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C. Mervin Palmer

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Edited by

Ray C. Friesner
The *Butler University Botanical Studies* journal was published by the Botany Department of Butler University, Indianapolis, Indiana, from 1929 to 1964. The scientific journal featured original papers primarily on plant ecology, taxonomy, and microbiology. The papers contain valuable historical studies, especially floristic surveys that document Indiana’s vegetation in past decades. Authors were Butler faculty, current and former master’s degree students and undergraduates, and other Indiana botanists. The journal was started by Stanley Cain, noted conservation biologist, and edited through most of its years of production by Ray C. Friesner, Butler’s first botanist and founder of the department in 1919. The journal was distributed to learned societies and libraries through exchange.

During the years of the journal’s publication, the Butler University Botany Department had an active program of research and student training. 201 bachelor’s degrees and 75 master’s degrees in Botany were conferred during this period. Thirty-five of these graduates went on to earn doctorates at other institutions.

The Botany Department attracted many notable faculty members and students. Distinguished faculty, in addition to Cain and Friesner, included John E. Potzger, a forest ecologist and palynologist, Willard Nelson Clute, co-founder of the American Fern Society, Marion T. Hall, former director of the Morton Arboretum, C. Mervin Palmer, Rex Webster, and John Pelton. Some of the former undergraduate and master’s students who made active contributions to the fields of botany and ecology include Dwight. W. Billings, Fay Kenoyer Daily, William A. Daily, Rexford Daudenmire, Francis Hueber, Frank McCormick, Scott McCoy, Robert Petty, Potzger, Helene Starcs, and Theodore Sperry. Cain, Daubenmire, Potzger, and Billings served as Presidents of the Ecological Society of America.

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A PRELIMINARY STUDY OF SACHERIA IN WESTERN NORTH AMERICA

By C. Merwin Palmer

Lemanea from both Europe and America is being studied to determine whether the representatives from the two continents are distinct, and whether there are undescribed species to be recognized particularly for American forms. The two subgenera, Eulemanea and Sacheria, are found on both continents (4). Occasionally plants of both the subgenera have been collected growing close together in the same stream (5, 6), but there are no indications that hybridization takes place. Several hundred specimens of Lemanea have been studied by the writer and in no case have any plants been discovered which could be considered as intermediate between Eulemanea and Sacheria.

Sirotot (7) recognized Sacheria as a separate genus but Ketel and later Atkinson (1) reduced it to a subgenus of Lemanea, and most phycologists have followed the latter procedure up to the present time. Atkinson's reason for combining Sacheria and Eulemanea into one genus was that "While the structural characters of the plants clearly show a natural division, the reproductive organs present only minor variations. The structural differences alone do not seem of sufficient value to warrant the acceptance of more than one genus." However, since there appears to be no hybridization and no occurrence of intermediates between Sacheria and Eulemanea, and since the distinctions do include differences in the location of the antheridia, procarps and carpospores, in addition to the difference in construction of the sexual strands, the present writer considers that it will be justifiable and desirable to follow Sirotot in raising Sacheria Sirotot to the rank of genus and retaining the forms now in the subgenus Eulemanea in the genus Lemanea Bory emend. Sirotot. Even in very young or very old material, the two groups can be distinguished by crushing a portion of the sexual strand and determining whether the central filament is naked or closely surrounded by a number of other filaments. The former arrangement is found in Sacheria and the latter in Eulemanea.

*A contribution in recognition of the 25th Anniversary of the Botany Department of Butler University.
The described species of the two genera are generally unsatisfactory for identification of American material. Atkinson, after having studied numerous specimens from many places in North America, found so many variations and species intermediates that he finally combined several European species of Sacheria and placed almost all of the American material of that genus into the unwieldy and variable species aggregate, *Lemanea (Sacheria) fusca* (Bory). Atkinson indicated as his only other alternative that "one could make a species for specimens from nearly each different locality."

When he considered the other genus, *Lemanea*, however, he refused to combine all of the American material into one large variable species. In fact, he actually added three new species to the list. This was done in spite of the fact that many forms from Virginia, Indiana, California, Kentucky and the southeastern states did not fit well any of the described species, either new or old. A specimen from Virginia was first listed by him as *L. nodosa* and later he changed it to *L. torulos*.

Material from Indiana was first identified by him as *L. catenata*, but upon re-examination, he decided to change it to *L. annulata*. From California he described a new variety intermediate in characteristics between two recognized species. In the southeastern states, he placed all of the variable specimens into one of his new species primarily because of similar geographic location. It appears that European phycologists have paid very little attention to American specimens of *Lemanea* since Atkinson's articles (1, 3), but, for their own continent, they have, as a rule, continued to recognize as separate species those which Atkinson combined into one for the American material.

A restudy of the species and varieties as recognized by Siridot indicates that one might well consider his work as a basis for the classification of these algae rather than placing too much emphasis upon that of Atkinson. The differences between species which he recognized are, in general, clear and distinct, and some of these differences were apparently not given much final consideration by Atkinson. It is true that American material does not fit the descriptions of European species, but it appears to make for more confusion to try to alter European descriptions to fit American forms.

Skujia (8) states that *for Lemanea* (including *Sacheria*), "Its center of development — is to be found to all appearances on the North American continent." In line with this, an intensive study of the American material has forced the present writer to assume that
there are probably a number of American species, more or less well defined, which are distinct from the European species.

Considering now the American material of Sacheria, we note that there have been no new species recognized for this continent. Atkinson (2) listed one in 1904, only to recall it a few years later. His suggested species, however, with slight modifications could readily represent a common American type. The best characteristic to separate the European from the American forms of Sacheria is the location of the carpospores in the sexual strands. All of the European forms appear to have the spores and the procarps located in both the nodal and the inter nodal zones with about equal distribution in both zones, while American material either has the spores and procarps limited to the nodal regions, or if they extend all or part way into the internodal regions, they are more concentrated in the nodes than in the internodes. There are very few exceptions to this arrangement and even the exceptions may be a misinterpretation due to displacement of loose, mature spores.

Geographically, the North American forms of Sacheria can be divided rather readily into three groups, the northeastern, the southeastern, and the western. Most of the specimens with much-branched sexual strands are from the northeast, only one collection from the west showing this character. The great majority of sexual strands with an undulate surface are from the west, those of the two eastern groups being generally cylindric with abrupt nodes even when containing mature spores. Most of the southeastern forms are green in color while various colors such as brown, green, violet and black-violet are found elsewhere. Strands with rough, gnarled nodes are not found in the west although they are fairly common in the east. Capillary forms are not encountered in the southeastern area but are present in the western and northeastern regions.

One is led to assume, from such a study, that each American species is likely to be confined to a limited geographic area. One of the best examples of this is to be found in specimens collected in Colorado and Utah. These small, capillary, brown-violet forms with spores in both nodes and internodes of the cylindric strands, with only slightly protruding antheridal papillae, and with attenuate rather than abruptly stipitate bases are distinct from specimens found in other parts of the continent. Another group of specimens, principally from Massachusetts and Ontario is characterized by small, brown, generally unbranched strands with abruptly raised, somewhat gnarled nodes, and with 3-7 large flat-topped nodes. The base is an abnormal stage and 3-7 large flat-topped nodes are often distinctly outstanding. It is possible, therefore, that a dozen or more of our American forms may be recognized. It should be noted, however, that the American forms do not respond to those described by S. alpina and the American forms of S. fluviatilis and the other American forms are less closely related to these than they do to European species which Atkinson claimed.

Plants of the genus S. alpina and S. fluviatilis have both been found in Arizona, California, Washington and British Columbia. Six species of Sacheria have been found in Colorado and Utah. One of these, S. alpina, from the western United States, is characterized by small, brown, generally unbranched strands with abruptly raised, somewhat gnarled nodes, and with 3-7 large flat-topped nodes. The base is an abnormal stage and 3-7 large flat-topped nodes are often distinctly outstanding. It is possible, therefore, that a dozen or more of our American forms may be recognized. It should be noted, however, that the American forms do not respond to those described by S. alpina and the American forms of S. fluviatilis and the other American forms are less closely related to these than they do to European species which Atkinson claimed.

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and with 3-7 large flat-topped, frequently confluent papillae at each
node. The base is an abrupt, long cylindric stipe.
It is possible, therefore, that with continued study of even more
specimens, a dozen or more American species of Sachcria eventually
may be recognized. It does not appear that any of these will cor-
respond to those described for Europe. As Atkinson (1) has indi-
cated, the American forms resemble S. rigida and S. fucina more
closely than they do L. fluviatilis. Since the writer has found no
European specimen which has carpospores limited to the nodes, he
sees no basis for that characteristic being used to distinguish between
S. fluviatilis and the other two species mentioned above as has been
claimed by Atkinson. Rather it appears to be a distinction between
each American forms on one hand and the American forms on the other.

Plants of the genus Sachcria in western North America have been
found in Arizona, California, Colorado, Montana, Oregon, Utah,
Washington and British Columbia. Most of the collections, so far,
are from California. It would seem that there may be at least five or
six species of Sachcria to be recognized in this area. The plants
from Colorado and Utah which have been described above constitute
one group. A second group is one to which quite a number of plants
from the other western states belong. The sexual strands of this
second group are distinctly undulate with no tendency during the
spore-forming stage from April to September to be cylindric. The
strands have a short, frequently abrupt stipe which is up to 5 mm
long, 2-3 indistinct antheridial papillae per node, and carpospores
which are in the nodes and may extend to all but the very center of
the internodes. The strands are flexible rather than rigid and when
mature vary from 2-17 cm in length. About half of the specimens
have a medium brown color while the others vary from green to
violet or black-violet. It is quite possible that the vividly colored ones
may represent a group separate from the brown ones. This cannot
be determined until more specimens have been studied. Plants in
this second group are from Arizona, California, Montana, Oregon
and Washington. The Sachcria reported from British Columbia (9)
has not yet been seen by the writer.

In the third western type of Sachcria, the sexual strands are
"thick, rigid, horny," corresponding to Sirodot's European S. rigida
in this respect. All of the western representatives are from Cali-
ifornia. Most of them are dwarf forms, being only 1-2 cm long when
mature, although an occasional strand may be as much as 8 cm long.
When young the strands may be violet but they soon change in matur-
ing to become a characteristic yellow to yellow-brown. They have a
rather plane surface with 2-3 slightly raised papillae per node. The
base tends to be short and thick and not abruptly stipitate. The per-
ipheral cell layer is generally 90-100 microns thick and 4-5 cells thick
rather than 3 cells thick as in most Sacheria. The “thick, rigid, horn-
ny” characteristic can easily be recognized when the strands are
observed dry under the low magnification of a binocular dissecting
microscope. The Chantransial filaments of this form appear to re-
main even through June and July and to form a dense hemispherical
mass.

The fourth western type of Sacheria is a capillary, dwarf form
resembling the second type in its undulate form of the strand and the
brown to brown-green color. The mature strands range from 0.7-3.5
cm in length and their maximum node diameter is only 0.5 mm. Plants
of this group have been collected in California and Montana.
The fifth and final group is represented, so far, by only one
collection and it is from California. The sexual strands are dis-
sectively cylindric rather than undulate even though abundant spores
are present. They are dark brown to black-violet in color and ex-
tend up to 8.5 cm in length. The papillae, 2-5 per node, are somewhat
raised and are frequently confluent when old. The form is flexible
rather than rigid and is not capillary. Spores are limited to the nodes.
The base of each strand is an abrupt stipe, 8-13 mm in length, and
branching of the strand is fairly common at the top of the stipe.

After it has been possible to group the eastern American forms, it
is planned to compare these with the western groups and the Euro-
pean species with the possibility of definitely recognizing and describ-
ing the American species of Sacheria. The writer hopes to be able
to carry this out in the near future.

Specimens of Lemanea and Sacheria from herbaria of the Chicago
Natural History Museum and the University of California, in ad-
dition to smaller numbers from other sources, have been made
available for this study and the writer expresses his appreciation to
those in charge of the herbaria who have made the study possible.

SUMMARY

It is planned to follow Sirodot in the recognition of Sacheria as
a genus rather than as a subgenus under Lemanea. Lack of hybridiza-
tion between the two genera is emphasized.
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