A SURVEY OF WATER MOLDS OCCURRING in THE SOILS OF WISCONSIN, AS STUDIED DURING THE SUMMER OF 1926.

JAMES VERNON HARVEY

In a previous paper by the author (3) the fact is discussed that many species of the common water-molds (Saprolegniaceae) occur in the soils. Not only were these common forms found, but some rare forms were discovered, some of which had been reported only once or twice before. Four new species were isolated, two of which belong to previously established genera, *Leptolegnia subterranea* and *Pythiopsis intermedia*. The other two species, however, were placed in a new genus of the Saprolegniaceae, Geolegnia. The two plants, *G. inflata* and *G. septisporangia*, possess the sexual characteristics of the Saprolegniaceae, but sporangial characters (spore formation and spore structure) more closely resemble those of certain of the Peronosporaceae. The plants were placed in the Saprolegniaceae because of the sexual behavior and other habits.

During the summer of 1926 work was continued by the writer at the University of Wisconsin, Madison, under the direction of Dr. E. M. Gilbert, to continue the isolation of the water-molds from the soil. 200 collections were made between June 19th and August 7th, in which many species of the Saprolegniaceae were found. The same methods of collection and culture were used as described by Butler (1) and by the author in his previous paper (3).

The experiments did not show as many species or show them so often as were found at Chapel Hill (N. C.), (3), in the same number of collections. However, let it be remembered that these molds are by no means so abundant at Madison as at Chapel Hill, even in the water. The forms isolated, nevertheless, give interesting information. The two new species of the new genus, Geolegnia, listed above, were found only a few times at Chapel Hill,
G. Inflata three times and G. septisporangia twice. However, at Madison G. inflata was isolated 35 times and G. septisporangia was found twelve times in two hundred collections—in widely scattered areas and to greater depths than at Chapel Hill. The two forms are identical with the Chapel Hill forms, but seem to be more hardy, usually found in cultures free from any other species, though found a few times in cultures rich in other growths. Saprolegnia ferax was isolated four times, one of these being from a very dry situation. Achlyya (probably A. flagellata) was found in three cultures taken at the same place but at various depths, then growing with Dictyuchus sterile, and possibly once more parasitized by Olpidiopsis (destroyed by the parasite). A different species of Achlyya was found in one other collection. Allomyces arbuscula was taken three times. Olpidiopsis species occurred twice. Pythium species were isolated 48 times. Ascomycetous and Zygomycetous forms appeared 26 times each. Bacteria infected 24 cultures but only a few cultures were destroyed by this form of life. Even Vorticella, Paramecia and Euglena were taken a few times, in dry to moist situations. These animals were destructive to the cultures of fungi. Even some Algae were found in fairly dry soil, in sand not far removed from the shore of Lake Mendota: Protococcus, Desmids, Oscillatoria, and Spirogyra.

In addition to the forms listed above, a new species of fungus was found. This species closely resembles the two species of Geolegnia mentioned before, (3) in sexula characters. On the other hand the plant possesses the sporangial characters of Thraustothea clavata, as well as those of Geolegnia septisporangia. This plant is described in full in the current issue of the Journal of the Elisha Mitchell Scientific Society.

The following description of the new genus, Geolegnia is taken from the original paper (3):

Geolegnia Coker

"Mycelium of very limited growth, forming a dense, opaque mat; hyphae very slender. Sporangia inflated at regular intervals or segmented into two or more compartments (unless very small); spores in a single row, very large, en-
cysting within the sporangium with a thick wall and without any motile stage; escaping by the decay of the thin-walled sporangium and sprouting by a germ tube. Oogonia abundant, even, containing a single eccentric egg that does not fill the cavity. Antheridia always present and androgynous.

In regard to the sporangia and spores this is a most peculiar genus of the Sparolegniaeae and it must occupy a section of its own. The peculiar sporangia and the large motionless spores with thick walls separate at a considerable distance all the other genera.”

*Geolegnea inflata.* Coker and Harvey.

The following description, with plates, is taken from the Journal of the Elisha Mitchell Society, Vol. 41, Nos. 1 and 2, pp. 154–155, September, 1925:

Mycelium of great density and slow and limited growth, as noted under the genus, forming after a few days a very dense, quite opaque, white mat, with individual threads distinguishable only on the margin. Growth on boiled hemp seed up to 2 mm. in six days, never reaching a length (ring growth) of over 3 mm. Hyphae straight, sparingly branched at first and then resembling Leptolegnea, 2.3–16μ thick. Primary sporangia formed from the straight ends of the larger hyphae, soon (usually before abstriction) becoming swollen at regular intervals; swellings 15–21μ thick; secondary sporangia, usually shorter, formed immediately below old ones, on the same thread or from lateral threads of irregular position. Spores very large and peculiar, spherical to oval, mostly spherical, rarely elongated, 3–15 to a sporangium, usually 4–6, formed singly in each swelling, 14–21μ thick, encysting in position with a thicker wall than that of the sporangium (0.5μ) and without any motile stage, escaping from the sporangium by decay of the delicate walls, which soon occurs; sprouting promptly when brought into new media. Oogonia abundant, spherical, 15–19μ thick, with thick (2μ), smooth, unpitted walls, usually appearing later than the sporangia, though occasionally earlier, borne singly and apically on smaller and more irregular branches than the main hyphae. Eggs one to each oogonium, 13–15μ, eccentric, with one large lateral oil drop. Antheridia, short, swollen, tuberous, always present, borne on slender, irregular often contorted branches which are mostly androgynous from near the oogonia, rarely dilinious.

In the early stages the plant resembles Leptolegnea, but is soon to the naked eye distinguished by the dense mat. The mat owes its density to the very large number of oogonial and antheridial branches, with many oogonia, and to the abundant (though fewer) sporangia.
The following table gives the distribution for *Geolegnia inflata* in and around Madison:

<table>
<thead>
<tr>
<th>Date</th>
<th>No.</th>
<th>Place</th>
<th>Kind of Soil</th>
<th>Vegetation</th>
<th>Depth, in.</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>6-21-26</td>
<td>317</td>
<td>Campus grove—Lake</td>
<td>Humus—loam</td>
<td>Water leaf</td>
<td>Surface</td>
<td>Slightly damp</td>
</tr>
<tr>
<td>6-21-26</td>
<td>320</td>
<td>Campus grove—Lake</td>
<td>Humus—loam</td>
<td>Water leaf</td>
<td>6 in.</td>
<td>Slightly damp</td>
</tr>
<tr>
<td>6-23-26</td>
<td>321</td>
<td>Campus grove—Lake</td>
<td>Humus—loam</td>
<td>Crow foot</td>
<td>8 in.</td>
<td>Slightly damp</td>
</tr>
<tr>
<td>6-23-26</td>
<td>322</td>
<td>Campus grove—Lake</td>
<td>Humus—loam</td>
<td>Crow foot</td>
<td>8 in.</td>
<td>Slightly damp</td>
</tr>
<tr>
<td>6-28-26</td>
<td>344</td>
<td>Campus grove—Lake</td>
<td>Humus—loam (oak leaves)</td>
<td>Ash</td>
<td>7 in.</td>
<td>Moist</td>
</tr>
<tr>
<td>6-28-26</td>
<td>348</td>
<td>Campus grove—Lake</td>
<td>(oak leaves) (under rock)</td>
<td>Ash, white oak, water leaf</td>
<td>2 in.</td>
<td>Dry</td>
</tr>
<tr>
<td>7-1-26</td>
<td>362</td>
<td>Campus grove—Lake</td>
<td>Dark soil, Leaves—Rainy</td>
<td>Violet, Waterleaf</td>
<td>Surface</td>
<td>Wet</td>
</tr>
<tr>
<td>7-1-26</td>
<td>363</td>
<td>Campus grove—Lake</td>
<td>Dark soil, Leaves—Rainy</td>
<td>Violet, Waterleaf</td>
<td>2 in.</td>
<td>Wet</td>
</tr>
<tr>
<td>7-1-26</td>
<td>367</td>
<td>Campus grove—Lake</td>
<td>Light loam</td>
<td>Violet, Waterleaf</td>
<td>Surface</td>
<td>Damp</td>
</tr>
<tr>
<td>7-2-26</td>
<td>372</td>
<td>Basecom Hall—Road</td>
<td>Black loam</td>
<td>Rhabarb</td>
<td>1 in.</td>
<td>Damp</td>
</tr>
<tr>
<td>7-2-26</td>
<td>372</td>
<td>Basecom Hall—Road</td>
<td>Black Loam</td>
<td>Rhabarb</td>
<td>1 in.</td>
<td>Damp</td>
</tr>
<tr>
<td>7-2-26</td>
<td>377</td>
<td>Grove—Mendota Rd.</td>
<td>Brick filled</td>
<td>Dandelion</td>
<td>2 in.</td>
<td>Dry</td>
</tr>
<tr>
<td>7-2-26</td>
<td>380</td>
<td>Grove—Mendota Rd.</td>
<td>Light loam</td>
<td>Moss, Elm</td>
<td>1 in.</td>
<td>Medium</td>
</tr>
<tr>
<td>7-6-26</td>
<td>415</td>
<td>Marsh—S. Wengra L.</td>
<td>Black (very)</td>
<td>Geranium</td>
<td>4 in.</td>
<td>Dry</td>
</tr>
<tr>
<td>7-6-26</td>
<td>420</td>
<td>Field—S. Wengra L.</td>
<td>Sandy loam</td>
<td>Pea (culb.)</td>
<td>6 in.</td>
<td>Dry</td>
</tr>
<tr>
<td>7-8-26</td>
<td>423</td>
<td>Face B'cav.—Mem. Union Bldg.</td>
<td>Loam</td>
<td>Loam</td>
<td>6 in.</td>
<td>Wet</td>
</tr>
<tr>
<td>7-8-26</td>
<td>427</td>
<td>Face Excav.—Mem. Union Bldg.</td>
<td>Loam</td>
<td>Loam</td>
<td>6 in.</td>
<td>Wet</td>
</tr>
<tr>
<td>7-8-26</td>
<td>431</td>
<td>Mendota L. Ditch</td>
<td>Brick filled</td>
<td>Chickweed</td>
<td>3 in.</td>
<td>Damp</td>
</tr>
<tr>
<td>7-8-26</td>
<td>439</td>
<td>Mendota L. Shore</td>
<td>Black loam</td>
<td>Surface</td>
<td>3 in.</td>
<td>Moist</td>
</tr>
<tr>
<td>7-16-26</td>
<td>441</td>
<td>Mendota &quot;Willows&quot;</td>
<td>Black loam</td>
<td>Surface</td>
<td>3 in.</td>
<td>Moist</td>
</tr>
<tr>
<td>7-16-26</td>
<td>442</td>
<td>Mendota &quot;Willows&quot;</td>
<td>Black loam</td>
<td>Surface</td>
<td>3 in.</td>
<td>Moist</td>
</tr>
<tr>
<td>7-16-26</td>
<td>446</td>
<td>New Dorms.—Rd. Lake</td>
<td>Sandy loam</td>
<td>Surface</td>
<td>3 in.</td>
<td>Moist</td>
</tr>
<tr>
<td>7-16-26</td>
<td>447</td>
<td>New Dorms.—Rd. Lake</td>
<td>Dark gravelly</td>
<td>Surface</td>
<td>3 in.</td>
<td>Moist</td>
</tr>
<tr>
<td>7-16-26</td>
<td>448</td>
<td>New Dorms.—Rd. Lake</td>
<td>Dark gravelly</td>
<td>Surface</td>
<td>3 in.</td>
<td>Moist</td>
</tr>
<tr>
<td>7-16-26</td>
<td>457</td>
<td>Marsh Rd.—Mendota</td>
<td>Sandy humus</td>
<td>Surface</td>
<td>3 in.</td>
<td>Moist</td>
</tr>
<tr>
<td>7-16-26</td>
<td>459</td>
<td>Beyond Chicken Farm</td>
<td>Black loam</td>
<td>Surface</td>
<td>2 in.</td>
<td>Very dry</td>
</tr>
<tr>
<td>7-17-26</td>
<td>471</td>
<td>Picnic Point—W. Beach</td>
<td>Black loam</td>
<td>Surface</td>
<td>2 in.</td>
<td>Very dry</td>
</tr>
<tr>
<td>7-23-26</td>
<td>481</td>
<td>New Dorms. (W.) Fl. Rd.</td>
<td>Humus—rocky</td>
<td>Surface</td>
<td>2 in.</td>
<td>Very dry</td>
</tr>
<tr>
<td>7-23-26</td>
<td>483</td>
<td>New Dorms. (W.) Fl. Bd.</td>
<td>Black loam</td>
<td>Surface</td>
<td>2 in.</td>
<td>Very dry</td>
</tr>
<tr>
<td>8-7-26</td>
<td>490</td>
<td>Biol. G. House (W.) Bd.</td>
<td>Black loam</td>
<td>Violets</td>
<td>10 in.</td>
<td>Dry</td>
</tr>
<tr>
<td>8-7-26</td>
<td>494</td>
<td>Biol. G. House (W.) Bd.</td>
<td>Black loam</td>
<td>Violets</td>
<td>10 in.</td>
<td>Dry</td>
</tr>
<tr>
<td>8-7-26</td>
<td>495</td>
<td>Biol. G. House (W.) Bd.</td>
<td>Sandy loam</td>
<td>Flowers</td>
<td>4 in.</td>
<td>Moist</td>
</tr>
<tr>
<td>8-7-26</td>
<td>496</td>
<td>Biol. G. House (W.) Bd.</td>
<td>Sandy loam</td>
<td>Mint</td>
<td>4 in.</td>
<td>Moist</td>
</tr>
<tr>
<td>4-7-26</td>
<td>497</td>
<td>Biol. G. House (W.) Bd.</td>
<td>Sandy loam</td>
<td>Mint</td>
<td>8 in.</td>
<td>Surface</td>
</tr>
<tr>
<td>5-7-26</td>
<td>498</td>
<td>Biol. G. House (S.) Bd.</td>
<td>Clay loam</td>
<td>Sunflower</td>
<td>Surface</td>
<td>Wet</td>
</tr>
<tr>
<td>5-7-26</td>
<td>498</td>
<td>Biol. G. House (S.) Bd.</td>
<td>Dark sandy loam</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Oogonia first appear when the plant is two or three days old and require about 15 days for the eggs to mature. The plant is hardy, surviving well through bacterial infections. Spores will sprout and grow into new plants in the presence of bacteria, but progress is hindered to a great extent.

The portion of a thread which is to become a sporangium, normally straight and cylindrical, becomes swollen at regular intervals, from the tip back, from 75 μ to 300 μ, the protoplasm becoming denser at these points and less dense in the narrow spaces between the swellings. The swellings become larger, the protoplasm rounds up, the small strands connecting the swellings now disappear, the rounded masses become smaller and shrink away from the sporangium wall. The sporangia are cut off from the main hyphae by a septum formed usually at the time when the swellings reach full size and just prior to spore formation, sometimes before swellings occur. After the formation of spores secondary sporangia may be formed below or by lateral branching. Primary sporangia are formed at the tip of nearly every thread within one day. Unless transferred to new media the spores in a dormant state float around indefinitely in original cultures.

It is of interest to note that the spores and oogonia are usually about the same size, or often the spores are larger than the oogonia. The spores have a distinctly clearer central region as described in the conidia of Pythium species. The spores sprout on corn meal agar, but growth of mycelium is very slow, a few sporangia being formed. It is several days after a piece of hemp seed is placed on a block of agar in water containing the mycelium that the hemp will be obviously inoculated. The plant grows well in distilled water on hemp seed, not so well on corn, fairly well on boiled and unboiled sweet potato and Irish potato, also on rye and a little growth has been noted on rice.

*Geolegania septisporangia* Coker and Harvey

Plate 7


Mycelium exactly as in the preceding species except of even more limited growth, forming after a few days a dense, opaque mat with individual threads distinguishable only at the edge of the mat. Growth on boiled hemp seed up to 2 mm. in five days, but never achieving a length (ring growth) of 3 mm. Primary sporangia formed at the ends of practically all hyphae, these and later ones usually divided into several cells by cross partitions after being cut off and just before the spores are formed; swollen at places, but not so often nor so greatly and regularly as in the preceding species,
11.8-21.15µ thick and up to 136µ long. Secondary sporangia formed at the tips of lateral branches somewhat as in Achlyla. Spores very large and peculiar, rarely spherical, mostly oval to ovoid or elongated, formed in a single row, 1-15 to a sporangium, usually 2-5, 11.8-21µ x 20.3-56.4µ, encysting within the sporangium with a rather thick wall (0.9µ) and never escaping from the sporangium except by the decay of the walls. On change of conditions, as removal to corn meal agar, sprouting at once by a germ tube; never forming swarm spores. Oogonia abundant, appearing very suddenly in young and old cultures alike and without apparent cause, borne singly and apically on smaller branches than the main hyphae; subspherical, 22-34µ thick; wall smooth, thin, colorless. Eggs one to each oogonium, spherical to slightly oval, 20-32µ thick, eccentric, with one large, lateral oil drop; walls very thick, 2µ. Antheridia always present, elongated and apically attached to the side of the oogonium, in all cases observed borne on short, irregular androgynous branches from the oogonial stalk at a little distance below the oogonium, 1-4 attached to each oogonium. Emptying of antheridial contents into egg observed.

Found twelve times in two hundred collections: three times in dry soil and nine times in medium to moist soil, down to 10 inches from soil around the roots of such plants as water leaf and chickweed and in beds of cultivated flowers, and once in a pea field, under such trees as hickory, hackberry, ash.

The mycelial mat appears to the naked eye like that of the preceding species, very dense and opaque and is formed in the same way by the close interlacing of oogonial and other lateral branches. The plant is hardy and survives ordinary bacterial infections easily. The spores sprout readily on agar, even more quickly and growing on agar better than those of the first form. Sprouting spores have been found also in water cultures.

The young sporangia often resemble those of Saprolegnia and Achlyla species as to shape and in the possession of a central vacuole, but are very much smaller. At other times the sporangia are straight and cylindrical. The primary sporangia are formed at the tips of the hyphae, and are densely filled with protoplasm just before they are cut off. A somewhat elongated central vacuole occurs, which becomes broken up into smaller vacuoles as the spore origins are formed. Spores are formed by the inward growth of vacuolate furrows, the spores appearing to be pinched off inside the sporangium. The septum does not change either to convex or concave inward after the spores are formed, as it does in the sporangia of species of Saprolegnia, Achlyla, etc., but remains in the same position. The frequent formation of cross walls in the sporangium initials after their separation from the hyphae is a remarkable peculiarity that is found
The following table gives the distribution for *Geolegaria septisporangia* in and around Madison:

<table>
<thead>
<tr>
<th>Date</th>
<th>No.</th>
<th>Place</th>
<th>Kind of Soil</th>
<th>Vegetation</th>
<th>Depth, in.</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>6-23-26</td>
<td>321</td>
<td>Campus Grove—Lake</td>
<td>Black loam</td>
<td>Crowfoot</td>
<td>Surface</td>
<td>Slightly damp</td>
</tr>
<tr>
<td>6-30-26</td>
<td>358</td>
<td>Biol. G. House (W.)</td>
<td>Loam</td>
<td>Flower bed</td>
<td>2 in.</td>
<td>Dry</td>
</tr>
<tr>
<td>7-1-26</td>
<td>365</td>
<td>Campus Grove—Lake</td>
<td>Light loam</td>
<td>Violet, Wet leaves</td>
<td>9 in.</td>
<td>Medium</td>
</tr>
<tr>
<td>7-2-26</td>
<td>377</td>
<td>Lakeside Drive, Rd.</td>
<td>Brick-filled—Sandy</td>
<td>Dandelion</td>
<td>6 in.</td>
<td>Damp</td>
</tr>
<tr>
<td>7-6-26</td>
<td>406</td>
<td>S. Wingra L. Field</td>
<td>Black humus</td>
<td>Ferns, Grass, Milkweed, etc.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7-8-26</td>
<td>430</td>
<td>Face-Exec.—Mem. Union Bldg.</td>
<td>“Buckshot”</td>
<td></td>
<td>Surface</td>
<td>Damp</td>
</tr>
<tr>
<td>7-8-26</td>
<td>433</td>
<td>Park St. Pier</td>
<td>Loam</td>
<td></td>
<td>Surface</td>
<td>Dry</td>
</tr>
<tr>
<td>7-16-26</td>
<td>441</td>
<td>L. Mendota—Willows</td>
<td>Black loam (Sandy)</td>
<td>Virginia Creeper, Ash, Dandelion, Mosses</td>
<td>3 in.</td>
<td>Moist</td>
</tr>
<tr>
<td>7-16-26</td>
<td>454</td>
<td>Marsh “Willows”</td>
<td>Black loam (Sandy)</td>
<td>Grass, Elm</td>
<td>Surface</td>
<td>Wet</td>
</tr>
<tr>
<td>7-16-26</td>
<td>455</td>
<td>Marsh “Willows”</td>
<td>Black loam (Sandy)</td>
<td>Grass, Elm</td>
<td>4 in.</td>
<td>Wet</td>
</tr>
</tbody>
</table>
in no other member of the family. For this reason and also for the fact that the spores are formed simultaneously in all the cells it would seem more correct to call the resulting row of cells a compound sporangium rather than a row of separate sporangia. In other water molds when sporangia occur in rows the spores are formed consecutively, beginning with the apical and the oldest one. The cross walls are all much thicker than the extremely thin lateral wall of the sporangium and they are usually so close to the nearest spore below as to appear much like a shining cap on its distal end.

Oogonia were abundant in practically all cultures after a few days. They were like those of the Chapel Hill form.

The Wisconsin new species referred to above, Brevislegnia diclina, has been described in full as a new genus and species in a current issue of the Elisha Mitchell Journal. Below is given a brief description of the plant.

The mycelium forms a dense opaque mat when the plant is grown on bits of hemp seed, although not so dense as Geolegna species, with threads distinguishable only at the outer edges, hyphae 5.12–28μ broad usually 10.24–12.8μ; Ring growth on bits of hemp seed up to 10 mm. within ten days. Primary sporangia formed after one day, the majority of the sporangia being long club-shaped, a few however being broader in the middle or below the middle, in which cases the spores are formed as in Thraustotheca clavata, or the sporangia may be long and slender, with a single row of spores, in which case the spores are formed as in Geolegna septisporangia; or a combination of the above types may be found; secondary sporangia formed immediately below the primary or by proliferation from below; sometimes intercalary; 10.24–33.28μ broadly 51.2–230μ long. Spores spherical to elongated, 10.28–12.8μ, without any swimming stage. Oogonia abundant, borne singly and apically on branches smaller than the main hyphae, usually within three days; 21–33μ, mostly 21–25μ; walls smooth, wavy, or with projections. Eggs one to each oogonium, eccentric, with one large lateral oil droplet, as in Achlya caroliniana or Geolegna species, eggs 18–25μ, mostly 18–21μ. Antheridia declineous or may be androgenous. Fertilization probable. The plant was found ten times in 200 collections in various kinds of soils from various places at depths from surface to nine inches, as per the following table:
<table>
<thead>
<tr>
<th>No.</th>
<th>Place</th>
<th>Kind of Soil</th>
<th>Vegetation</th>
<th>Depth, in.</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>321</td>
<td>Campus Grove Lake</td>
<td>Humus—Loam</td>
<td>Water-bed</td>
<td>6 in.</td>
<td>Slightly damp</td>
</tr>
<tr>
<td>322</td>
<td>Campus Grove Lake (W)</td>
<td>Humus—Loam</td>
<td>Water-bed</td>
<td>8 in.</td>
<td>Slightly damp</td>
</tr>
<tr>
<td>342</td>
<td>Blod. C. House (W)</td>
<td>Loam</td>
<td>Water-bed</td>
<td>10 in.</td>
<td>Medium</td>
</tr>
<tr>
<td>367</td>
<td>Bloed. C. House (W)</td>
<td>Loam</td>
<td>Water-bed</td>
<td>12 in.</td>
<td>Dry</td>
</tr>
<tr>
<td>368</td>
<td>S. Winnac Lake (by spring)</td>
<td>Loam</td>
<td>Water-bed</td>
<td>8 in.</td>
<td>Moist</td>
</tr>
<tr>
<td>418</td>
<td>S. Winnac Lake, Home V. (W)</td>
<td>Dark loam</td>
<td>Water-bed</td>
<td>8 in.</td>
<td>Dry</td>
</tr>
<tr>
<td>420</td>
<td>S. Winnac Lake, Home V. (W)</td>
<td>Dark loam</td>
<td>Water-bed</td>
<td>8 in.</td>
<td>Dry</td>
</tr>
<tr>
<td>451</td>
<td>L. Mundina (W)</td>
<td>Sandy loam</td>
<td>Water-bed</td>
<td>5 in.</td>
<td>W.</td>
</tr>
</tbody>
</table>
Saprolegnia ferax was isolated four times (in the 200 collections) from different places at different times: Once, at Park St. pier in gravel and cinders underlaid by rock, dry, 7–8–26. Again in an evergreen grove on the lake shore (Mendota) in coarse wet sand at a depth of two inches, 7–26–26. Also in damp coarse gravel at the “Willows” pier. The last time at Picnic Point in moist beach gravel, this time being parasitized by Olpidiopsis.

Achlya (species not definitely determined) four times in the 200 collections, three times found with Dictyuchus, given below.

Dictyuchus sterile. This form occurred in three collections taken from the same place, but at various depths; surface, 2 inches, and 6 inches, from wet, coarse sand on lake shore beach, 7–5–26.

Various Pythium species were found 48 times in the following probable proportions of species: P. deBaryanurn 12 times; P. proliferum 9 times; and P. monospermum 4 times; unidentified forms 23 times. Taken between 6–19–26 and 8–7–26, from various kinds of soils, wet or dry, ordinarily at depths down to 6 inches; once at 65 inches vertically from the face of an excavation for a new building (about 6 inches inward) in wet clay-sandy-loam.

Allomyces arbuscula. Taken three times: (1) in sandy loam at surface of ground, slightly moist, N. W. corner Biology Building, under Lilac, 6–30–26; (2) with Saprolegnia ferax in coarse damp gravel at “Willows” pier, 7–28–26; (3) in moist sandy soil at a depth of 7 inches in sunflower bed at the south side of the biology greenhouse, 8–7–26.

Olpidiopsis (probably O. saprolegniaeae). Once in black loam (humus), slightly damp, campus grove, lake front, this time parasitizing Achlya. Again from Picnic Point with Saprolegnia ferax.

Note:—In order to determine that the water used in the culture of these plants had no spores from which molds could be produced, ten collections, 481–490, were made in two series (parallel). One set being autoclaved before the placing of substrata and the other series being cultured without autoclaving. The one series, when sterilized and hemp placed thereon and regular methods followed out, not a sign of growth of any form of life was noticed. On the other hand, growth was noticed in practically every culture in which the dirt had not been sterilized. The following table presents the variety of
growths identified in the unautoclaved dirt: 481, Geolegnia inflata and Ascomycetous forms; 482, G. Septisporangia and Ascomycetous forms; 483; G. inflata; 484, Bacteria infected growths. 485, Ascomycetous growths dominant; 486 Ascomycetes; 487, Saprolegnia ferox; 488, Bacteria infected; 489, Pythium proliferum; 490, P. proliferum and Ascomycetous forms.

Although this paper is primarily concerned with the Saprolegniaceae, mention is made of the other forms of life when found, such as the Pythiums, Ascomycetes, and Zygomycetes, as noted above, the idea being held in mind to find whether these forms, together with the true water-molds, have any relation to one another in their distribution.

The writer is now making collections of soils around and near Shawnee, Oklahoma, with the hope that many more of the established species may be found, as well as other new forms. The task at present seems to bid success. In the first ten collections made, Saprolegnia and Achlya species were found in about half the collections. Geolegnia inflata has been found five times in the ten samples. Also the new Wisconsin species, Brevilegnia dictina, has been found four times in the ten samples.

Baptist University,
Shawnee, Oklahoma.

LITERATURE CITED


Dr. W. C. Coker has kindly loaned the cuts for the four plates which follow. They were used in illustrating an article which appeared in a recent number of the Journal of the Elisha Mitchell So-
PLATE 4

GEOLEGNIA INFLATA

Microphotograph of a portion of the plant on hemp seed, to show sporangia. × 37. (Below) Microphotograph to show the relation of the oogonia to the hyphae and sporangia. × 123.

PLATE 5

GEOLEGNIA INFLATA

Figs. 1–6. Various stages in the development of the sporangia. × 450.
Fig. 7. Mature sporangium. × 450.
Fig. 8. Sprouting spore. × 450.
Fig. 9. Habit sketch to show the branching, oogonia, and sporangia. × 60.
Fig. 10. Spore. × 975.

PLATE 6

GEOLEGNIA INFLATA

Figs. 1–4. Various stages in the development of the oogonia. × 950.
Fig. 5. Portion of plant to show the relation of the sexual bodies to the sporangia. × 640.
Fig. 6. Portion of the plant to show relation of oogonium to hypha. × 950.

PLATE 7

GEOLEGNIA SEPTISPORANGIA

Figs. 1–5. Stages in the development of the sporangia. × 450.
Figs. 6–9. Stages in the development of the oogonia. × 950.
Fig. 10. Portion of plant to show the relation of a sporangium and an oogonium. × 450.
Fig. 11. Habit sketch of the plant to show sympodial branching. × 250.
Fig. 12. Spore. × 975.