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A NEGLECTED FIELD OF STUDY WITH THE DESCRIPTION OF A NEW LICHEN FROM CALIFORNIA

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I suggest that students of fresh water and aerial algae take up seriously the study of certain life forms that in this country have been greatly neglected. I refer to those algae found in lichens, whether they are one of the two essential lichen components or merely play a secondary part. Apparently no one in this country is working upon them with a view to finding out the changes they incur when enslaved by a fungus, as in ordinary lichens, or the way they are affected when more or less dominant as in the gelatinous lichens or other groups where the alga gives form and character.

European botanists long ago isolated the algae of some lichens and determined them with more or less exactitude. At various times pure cultures of different lichen algae and fungi have been made; sometimes these have later been synthesized and lichens grown until fruiting condition was reached. There is ample room for more such studies, but studies of a different character are likewise needed.

There are two other lines of research waiting for algologists to take up in connection with lichens. First, little or nothing has been done in this country upon the ecological and physiological changes or adaptations (and their resultant effect upon morphology) which an alga must sometimes undergo if it is to flourish or even survive as a prime factor in making what we call a lichen. That such changes do occur and are relatively common is well known to the few who have examined large numbers of lichens under the microscope. That they are quite unknown to the students of algae is not generally appreciated. For example, algologists are familiar with *Trentepohlia* and its orange red color, but they are not generally aware that in lichens containing this alga the orange red disappears and the alga is green. The student of lichens must therefore recognize the presence of *Trentepohlia* by other criteria than color. *Nostoc,* when growing in lichens, apparently never has heterocysts; in some lichens it forms characteristic chains, but in others it becomes compacted into masses very different from ordinary *Nostoc,* while in still others it breaks up into very small groups which can hardly be called chains. *Scytonema,* too, breaks up into tiny groups or solitary cells, and does not at all resemble the pictures in the books. Thirty-six years ago my friend and teacher, Dr. Alexander Zahlbruckner, called my attention to the fact that Rivulariaceae (*Calothrix* and *Rivularia*) lost their basal heterocysts when growing in lichens, and were therefore hard to recognize.

Gloeocapsa is a common and well known free living alga, found in stagnant water and damp places. Algologists say the cells are always globose, more or less, and are never elongate or develop rhizoids. In

the new species of lichen described later, the alga is *Gloeocapsa*, section *Xanthocapsa*. In the interior of the lichen the algal cells are from 6 to 10 μ in diameter, arranged in groups 15 to 25 μ in diameter, surrounded by a thick gelatinous sheath. Near the under surface of the lichen the *Xanthocapsa* groups are much larger, and just within the surface some of the cells are seen to be somewhat elongate, instead of globose. From this stage they become two or three times as long as broad; a septum develops and the tip elongates still more until it projects beyond the lower margin of the lichen. This tip, which may or may not develop further septa, continues to lengthen until it becomes a very elongate, slender, and tubular rhizoid. The basal portion is the dark blue-green of the typical *Gloeocapsa* or *Xanthocapsa* color, with its characteristic gelatinous coat, but the burrowing tip soon becomes colorless in its outer part. The whole under surface of the lichen is covered with these rhizoids, which may be 5 mm. or more in length and form a dense mat that binds together the loose grains of the desert surface and holds the thallus firmly in position. In all other crustaceous lichens known to me the rhizoids are hyphal (fungal) threads only. I have no doubt that this is merely one instance of many that would give algologists new light upon the adaptions and physiology of algae.

Second, algologists should critically examine the algal constituents of various lichens and establish their correct identity. This is particularly needed in the case of those lichens containing blue-green algae. Many, if not most, of the published records have merely been copied from one author to another, without a thorough comparative examination of genera and authentic species, a practice of which I have myself been guilty.

Recent studies of large numbers of lichens sent from all over the United States, for identification, often reveal that lichens said to have *Nostoc* as their alga do not contain *Nostoc* at all. This is particularly true of members of the Pannariaceae, in which *Scytonema* or *Xanthocapsa* may be mistaken for *Nostoc*. For example, in *Pannaria lepidiota*, distributed by Cummings and Seymour as No. 122, Decades of North American Lichens, from Mt. Tamalpais, California, the alga is *Xanthocapsa*, not *Nostoc* as given in all published works.

In a number of lichens containing *Gloeocapsa* (*Xanthocapsa*) or *Scytonema*, I have also found *Aphanocapsa*, a blue-green alga not hitherto reported as occurring in any lichens. Whether it is an intrusive in the same way that *Nostoc* enters the hepatic *Anthoceros* and various foliose lichens, whether it is the sole algal component of a lichen, or whether it shares that onus with *Xanthocapsa* or *Scytonema*, is another problem for the algologist to solve. To conclude, our knowledge of the algal constituent of several families of lichens is but fragmentary, or even erroneous, and needs to be investigated by algologists who should settle their systematics and explore their hidden ecology.

All this is preliminary to the description of a new desert lichen from

California. Various workers, especially Dr. H. E. Hasse, have collected and studied the earth lichens of California deserts, and it was assumed that they were all known. The discovery of one belonging to a genus hitherto unknown in this country is therefore of some interest.

Anema Dodgei Herre sp. nov. (Pyrenopsidaceae)

Thallus monophyllus, squamulosus, pseudoparenchymaticus, crassus, salebrosus, inequalis, usque ad 5 mm. latitudine, substratum arcte obducens, late rhizino-affixus, niger, aut virescenti-niger vel opace olivaceo-umbrinus rigidus, cartilagineus, madefactus turgidus, subgelatinosus; gonidia *Xanthocapsa* sunt.

Apothecia parva vel mediocria, primum punctiformia, demum dilatata et urceolata demum lecanorina, margine thallino prominulo, usque ad 1.25 mm., lata rufa vel fusco-rufa; asci cylindrici; sporae octonae, monostichae, simplices, late ovoideae 10–22 μ longae, 5.5–11 μ crassae. Spermatia parva, bacilliformia aut subellipsoidea.

Ad terram desertorum, areas usque ad 8 cm. in diametro formans. Riverside and San Bernardino Counties, California.

Thallus monophyllous, thick, the squamules unequal in size, reaching a width of 5 mm. and forming a regular crust with rough irregular surface, pseudoparenchymatous within and closely adherent to the substratum by numerous rhizoids which reach a length of 5 mm. or more. Color, black or greenish black to dull olive brown; when dry the thallus is rigid and cartilaginous, becoming turgid and subgelatinous when wet. The alga is *Xanthocapsa*, with cells 6–10 μ in diameter, forming groups 15–25 μ in diameter, and surrounded by a thick gelatinous sheath.

The apothecia, reaching a width of 1.25 mm., are punctiform at first, becoming open and urceolate to lecanorine, with prominent thalline margin, the disk red to dark red; the epithecium is yellow, the thecium colorless, about 125 μ wide, the hypothecium gray or dusky gray, about 150 μ wide; the asci are cylindrical; the paraphyses jointed, coherent. Spores simple, colorless, 8, in a single row, broadly ovoid, 5.5–11 μ by 10–22 μ. Spermatia small, bacilliform or slightly ellipsoid.

Apparently an abundant earth lichen in the deserts of Riverside and San Bernardino Counties, California, forming crustose patches which may reach a width of 8 centimeters, more or less. Collected by Francis Drouet and J. Francis Macbride of the Field Museum, in 1941; No. 4621, type material, on barren soil a mile southwest of Essex, San Bernardino County, altitude about 1000 feet; Nos. 4624, 4626, and 4627, co-type material, on open places in the desert about 2 miles east of Danby, San Bernardino County; No. 4711, co-type material, on barren ground in open scrub forest just west of Desert Center, Riverside County; altitude about 900 feet.

Named for Dr. Carroll W. Dodge, of the Missouri Botanical Garden, in recognition of his contributions to the study of lichens.

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