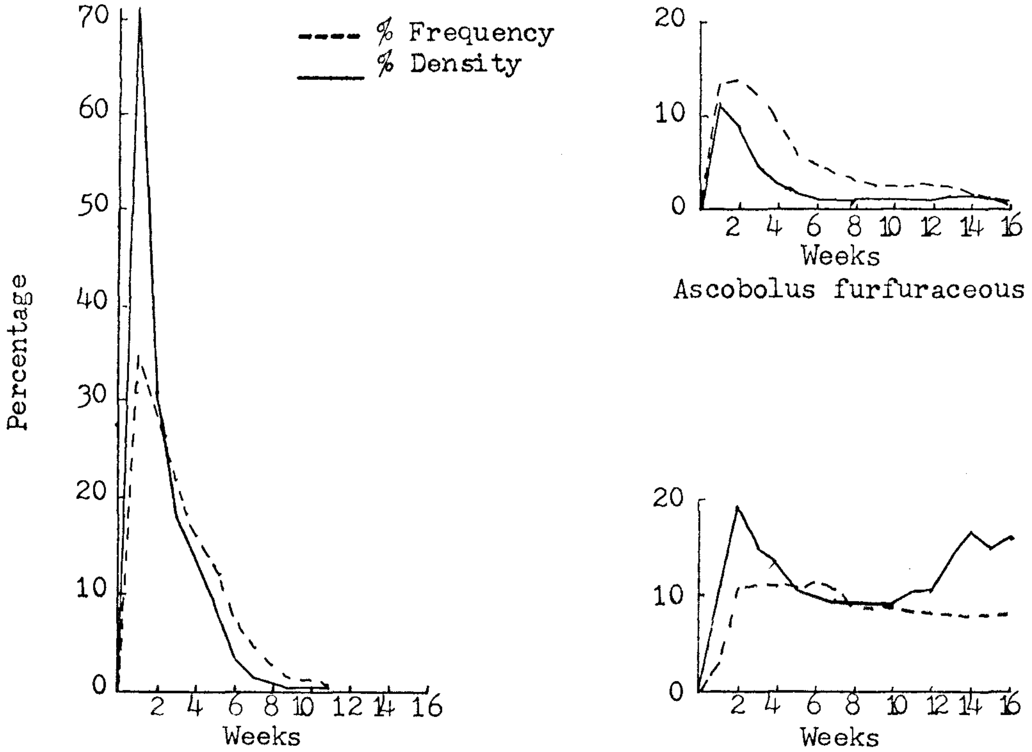
are rare species. In Figure 2 the percentage frequency and relative density of the major species are presented in line graphs. By comparing the peak values of the percentage frequency and relative density of each major species with those of the other major species, it is possible to arrange the species into three successional communities. The period of each community on the cultures is based on the duration of the dominance of the dominant species of the communities.

## The Early Community

The period of the early community extended from the start of incubation to the second week. This community was characterized by the presence of three discomycete species, *Ascobolus immersus*, *Ascobolus furfuraceous*, and *Ascophanus holmskjoldii*. These three species were the only major species to reach a peak in their absolute density, relative density and percent frequency during this period (Fig. 2 and Tables 6-8).

On the basis of its frequency and density *Ascobolus immersus* was the dominant species of this community (Fig. 2 and Tables 6-8). This species averaged per culture a maximum absolute density of 100.2 ascocarps, a maximum relative density of 71.3% and a maximum percent frequency of 34.4% during this period of this community (Tables 6-8). Of all the species fruiting on cultures 1-6 and 7a-10a, *A. immersus* reached the highest relative density and percentage frequency and was second only in absolute density to *Podospora coronifera* which averaged 145.8 ascocarps per culture at its maximum absolute density (Table 4). In both percentage frequency and relative density *A. immersus* had values at least two and one-half times greater than either of the

Major Species of the Early Community

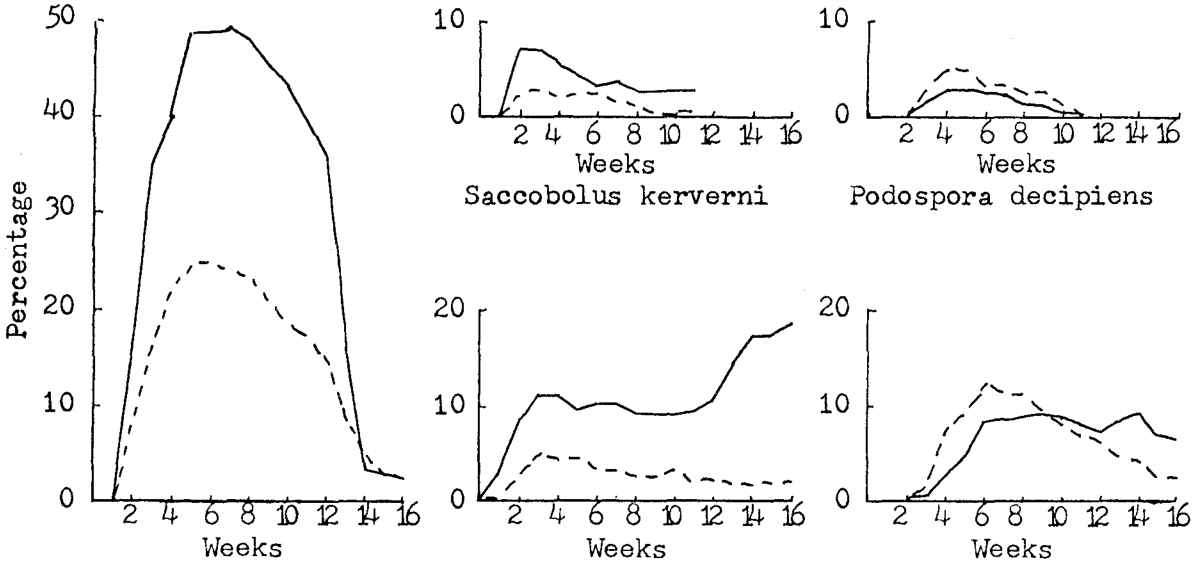


Ascobolus furfuraceous

Ascobolus immersus

Ascophanus holmskjoldii

Major Species of the Intermediate Community



Saccobolus kerverni

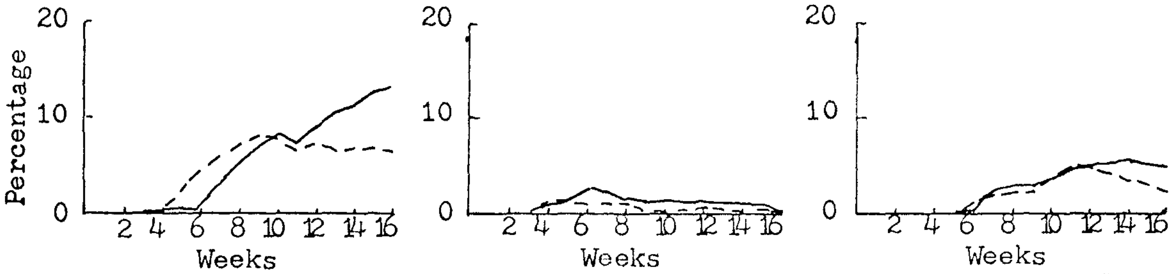
Podospora decipiens

Podospora coronifera

Chaetomium globosum

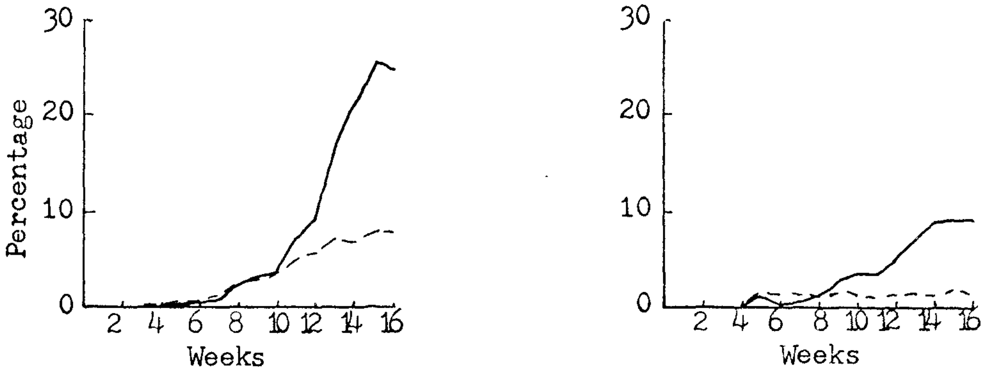
Podospora curvula

Fig. 2--Comparison of the summarized relative density and percentage frequency values of major species fruiting at 21° C. on cultures 1-6 and 7a-10a.



Podospora piriformis Ascophanus granuliformis Podospora sp. #1

## Major Species of the Late Community



Podospora vestita Ascophanus ochraceous

Fig. 2--Continued

other two major species, Ascobolus furfuraceous and Ascophanus holmskjoldii, of this community (Tables 6 and 8). The relative sizes of these four species can be seen in Figure 3.

Both A. furfuraceous and A. holmskjoldii persisted on the cultures throughout the incubation period. A. holmskjoldii reached a second, though lower, peak in its relative density during the fourteenth week. This second rise in its relative density was due to the persistence of large numbers of ascocarps of A. holmskjoldii on culture 6 and by late fruiting on culture 10a (Table 5).

There were three minor species in the early community: Sordaria fimicola, Sordaria humana, and Saccobolus intermedius. These had constancy percentages on the cultures incubated at 21° C. of 20% or less as compared to 80% for Ascobolus immersus and 60% for both Ascobolus furfuraceous and Ascophanus holmskjoldii (Table 2).

Coprinus sp. #1 was the only rare species to fruit on cultures 1-6 and 7a-10a in the early community.

Five major species, which started to fruit during the period of the early community, reached their greatest absolute and relative densities and percentage frequencies during the period of the succeeding community (Table 6-8 and Fig. 2). These five species were Chaetomium globosum, Podospora coronifera, Podospora decipiens, Saccobolus kerverni, and Podospora curvula. During the second week of incubation the relative densities of P. coronifera and C. globosum were approximately equal to the relative densities of Ascophanus holmskjoldii and Ascobolus furfuraceous, respectively.

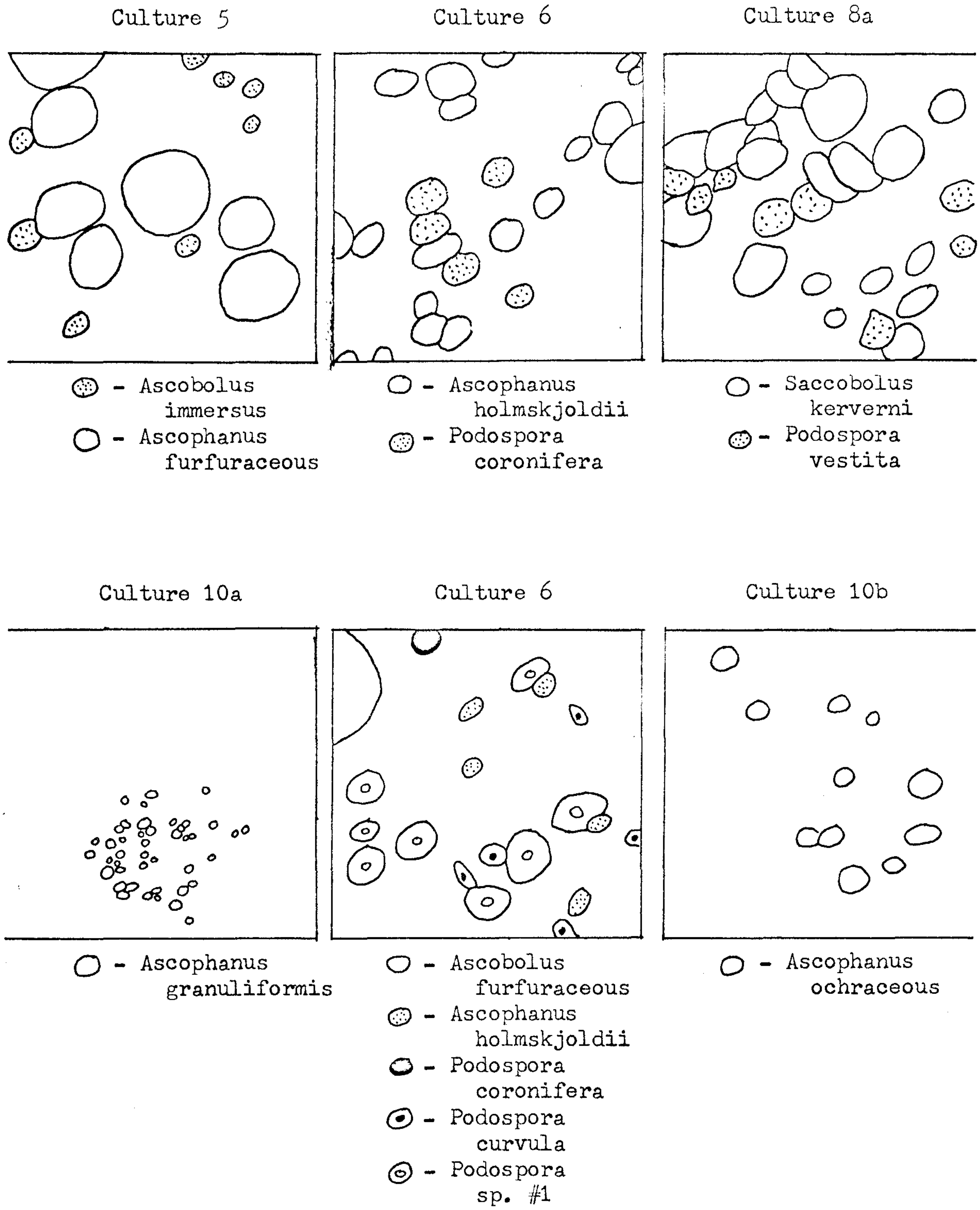


Fig. 3--Chart quadrats showing the relative size of the fruiting bodies of some of the major species fruiting on cultures 1-10b. The quadrats were 5 mm square. They are drawn here 50 mm square or 10X normal size.

## The Intermediate Community

The period of the intermediate community extended from the third to the twelfth week. This community was characterized principally by pyrenomycete species. Of the eight major species in this community, six (Podospora coronifera, Podospora decipiens, Podospora curvula, Chaetomium globosum, Podospora piriformis, and Podospora sp. #1) are Pyrenomycetes (fig. 2). The two remaining species, Saccobolus kerverni and Ascophanus granuliformis are Discomycetes (Fig. 2).

Podospora coronifera was the dominant species in this community (Fig. 2). Unlike Ascobolus immersus, the dominant species of the early community, P. coronifera persisted on the cultures and thus retained its dominance for a larger period of time. Its dominance diminished rapidly during the final four weeks of incubation, however (Fig. 2). This rapid decrease was caused principally by the fungus fly larvae which had disturbed 100% of the quadrats on cultures 1-5 by the fourteenth week of incubation (Table 4).

The next most important species of this community were Podospora curvula, Podospora piriformis and Chaetomium globosum. These three species had frequency peaks approximately one-half, one-third, and one-fifth, respectively, that of Podospora coronifera (Fig. 2). Although Chaetomium globosum and Podospora piriformis reached their maximum percentage density during the period of the late community (Fig. 2), they and P. curvula each reached their maximum absolute density on the cultures during the period of this community (Table 7). When compared at the time of their maximum absolute densities, P. coronifera had an absolute density that was approximately $4\frac{1}{2}$, 6 and 8 times the absolute densities of *C. globosum*, *P. curvula*, and *P. piriformis* respectively (Table 7). The relative sizes of most of these species can be seen in Figure 3.

Of the eight major species in this community, six fruited most abundantly during the first half (between the third and seventh week) of the period of this community. These six species were *Podospora coronifera*, *Podospora curvula*, *Chaetomium globosum*, *Podospora decipiens*, *Saccobolus kerverni* and *Ascophanus granuliformis*. The two major species which fruited most abundantly during the last half (between the seventh and the thirteenth week) of the period were *Podospora piriformis* and *Podospora* sp. #1. Seven of these major species had constancy percentages of 40% or greater: *P. piriformis* (90%), *P. curvula* (80%), *P. decipiens* (70%), *A. granuliformis* (60%), *P. coronifera* (50%), *S.* kerverni (40%), and C. globosum (40%) (Table 2). The remaining species *Podospora* sp. #1 had a constancy of 20%.

Sixteen minor species were in this community (Table 8). Four were basidiomycete (*Coprinus*) species, ten were pyrenomycete species and two were discomycete species. The basidiomycete species were *Coprinus* spp. (probably a mixture of immature coprinus species), *Coprinus parvisporus*, *Coprinus pellucidus*, and *Coprinus* sp. #2. The pyrenomycete species were *Sporormia minima*, *Sporormia neglectans*, *Sporormia vexans*, *Sporormia kansensis*, *Sporormia megalospora*, *Sporormia intermedia*, *Podospora* sp. #2, *Podospora* sp. #3, *Chaetomium* sp. #2 and *Bombardia caerulea*. The discomycete species were *Ascophanus argenteus* and *Saccobolus depauperatus*. Ten of these minor species fruited most abundantly during the first half of the period of the intermediate community. These ten species were *Coprinus* spp., *Coprinus* sp. #2 *C. parvisporus*, *C. pellucidus*, *S. minima*, *S. neglectans*, *S. vexans*, *S. kansensis*, *S. intermedia*, and *A. argenteus* (Table 7). The six remaining minor species fruited most abundantly during the last half of the period. These six species were *S. megalospora*, *Podospora* sp. #2 and #3, *Chaetomium* sp. #2, *B. caerulea* and *S. depauperatus* (Table 7).

Of these sixteen minor species, four species had constancy values over 20%: *Sporormia intermedia* (50%), *Sporormia minima* (40%) *Chaetomium* sp. (40%), and *Ascophanus argenteus* (30%) (Table 2). (Although *Coprinus* spp. had a constancy of 80% it was excluded from this list because it is probably a mixture of species.) The relatively high constancy values of these species indicate that they may have a relatively regular occurrence on the cow platters from Santaquin Canyon, although on each platter they may be represented by only a few fruiting bodies.

Twelve rare species fruited on the cultures incubated at 21° C. Ten of these species fruited during the period of the intermediate community. Of these ten species *Lasiobolus equinis*, *Coprinus fimetarius*, *Ascophanus microsporus*, *Ascophanus argenteus* var. *macrosporus*, *Chaetomium* sp. #1 and *Peziza granulata* fruited during the first half of this period. During the last half of the same period *Conocybe bulbifera*, *Coprinus stercorarius*, *Coprinus* sp. #3 and *Ascophanus carneus* fruited.

During this period the major species of the succeeding community, *Podospora vestita* and *Ascophanus ochraceous*, started to fruit on the cultures. The three major species of the early community also extended into the intermediate community. Although the relative density of *Ascobolus immersus* and *Ascobolus furfuraceous* decreased rapidly to reach a level of 1% at about the eighth week, the relative density of *Ascophanus holmskjoldii* only decreased to a level of 10% (Fig. 2). Thus *A. holmskjoldii*, on the basis of its relative density during the period of the intermediate community, should be considered with *Podospora piriformis*, *Chaetomium globosum*, and *Podospora curvula* as one of the important species of this community.

## The Late Community

The period of the late community extended from the thirteenth week to the end of the incubation period and as characterized by the dominance of *Podospora vestita* in absolute density, relative density, and percentage frequency (Tables 6-8). The maximum absolute density and relative density attained by *Ascophanus ochraceous*, the only other major species to reach its absolute density and percentage frequency peaks during this community, were approximately one-third of the maximum absolute density and relative density reached by *P. vestita* (Tables 6-8).

*Podospora vestita*, *Ascophanus ochraceous* and two minor species, *Sporormia australis* and *Sporormia pascua*, were the only species which reached their greatest abundance during the period of the late community (Table 7). Both of these minor species had a constancy of 10% as compared to 40% for *P. vestita* and 30% for *A. ochraceous* (Table 2). These four species at their peak relative densities only composed 38% of the ascomycete and basidiomycete vegetation of this community. The remainder of this vegetation was composed of the species persisting on the cultures from the early and intermediate communities. During the fourteenth week of incubation four of these species, Ascophanus holmskjoldii of the early community and Podospora piriformis, Chaetomium globosum, and Podospora curvula of the intermediate community each composed an equal or greater percentage of the ascomycete and basidiomycete vegetation of the late community than did Ascophanus ochraceous (Fig. 5 and Table 8).

Pleospora sp. #1 was the only rare species that fruited in the late community.

## Insect Disturbance

On the last page of Table 4 the percentage frequency of the quadrats disturbed by burrowing of the fungus fly larvae is presented. The larvae disturbance started as early as the second week of incubation and by the fourteenth week all the quadrats on cultures 1-5 were disturbed. Only culture 6 of the first experiment and the eight cultures of the second experiment received no insect disturbance.

## Effect of Incubation under Different Temperature

The purpose of part of this study was to investigate what effect incubation under different temperatures might have on the fruiting patterns of the coprophilous Ascomycetes and Basidiomycetes. The data in Table 9 show the general response in the number of fruiting bodies produced collectively by species fruiting on the cultures incubated at each of the three different temperatures, 26° C., 21° C., and 16° C. These data show that when presented collectively, the highest density reached by the species growing at 21° C. was two weeks

## TABLE 9

### AVERAGE NUMBER OF FRUITING BODIES PER CULTURE SETS INCUBATED AT 21° C., 26° C., AND 16° C.

| Culture Set | Temp. ° C. | Average Number * of Fruiting Bodies Per Culture Set Per Week | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 |
| 1-10a | 21 | 141 | 215 | 259 | 280 | 300 | 289 | 267 | 247 | 238 | 227 | 210 | 188 | 137 | 114 | 113 | 108 |
| 7b & 8b | 26 | 6 | 62 | 58 | 62 | 75 | 98 | 120 | 102 | 95 | 79 | 80 | 85 | 72 | 68 | 67 | 65 |
| 9b & 10b | 16 | 13 | 25 | 36 | 29 | 62 | 107 | 200 | 259 | 261 | 221 | 213 | 192 | 193 | 196 | 218 | 208 |

*The numbers are rounded off to the nearest whole integer.

earlier and 2.5 times greater than the highest density reached by the species growing at 26° C., and was four weeks earlier but only 1.2 times greater than the highest density reached by the species growing at 16° C.

The following lists, which are based on the data in Tables 2 and 10 show the responses of the individual species to incubation under the three different temperatures. These lists include only those species which fruited on the cultures of the second experiment.

The effect of incubation under different temperatures on the composition of the communities can be seen in Table 11. In this table the major species of each community are presented at each of the incubation temperatures, 21° C., 26° C., and 16° C. The species were assigned to the respective communities at 21° C. by the methods previously described. The species were assigned to the respective communities at 26° C. and 16° C. on the basis of when they reached their maximum average absolute density at each of these temperatures as listed in Table 10. At each temperature only those species with an

List 1

Species fruiting only at 26° C.

Tripterospora sp. #1
Chaetomium sp. #3
Coprinus sp. #4

List 2

Species fruiting only at 21° C.

Sordaria fimicola
Sordaria humana
Sporormia minima
Ascophanus holmskjoldii
Bombardia caerulea
Coprinus sp. #2
Coprinus parvisporus
Saccobolus depauperatus
Podospora pilosa
Ascophanus microsporus
Conocybe bulbifera

List 3

Species fruiting only at 16° C.

Ascobolus furfuraceous
var. coronatus
Ascophanus brunneus
Ascophanus sp. #1
Chaetomium sp. #1
Coprinus hexagonosporus
Chaetomium murorum
Preussia typharum
Coprinus sp. #5
Coprinus ephemerus
Ascophanus argenteus

List 4

Species which fruited earlier at 26° C. on cultures 7b and 8b than at 21° C. on cultures 7a and 8a.

Chaetomium globosum
Podospora decipiens
Podospora vestita

List 5

Species which fruited later at 26° on cultures 7b and 8b than at 21° C. on cultures 7a and 8a.

Podospora curvula
Podospora piriformis

List 6

Species which fruited earlier at 16° C. on cultures 9b and 10b than at 21° C. on cultures 9a and 10a.

Ascophanus ochraceous

List 7

Species which fruited later at 16° C. on cultures 9b and 10b than at 21° C. on cultures 9a and 10a.

Ascobolus immersus
Chaetomium globosum
Podospora curvula
Podospora decipiens
Podospora piriformis
Podospora vestita
Saccobolus kerverni

# TABLE 10

## A SUMMARY OF THE WEEKLY ABSOLUTE DENSITY OF THE SPECIES FRUITING ON THE CULTURES OF THE SECOND EXPERIMENT WHICH WERE INCUBATED UNDER DIFFERENT TEMPERATURES

| Species | Temp. °C. | Culture | Number of Weeks From Start of Incubation | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 |
| Sordaria | 21 | 7a & 8a | 10 | 30 | 22 | 21 | 16 | 9 | 9 | 7 | 6 | | | | | | | |
| humana | 26 | 7b & 8b | | | | | | | | | | | | | | | | |
| Sordaria | 21 | 7a & 8a | 56 | 60 | 60 | 55 | 38 | 38 | 24 | | | | | | | | | |
| fimicola | 26 | 7b & 8b | | | | | | | | | | | | | | | | |
| | 21 | 7a & 8a | | 56 | 83 | 86 | 68 | 59 | 45 | 25 | 27 | 26 | 19 | 20 | 21 | 21 | 21 | 21 |
| Chaetomium | 26 | 7b & 8b | 8 | 6 | 3 | 4 | 3 | 7 | 10 | 10 | 12 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| globosum | 21 | 9a & 10a | 38 | 141 | 204 | 226 | 227 | 232 | 227 | 210 | 197 | 185 | 181 | 181 | 176 | 176 | 176 | 176 |
| | 16 | 9b & 10b | | | | 5 | 10 | 4 | 4 | 4 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| Ascobolus | 21 | 9a & 10a | 169 | 134 | 81 | 43 | 23 | 12 | 9 | 3 | 2 | | | | | | | |
| immersus | 16 | 9b & 10b | | 12 | 34 | 12 | 12 | 11 | 8 | 8 | 7 | 6 | 5 | | | | | |
| Ascobolus | 21 | 9a & 10a | 56 | 64 | 33 | 20 | 15 | 13 | 5 | 3 | | | | | | | | |
| furfuraceous | 16 | 9b & 10b | 25 | 25 | 22 | 19 | 14 | 19 | 6 | 6 | 5 | 2 | | | | | | |
| | 21 | 7a & 8a | | 8 | 12 | 37 | 71 | 97 | 98 | 116 | 132 | 123 | 106 | 80 | 61 | 57 | 50 | 43 |
| Podospora | 26 | 7b & 8b | | | 8 | 1 | 6 | 2 | 4 | 9 | 3 | | | | | | | |
| curvula | 21 | 9a & 10a | | | | 2 | 6 | 17 | 17 | 21 | 22 | 23 | 17 | 19 | 18 | 13 | | |
| | 16 | 9b & 10b | | | | | | | 13 | 9 | 32 | 33 | 40 | 39 | 38 | 38 | 40 | 40 |
| | 21 | 7a & 8a | | 144 | 171 | 157 | 128 | 105 | 100 | 60 | 55 | 54 | 53 | | | | | |
| Saccobolus | 26 | 7b & 8b | | 72 | 55 | 42 | 51 | 24 | 31 | 15 | 11 | 6 | 3 | | | | | |
| kerverni | 21 | 9a & 10a | | 6 | 4 | | | | 4 | 1 | | | | | | | | |
| | 16 | 9b & 10b | | | 1 | 1 | 1 | | | | 1 | | | | | | | |
| Saccobolus | 21 | 9a & 10a | | 16 | 12 | 10 | 14 | 13 | 1 | 5 | 2 | | | | | | | |
| intermedius | 16 | 9b & 10b | | | | | | | | | | | | | | | | |
| | 21 | 7a & 8a | | | | | | | | | | | | 1 | | | | |
| Coprinus | 26 | 7b & 8b | | | | | | | | | | | | | | | | |
| spp. | 21 | 9a & 10a | | 1 | | | | | | | | | | | | | | |
| | 16 | 9b & 10b | | | | | | | 2 | 2 | | | | | | | | |

TABLE 10--Continued

| Species | Temp °C. | Culture | Number of Weeks From Start of Incubation | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 |
| Podospora decipiens | 21 | 7a & 8a | | | 24 | 28 | 30 | 28 | 28 | 20 | 23 | 11 | 7 | | | | | |
| | 26 | 7b & 8b | | 2 | 6 | 6 | 7 | 2 | 3 | | | | | | | | | |
| | 21 | 9a & 10a | | | 21 | 38 | 47 | 38 | 26 | 19 | 1 | | | | | | | |
| | 16 | 9b & 10b | | | | | 5 | 12 | 18 | 25 | 23 | 15 | 19 | 15 | 14 | 13 | 12 | 12 |
| Tripterospora sp. #1 | 21 | 7a & 8a | | | | | | | | | | | | | | | | |
| | 26 | 7b & 8b | | 44 | 43 | 47 | 35 | 25 | 23 | 20 | 15 | 11 | 9 | 8 | 5 | | | |
| Ascobolus furfuraceus v. coronatus | 21 | 9a & 10a | | | | | | | | | | | | | | | | |
| | 26 | 9b & 10b | | 13 | 15 | 13 | 11 | | | | | | | | | | | |
| Sporormia minima | 21 | 7a & 8a | | | 6 | 5 | | | | | | | | | | | | |
| | 26 | 7b & 8b | | | | | | | | | | | | | | | | |
| | 21 | 9a & 10a | | | 9 | | | | | | | | | | | | | |
| | 16 | 9b & 10b | | | | | | | | | | | | | | | | |
| Coprinus sp. #2 | 21 | 9a & 10a | | | 28 | 19 | 12 | 20 | 10 | 6 | | | | | | | | |
| | 16 | 9b & 10b | | | | | | | | | | | | | | | | |
| Saccubolus neglectans | 21 | 7a & 8a | | | | 19 | 14 | 40 | 32 | 30 | 26 | 17 | 13 | 9 | 12 | 7 | | |
| | 26 | 7b & 8b | | | | 5 | 9 | 17 | 23 | 16 | 12 | 11 | 10 | 6 | | | | |
| Podospora vestita | 21 | 7a & 8a | | | | | | 4 | 12 | 30 | 48 | 66 | 136 | 154 | 186 | 193 | 241 | 221 |
| | 26 | 7b & 8b | | | | 18 | 39 | 121 | 145 | 134 | 136 | 119 | 127 | 146 | 128 | 125 | 124 | 120 |
| | 21 | 9a & 10a | | | | 13 | 13 | 15 | 15 | 27 | 28 | 12 | 21 | 25 | 46 | 48 | 48 | 46 |
| | 16 | 9b & 10b | | | | | | | | | | | | | 3 | 4 | 19 | 19 |
| Ascophanus ochraceous | 21 | 7a & 8a | | | | | 36 | 16 | 19 | 32 | 63 | 84 | 79 | 103 | 102 | 99 | 97 | 97 |
| | 26 | 7b & 8b | | | | | | | | | | | | | | | | |
| | 21 | 9a & 10a | | | | | | 1 | 1 | 1 | 2 | 1 | | | | | 6 | 4 |
| | 16 | 9b & 10b | | | | 8 | 13 | 93 | 238 | 391 | 328 | 328 | 311 | 271 | 248 | 234 | 238 | 225 |
| Ascophanus granuliformis | 21 | 9a & 10a | | | | | 7 | 45 | 29 | 20 | 17 | 17 | 19 | 14 | 14 | 14 | 12 | 9 |
| | 16 | 9b & 10b | | | | | 58 | 82 | 109 | 64 | 45 | 42 | 31 | 20 | 14 | 14 | 14 | 12 |

TABLE 10--Continued

| Species | Temp ° C. | Culture | Number of Weeks From Start of Incubation | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 |
| | 21 | 7a & 8a | | | | | | | | | | | 2 | 1 | | 1 | 2 | 1 |
| Podospora | 26 | 7b & 8b | | | | | | | | | | | | | 1 | | | |
| piriformis | 21 | 9a & 10a | | | | | | 13 | 67 | 114 | 154 | 163 | 149 | 149 | 143 | 124 | 120 | 120 |
| | 16 | 9b & 10b | | | | | | | | 8 | 10 | 10 | 15 | 32 | 61 | 82 | 100 | 96 |
| Peziza | 21 | 9a & 10a | | | | | | | | | | | | | | | | |
| granulata | 16 | 9b & 10b | | | | | | 1 | 1 | 1 | | | | | | | | |
| Ascophanus | 21 | 9a & 10a | | | | | | | 2 | 6 | 9 | 7 | 7 | 7 | 7 | 7 | 7 | 8 |
| holmskjoldii | 16 | 9b & 10b | | | | | | | | | | | | | | | | |
| Coprinus | 21 | 9a & 10a | | | | | | | | | 2 | 1 | | | | | | |
| parvisporus | 16 | 9b & 10b | | | | | | | | | | | | | | | | |
| Ascophanus | 21 | 9a & 10a | | | | | | | | | | | | | | | | |
| brunneus | 16 | 9b & 10b | | | | | | | | | 2 | 2 | 2 | 2 | 3 | 3 | 2 | 2 |
| Saccobolus | 21 | 9a & 10a | | | | | | | | | | 1 | 1 | | | | | |
| depauperatus | 16 | 9b & 10b | | | | | | | | | | | | | | | | |
| Coprinus | 21 | 9a & 10a | | | | | | | | | | | | | | | | |
| hexagonosporus | 16 | 9b & 10b | | | | | | | | | | | | | 1 | | 1 | 1 |
| Sporormia | 21 | 7a & 8a | | | | | | | | | | | | | 17 | 17 | 17 | 17 |
| australis | 26 | 7b & 8b | | | | | | | | | | | | | | | | |
| Coprinus | 21 | 9a & 10a | | | | | | | | | | | | | | | | |
| cordisporus | 16 | 9b & 10b | | | | | | | | | | | | | 1 | | | |
| Ascophanus | 21 | 9a & 10a | | | | | | | | | | | | | | | | |
| sp. #1 | 16 | 9b & 10b | | | | | | | | | | | | | | | 3 | 3 |
| Chaetomium | 21 | 9a & 10a | | | | | | | | | | | | | | | | |
| sp. #1 | 16 | 9b & 10b | | | | | | | | | | | | | | | 4 | 4 |
| Bombardia | 21 | 9a & 10a | | | | | | | | | | | | | | | | 1 |
| caerulea | 16 | 9b & 10b | | | | | | | | | | | | | | | | |

TABLE 11

THE COMPOSITION OF THE COMMUNITIES AT EACH OF THE DIFFERENT INCUBATION TEMPERATURES

Major Species of the Early Community

| At 21° C. | At 26° C | At 16° C. |
|---|---|---|
| *Ascobolus immersus | *Saccobolus kerverni | *Ascobolus furfuraceous |
| Ascobolus furfuraceous | | |
| Ascophanus holmskjoldii | | |

Major Species of the Intermediate Community

| At 21° C. | At 26° C. | At 16° C. |
|---|---|---|
| *Podospora coronifera | *Podospora vestita | *Ascophanus ochraceous |
| Podospora decipiens | Tripterospora sp. #1 | Ascobolus imersus |
| Podospora curvula | Saccobolus neglectans | Podospora decipiens |
| Podospora piriformis | | Podospora curvula |
| Chactomium globosum | | Ascophanus granuliformis |
| Podospora #1 | | Ascobolus furfuraceous v. coronatus |
| Saccobolus kerverni | | |
| Ascophanus granuliformis | | |

Major Species of the Late Community

| At 21° C. | At 26° C. | At 16° C. |
|---|---|---|
| *Podospora vestita | | *Podospora piriformis |
| Ascophanus ochraceous | | Podospora vestita |

*Species with the highest absolute density average of at least 7.5 fruiting bodies per culture were considered major species.

## Temperature and Light Fluctuations

During the incubation period from October 7 through February 1 there were no known fluctuations in the 21° C. incubation chamber. During the incubation period from February 1 through May 26, the electrical power to the research laboratory was shut off on the following dates for the specified length of time: (1) March 19--5½ hours, (2) March 20--2½ hours, (3) April 18--6 hours, and (4) April 20--4½ hours. During these periods without electricity, all the cultures were, of course, in darkness. The electrical shortages also caused the following fluctuations in the temperature in the incubation chambers. (1) On March 19 the temperature dropped from 26° C. to 23° C. in the 26° C. incubation chamber where cultures 7b and 8b were incubated. In the 16° C. chamber where cultures 9b and 10b were incubated, the temperature rose to 21° C. (2) On April 18 the temperature rose in the 16° C. chamber to 20° C. It also rose to 24° C. in the 21° C. chamber where cultures 7a-10a were incubated. This rise was followed immediately by a drop to 18° C. in the 21° C. chamber.

Six rises in temperature unrelated to the electrical shortage were observed in the 26° C. chamber. During the first week of incubation on February 7, the temperature rose to approximately 40° C. during a six hour period and during the fourteenth week the temperature rose to 29° C. five different times.

It is not known if any of the variation in the fruiting of the fungi growing on the cultures incubated at the different temperatures can be attributed directly to the temperature and light fluctuations. However, it is possible that Tripterospora sp. #1 may have been induced to fruit on culture 7b by the rise from 26° C. to 40° C. in the 26° C. chamber. Fruiting bodies of this species were observed only on the culture the following examination after the temperature rise.

## DISCUSSION

### General Considerations

It is significant that in this study sixty ascomycete and basidiomycete species representing fifteen different genera were found fruiting on the fourteen cultures. These cultures were taken from only ten different cow dung platters collected from the same general area in Santaquin Canyon, Utah. Hanks (1963) found fifty-nine ascomycete species on cow dung collected from fifteen different areas throughout Utah and one area each in Idaho and Arizona. Twenty-nine of these species found by Hanks were also found on the cow dung from Santaquin Canyon. Seventeen additional ascomycete species were found on the cow dung from Santaquin Canyon which were not reported by Hanks. Some of these additional species may be accounted for by the longer incubation period and additional temperatures used in this study. Hanks incubated his cultures at 20° C. for only four to six weeks while in the current study the cultures were incubated for sixteen weeks and at three different temperatures (21° C., 26° C. and 16° C.).

Hanks (loc. cit.) also reported that Podospora decipiens[1] and Ascobolus immersus were common and widely distributed throughout Utah. The results of this study are in agreement with Hanks' report since both species were major species and had constancy ratings of 70% and

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[1] Hanks listed this species as Sordaria decipiens.

80%, respectively (Table 6). However, for Lasiobolus equinis, which Hanks reported as being one of the most frequently collected species in his study, the results of the present study are not in agreement since this species was only a rare species on the cultures incubated during this study (Table 2).

Although the genus Coprinus was represented on the cultures incubated at 21° C. by eight different species none of them were major species (Table 3). This was due mainly to the fruiting of the Coprini usually around the periphery of the cultures and thus out of the range of the quadrats. This pattern of fruiting of the Coprini may be accounted for in at least one of three ways. The first way may be that the basidiocarps are inhibited by light as explained by Buller (1922) who found that all the mature fruiting bodies of the coprophilous agaric, Anellaria separata, grew from dark crevices underneath or between the dung pieces. He reported this was probably due to the fact "that as in Coprinus sterquilinus, strong light inhibits the development of small fruit-body rudiments" (loc. cit., p. 348). If strong light likewise inhibited the development of the Coprini in this study, this inhibition could account for the usual absence of mature Coprinus fruiting bodies from the surface of the cultures. Coprini in the button-stage were sometimes found in the quadrats, but these often failed to mature and thus could not be identified. The presence and number of such immature Coprini are recorded under Coprinus spp.

The second way may be that the tips of the stipes are heliotropic. Buller (1909) found that fruiting bodies of Coprinus niveus are at first strongly positively heliotropic. This enables the stipes to push their yet unexpanded pilei outwards between or from under the dung pieces into the open. Therefore, if young basidiocarps are closer to the side than to the surface of the dung pieces, they may grow out from the side into the light. Thereafter as the pilei begin to expand, the tips of the stipes cease to be heliotropic and become negatively geotropic instead (Buller, loc. cit.). This causes the fruiting bodies to then grow vertically upwards around the periphery of the dung pieces.

The third way may be that the *Coprinus* basidiocarps are unable to penetrate up through the firm less moist surfaces of the cow dung cultures. Dr. K. H. McKnight has observed the appearance of broken or otherwise damaged caps of *Coprinus* basidiocarps that had penetrated through the surfaces of some of his cultures. He believes the damage may be due to the pressure exerted on the caps as they were pushed by the elongating stiped up through the firm surfaces (Personal communication).

*Sporormia* also had no species in the major category (Table 3). The author has observed that the *Sporormia* species either were represented by only a few isolated ascocarps or when more numerous, the ascocarps were grouped into small isolated areas of the culture. This may be due to the mycelium of the *Sporormia* being restricted in its growth and either fruiting sparingly to produce the few isolated ascocarps of such species as *Sporormia vexans* and *Sporormia pascua*, or fruiting more profusely to produce the small isolated groups of ascocarps of such species as *Sporormia australis*. This species was represented on culture 7a by 17 fruiting bodies in only one quadrat

(Table 4 and 5).

In contrast to the *Sporormia* species, *Podospora coronifera* and *Ascobolus immersus* were represented on the cultures by abundant well distributed ascocarps. Therefore, the mycelium of these two species must have been well distributed throughout the dung. The mycelium of these two species also produced fruiting bodies profusely since these species were the only ones which averaged over 100 ascocarps per culture at their maximum absolute densities (Table 7).

Of the six major discomycete species which fruited during this study, three, *Ascobolus immersus*, *Ascobolus furfuraceous*, and *Ascophanus holmskjoldii*, fruited most abundantly during the period of the early community; two, *Saccobolus kerverni* and *Ascophanus granuliformis*, fruited most abundantly during the first half of the period of the intermediate community; and one, *Ascophanus ochraceous*, fruited most abundantly during the late community (Table 7). Of the minor discomycete species which fruited, *Saccobolus intermedius* fruited most abundantly during the second week of the early community; *Saccobolus neglectans* and *Ascophanus argenteus* fruited most abundantly during the tenth week of the intermediate community (table 7). Typically, then, the discomycete species fruited early in the study since only two, *S. depauperatus* and *A. ochraceous*, fruited most abundantly after the sixth week of incubation.

When presented collectively, as in Tables 6-8, the species which fruited during this study seem to fruit in an orderly manner. However, some variation does exist among the various cultures and their species as shown in Tables 4 and 5. Following are possible reasons which could account for some of these variations; (1) unequal innoculation of the various platters, (2) variations in the nutrients, pH, mineral, and water content of the different platters, (3) differences in the age and weathering of the platters, (4) variations in the activities of insects, bacteria, and other microorganisms prior to or concurrently with, or both, the fruiting of the higher fungi, (5) effects of incubation under different temperatures, and (6) possible errors in the observations, and identifications of the species.

In addition to the above possible causes of variation, cultures 7a-10b of the second experiment were stored in the laboratory four months before incubation while cultures 1-6 of the first experiment were stored only four days before incubation. Although this extra storage period was evidently harmful to such species as *Podospora coronifera*, it seemed not to harm other species such as *Podospora vestita* and *Ascophanus ochraceous*. *P. coronifera*, which was so plentiful on cultures 1-6, only appeared as a rare species on cultures 7a-10a (Table 2). In contrast to *P. coronifera*, however, *P. vestita* and *A. ochraceous*, which were the major species of the late community, fruited only on cultures 7a-10b(Table 6). Perhaps the spores of such species as *P. vestita* and *A. ochraceous* need to age before germination, or if already germinated, the mycelium of such species may be able to retain its vitality while being stored. For species such as *P. coronifera*, however, the storage period may have been too long for the survival of most or all of their spores or mycelium.

## The Successional Communities

In the current study the successional patterns of Ascomycetes and Basidiomycetes which grow on cow dung from Santaquin Canyon, Utah, were studied in detail for sixteen weeks. From the data obtained it was found that the species of these two classes of fungi could be assigned to one of three successional communities based on the time the species reached their greatest distribution and abundance on the cultures.

The early successional community was characterized by Discomycetes while both the intermediate community and the late community were characterized by Pyrenomycetes. The Basidiomycetes were distributed among two of the three communities as follows: in the early community one basidiomycete species fruited, in the intermediate community eight basidiomycete species fruited, while in the late community no basidiomycete species fruited. Thus, the Basidiomycetes seemed to fruit concurrently with the Ascomycetes. However, it should be noted that the majority of the ascomycete species started to fruit before the fifth week, whereas the majority of the Basidiomycetes started to fruit during or after the fifth week (Table 4). Thus, on the basis of time of fruiting alone, the statement of Ingold (1953) that the Basidiomycetes follow the Ascomycetes would hold true for this study as well.

Ingold (1953) has postulated that the later development of the Basidiomycetes may be due to the relatively slow growth of their mycelium and the late stage at which their basidiocarps are formed. Gwynn-Vaughn and Barnes (1937) have stated that the Basidiomycetes probably play an important part in the final break-down of the coprophilous substratum. Buller (1931) postulated that ability of early germination of the spores of a species is important in determining the success of that species in meeting the competition of other fungi in gaining possession of the substratum. Thus, the early fruiting of the Discomycetes may be an indication that they had rapid spore germination and mycelial growth followed by early development of their fruiting bodies. They are probably primary decomposers and rapidly use up the less complex nutrients in the substratum. As these nutrients are used up, the Pyrenomycetes and Basidiomycetes, which may be more adapted than the Discomycetes for the decomposition of the more complex materials left in the substratum, replace the Discomycetes in the two later communities.

In contrast to the other major discomycete species which fruited in the earlier communities, Ascophanus ochraceous reached its maximum absolute density and percent frequency during the late community on the cultures incubated at 21° C. (Fig. 2 and Tables 6 and 7). However, on the cultures incubated at 16° C., the average maximum density per culture reached by this species was approximately nineteen times greater and three weeks earlier than on the culture incubated at 21° C. (Tables 7 and 10). Apparently Ascophanus ochraceous was delayed in its fruiting at 21° C. because this temperature was less favorable for its growth and sporulation than the lower temperature.

## Insect Disturbance

The insect disturbance to the cultures had several effects on the fungal population. First, there was generally a rapid decrease in the number of fruiting bodies on the cultures as the disturbance to the cultures increased. This was effectively demonstrated by the rapid decrease in the number of ascocarps of *Podospora coronifera* during the last four weeks of incubation (Table 5) when the insect disturbance was so extensive to the culture on which *P. coronifera* was growing (Table 4). Had this disturbance not occurred, *P. coronifera* might have remained the dominant species throughout the period of the late community as well as throughout the period of the intermediate community.

The second effect was that some species failed to fruit on the disturbed cultures if the disturbance occurred before the species typically started to fruit. The disturbance probably broke up or otherwise damaged the mycelium enough to prevent the species from becoming established sufficiently in the culture to fruit. Examples of this effect are *Podospora coronifera* and *Podospora curvula*. These two species, which usually started to fruit between the second and the fourth week, failed to fruit on culture 1 which was 66% disturbed by the second week and 90% disturbed by the fourth week (Table 4). Also it should be noted that both major species, *Podospora vestita* and *Ascophanus ochraceous* of the late community, failed to fruit on any of the cultures disturbed by the insect larvae (Table 4). Since these two species are late in fruiting the disturbance may have occurred before they were able to establish themselves on the cultures which were disturbed

A third effect which might be attributed to the insect disturbance was that some species fruited, or at least continued to fruit, on disturbed cultures. As examples, *Coprinus* spp. continued to fruit on cultures 1, 2, and 4 after all the quadrats in these cultures had been disturbed (Table 4), and *Podospora piriformis* fruited on cultures 1 and 4 only after all the quadrats had been disturbed. On cultures 2, 3, and 5, however, *P. piriformis* fruited before the disturbance occurred and then gradually decreased in density as the disturbance increased on these three cultures (Table 5). Since *P. piriformis* fruited on culture 1 three weeks after and on culture 4 eight weeks after 100 % disturbance had occurred, the insect activity in these two cultures had probably ceased and the species was able to re-establish itself sufficiently to fruit.

Since there was no fungus fly larvae disturbance on cultures 7a-10b which were stored four months before incubation the storage condition may have been unfavorable for the survival of the flies.

## Effect of Incubation under Different Temperatures

The optimum temperature for twenty-three of the forty-five species which fruited on the eight cultures of the second experiment was 21° C. From Lists 5 and 7 and Tables 2 and 10, it can be seen that eleven of these species fruited earlier or more abundantly, or both, at 21° C. than at either 16° C. or 26° C. These eleven species were *Chaetomium globosum*, *Ascobolus immersus*, *Ascobolus furfuraceous*, *Podospora curvula*, *Saccobolus kerverni*, *Saccobolus intermedius*, *Podospora decipiens*, *Saccobolus neglectans*, *Podospora vestita*, *Podospora piriformis*, and *Sporormia australis*. The twelve species on List 2 fruited only at 21° C.

The optimum temperature for fifteen of the forty-five species was 16° C. *Ascophanus ochraceous*, *Ascophanus granuliformis*, *Peziza* *granulata*, *Coprinus* spp., and *Coprinus cordisporus* fruited earlier or more abundantly, or both, at 16° C. than at either 21° C. or 26° C. In addition to these five species, the ten species shown on List 3 fruited only on the cultures incubated at 16° C. Although *Ascophanus granuliformis* started to fruit the same week at both 21° C. and 16° C. it fruited approximately two and one-half times more abundantly at the cooler temperature (Table 10).

The optimum temperature for three of the species, *Tripterospora* sp. #1, *Chaetomium* sp. #3, and *Coprinus* sp. #4, was 26° C. since they fruited only at this temperature (List 1). These species may have been induced to fruit on the cultures incubated at 26° C. by the high temperature fluctuation to 40° C. during the first week of incubation. According to Lilly and Barnett (1951) exposure to high temperature is one of the factors which may be necessary in breaking the dormancy of some fungal spores. This may have been the case with the spores of these three species.

The four remaining species which fruited on the cultures of the second experiment were only rare species; therefore, no density data was obtained for them. These species were *Podospora anserina* which fruited at both 16° C. and 26° C., *Coprinus fimetarius* and *Coprinus* sp. #3 which fruited at both 21° and 16° C., and *Pleospora* sp. #1 which fruited at 21° C. and 26° C. Since no density data were obtained for these species it is not known which temperature was optimum for them.

Thus 21° C. seems to be the optimum temperature for the fruiting of the majority (51.1%) of the species growing on the cultures incubated during the second experiment, and 26° C. seems to be the optimum temperature for only 6.7% of the species. It is interesting that although the majority of species fruited most abundantly at 21° C. more species fruited on the cultures incubated at 16° C. than on the cultures incubated at either 26° C. or 21° C. An average of sixteen species fruited on the cultures incubated at 16° C. as compared to an average of 13.5 for cultures 7a-7b which were incubated at 21° C. and an average of 9.0 on the cultures incubated at 26° C.

It is significant that of the 18 discomycete species which fruited on cultures 1-10b (Table 1) the only ones to fruit at 26° C. were three *Saccobolus* species. These species were *Saccobolus kerverni*, which fruited at all three temperatures, and *Saccobolus intermedius* and *Saccobolus neglectans*, which fruited at 21° C. and 26° C. (Table 2). *Saccobolus depauperatus* also fruited on the cultures but it fruited only at 21°C. (Table 2). Evidently, 21° C. and 26° C. are more favorable than 16° C. for growth and sporulation of the *Saccobolus* species. *S. Kerverni* which was the only *Saccobolus* to fruit at 16° C. did so in only trace amounts (Table 10).

The effect of incubation under different temperatures on the composition of the communities was very pronounced (Table 11). This demonstrated that temperature has a great effect on the growth and fruiting patterns of the fungal species which compose these communities.

## SUMMARY

1. The succession and strucure of some ascomycete and basidiomycete communities growing on cow dung platters collected from Santaquin Canyon, Utah, were studied in detail.

2. These communities were composed of sixty ascomycete and basidiomycete species representing four series, and fifteen genera. Two of the species were from the series Plectomycetes, twenty-six species were from the series Pyrenomycetes, eighteen species were from the series Discomycetes and fourteen species were from the series Hymenomycetes.

3. Fifteen (25%) of the sixty species had a constancy percentages of 40% or above. These species were *Podospora piriformis* with a constancy of 90%; *Ascobolus immersus*, *Podospora curvula* and *Coprinus* spp. with constancies of 80%; *Podospora decipiens* with a constancy of 70%; *Ascobolus furfuraceus*, *Ascophanus holmskjoldii* and *Ascophanus granuliformis* with constancies of 60%; *Podospora coronifera*, *Sporormia intermedia*, and *Saccobolus kerverni* with constancies of 50%; *Chaetomium globosum*, *Chaetomium* sp. #2, *Sporormia minima* and *Podospora vestita* with constancies of 40%. Forty-five (75%) of the species had constancy percentages below 40%.

4. Data for determining the absolute density, relative density, and percentage frequency of the species fruiting in the communities were obtained from 50 twenty-five square millimeter quadrats placed on each of ten cultures which were incubated at 21° ± 2° C. The quadrats

were examined weekly for sixteen consecutive weeks.

5. From the data obtained it was determined that three successional communities developed on the ten cultures during the sixteen week incubation period.

6. The first community to develop was characterized principally by three major discomycete species. Of these species, *Ascobolus immersus* was the dominant fungus as determined from its density and frequency. This community was present on the cultures during the first two weeks of incubation.

7. The second community to develop was characterized principally by six major pyrenomycete species. One of these species, *Podospora coronifera*, was the dominant fungus of this community as determined from its density and frequency. The second community was present on the cultures from the second to the thirteenth week.

8. The third community to develop was characterized by a pyrenomycete species, *Podospora vestita*, and a discomycete species, *Ascophanus ochraceous*. *Podospora vestita* was the dominant species. Most of the major species from the preceeding communities extended into this community which was present on the cultures during the final four weeks of the incubation period.

9. The effect of incubation under three different temperatures on the fruiting patterns of the species was also studied. Eight cultures were obtained by sectioning four cow platters into halves. Four cultures, one from each of the four platters, were incubated at $21^\circ \pm 2^\circ$ C. Of the four remaining cultures, two were incubated at $16^\circ \pm 2^\circ$ C. and two were incubated at $26^\circ \pm 2^\circ$ C.

10. The data obtained from these eight cultures showed that 21° ± 2° C. was the optimum of the three temperatures, 26° ± 2° C., 21° ± 2° C., 16° ± 2° C., for the fruiting of twenty-three of the forty-five ascomycete and basidiomycete species which fruited on these cultures; 16° ± 2° C. was found to be the optimum temperature for the fruiting of fifteen of the forty-five species; 26° ± 2° C. was found to be the optimum temperature for the fruiting of only three of the thirty species. The optimum temperature for four of the forty-five species was not possible to determine from the data collected.

11. The data obtained from all the cultures incubated showed that of the sixty species which fruited on them, seven fruited at all three temperatures, ten fruited at 16° C. and 21° C., two fruited at 16° and 26° C. three fruited at 21° C. and 26° C., 27 fruited only at 21° C. three fruited at only 26° C., and eight fruited at only 16° C.

12. The insect population on the dung was found to have a great effect on the structure and succession of the dung fungal communities.

13. Possible reasons for variation is the fruiting patterns of various species were discussed.

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# A PHYTOSOCIOLOGICAL STUDY OF COPROPHILOUS ASCOMYCETE AND BASIDIOMYCETE COMMUNITIES FROM SANTAQUIN CANYON, UTAH

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# ABSTRACT

Numerous reports have been published on the taxonomy and distribution of the coprophilous Ascomycetes and Basidiomycetes. No known quantitative work has been done, however, on the succession and structure of the communities formed by these higher fungi. This research was undertaken to study those two phases of the ascomycete and basidiomycete communities which grow and fruit on cow dung collected from Santaquin Canyon, Utah.

Sixty ascomycete and basidiomycete species representing four series and fifteen genera fruited on this cow dung. Four of these species had constancy percentages of 80% or 90%, four had constancy percentages of 60% or 70%, seven had constancy percentages of 40% or 50%, and forty-five (75%) had constancy percentages of below 40%.

Data on the succession and structure of the communities were obtained by making weekly examinations of 500 small quadrats distributed evenly over ten cow dung cultures. The cultures were incubated at 21° ± 2° C. under continuous illumination.

The ascomycete and basidiomycete species which fruited on the cultures were arranged into three successional communities. The early community was characterized by the major discomycete species *Ascobolus immersus*, *Ascobolus furfuraceous* and *Ascophanus holmskjoldii*. They were accompanied by four minor and rare species consisting of one basidiomycete species, two pyrenomycete species, and one discomycete species.

The intermediate community was characterized principally by six major pyrenomycete species and two major discomycete species. These pyrenomycete species were *Podospora coronifera*, *Podospora decipiens*, *Podospora curvula*, *Chaetomium globosum*, *Podospora piriformis* and *Podospora* sp. #1. The discomycete species were *Saccobolus kerverni* and *Ascophanus granuliformis*. These major species were accompanied by sixteen minor species and ten rare species. The three major species of the early community extended into this community.

The late community was characterized by two major species, *Podospora vestita*, a pyrenomycete species and by *Ascophanus ochraceous*, a discomycete species. These two major species were accompanied by two minor species, one rare species, and by eight of the eleven major species of the preceeding communities which continued to persist on the cultures.

Part of this study was an investigation of the effect of incubation under different temperatures on the fruiting pattern of the coprophilous Ascomycetes and Basidiomycetes. From four cultures incubated at 21° ± 2° C., two cultures incubated at 16° ± 2° C., and two cultures incubated at 26° ± 2° C. it was found that 21° ± 2° C. was the optimum temperature for the fruiting of twenty-three of the forty-five species which grew on these cultures, 16° ± 2° C. was the optimum temperature for the fruiting of fifteen of the species, and 26° ± 2° C. was the optimum temperature for the fruiting of only three of the species. It was not possible to determine the optimum temperature for the fruiting of four of the forty-five species.