

the inclination is in both cases quite considerable, so that these must approach much nearer to their common node in order that such a mutual action may take place, than is necessary for the first mentioned pair.

The table of longitudes in the orbit shows whether at such an approach the planets would be visible, or lost in the solar rays.

Although the planes of the Vesta and Flora orbits are inclined by so small an angle, yet at the point of nearest approach they are 0.222 distant from one another.

On the other hand we find that the following orbits,  
 Iris and Astræa in  $\Omega$       Pallas and Hebe in  $\Im$   
 Hebe and Astræa in  $\Im$       Ceres and Hebe in  $\Omega$   
 Juno and Vesta in  $\Omega$

are at a distance nearly equal to that of the earth from the sun, —but that this is for the different orbits in different nodes.

Farther from one another than the astronomical unit are,

Iris and Pallas,  
 Flora and Pallas,

in their descending nodes.

In order to give a still clearer view of the situation of the asteroidal orbits, I have stereographically projected the poles of all these planes of the several planet-orbits and of the sun's equator upon the accompanying chart, on the preceding page.

The observation of Dr. Olbers that the asteroids varied considerably in the intensity of their light, from day to day, seems to hold also for the newly discovered ones. In order to determine this definitely, and if confirmed to find the periods, long series of observations are requisite.

The investigations\* of Gauss concerning the Zodiacs of the planets have rendered it comparatively easy to compute for every asteroid, the limits of its geocentric places. Gauss has done this for Ceres and Pallas,† and Prof. Goldschmidt for Iris,‡ and calculators will not be wanting to do the same for the other five. By this means the search for former observations is facilitated, since it has thus become possible, in the case of every missing star, to decide at the first glance whether any one of the asteroids can ever have been in that place.

\* M. C., x, 173. Ast. Nach., xxvi, No. 614 (?) † M. C., ibid. ‡ Ast. Nach., ibid.

ART. IV.—Continuation of the List of Localities of Algæ in the United States; by Prof. J. W. BAILEY.

(Continued from vol. iii, ii Ser., p. 403.)

DEFERRING for the present, a list of American Desmidiaceæ and select Diatomaceæ or Bacillariæ with which I intended to complete this paper, I proceed to give the following catalogue of genuine Algæ, localities of which have been recently discovered in the United States.

For some of the most interesting species I am indebted to Prof. Lewis R. Gibbes of Charleston College, South Carolina, who, in addition to some fine Algæ, collected by himself in Charleston Harbor, gave me a most valuable collection made at Key West, Florida, by Dr. F. Wurdemann.

The Algæ from Key West are generally so different from those of the Northern Atlantic, which I have hitherto chiefly studied, that I determined to submit them to the examination of the distinguished British Algologist, W. H. Harvey of Trinity College, Dublin, who by means of his extensive Herbarium and great familiarity with the Algæ of all parts of the world, could easily determine the proper position of the species which to me appeared new or doubtful. To this gentleman I am greatly indebted for his liberal communication of information, relating to many of our Algæ which, for want of standard collections in this country, I was unable to determine satisfactorily.

I am also indebted to the eminent French Algologist, Dr. Montagne, for interesting remarks upon some specimens which I sent to him.

A few additional localities are given of plants already included in the preceding portions of this list.

MELANOSPERMÆ.

*Sargassum vulgare*, Ag. Key West, Florida. Dr. F. Wurdemann.

*Padina Pavonia*, Lamour., fine specimens. Key West.

*Dictyota ciliata*, J. Ag. Key West. Fine specimens.

*Dictyota linearis*? Key West.

*Ectocarpus viridis*, Harv. mss. Charleston, S. C. "Not in fruit and therefore a doubtful species, but its color very remarkable." Harv.

*Ectocarpus fasciculatus*, Harv. Rhode Island. Common.

*Ectocarpus littoralis*, Lyngb. New Brighton, Staten Island.

*Chordaria divaricata*, Harv. Stonington, Conn. Fine specimens near the light-house.

## RHODOSFERMEE.

*Rhodymenia cristata*, Grev. Massachusetts Bay. Fine specimens of this interesting plant were given me by Miss Saltonstall of Salem, Mass. It has been found also at Newport and Staten Island, while in the Eastern Atlantic, according to Harvey, it is not found south of the Orkney Islands.

*Amansia multifida*, Lamour. Key West.

*Laurencia obtusa*, Lamour. Key West.

*Laurencia pinnatifida*, Lamour. Key West.

*Laurencia Baileyanum*, Mont. in litt. I had supposed this to be a variety of *L. dasyphylla*, but Dr. Montagne, to whom I sent some specimens of it, pronounces it new, and gives the following as its specific characters.

"*L. Baileyanum*, Mont. Fronde elongata filiformi subsimplici, ramentis subternis lineari-lanceolatis utrinque attenuatis erectis obsessa. (Individuum tetrasporophorum)." He adds, that "notwithstanding the close affinity of this Alga to *Laurencia tenuissima* and to *L. dasyphylla*, it cannot be confounded with either of them. The absence of ramification distinguishes it sufficiently from the first, and the form of the ramenta does not permit it to be referred to the second, from which it is in other respects quite distinct."

It occurs at Newport, R. I., Stonington, Conn., and Fort Hamilton, N. Y.

*Hypnea robusta*, Harv. mss. "A fine species quite new to me." Harv. Key West.

*Hypnea musciformis*, Lamour. Key West.

*Ceramium clavulatum*, Ag. Abundant at Key West.

*Ceramium fastigiatum*, Harv. Common at Newport, R. I., and Fort Hamilton, N. Y.

*Callithamnion Baileyi*, Harv. mss. "A distinct and beautiful species." Harv. Abundant at Fort Hamilton and New Brighton, N. Y.

*Callithamnion arachnoideum*, Ag. Rhode Island.

*Alsidium triangulare*, J. Ag. Key West.

*Polysiphonia* (Alsidium?) *Gibbesii*, Harv. mss. Key West.

"A very remarkable plant." Harv.

*Polysiphonia breviarticulata*, Ag. "A Mediterranean species, the Florida specimens very similar to the European but smaller." Harv.

*Polysiphonia variegata*, Ag. Very fine specimens near the light-house at Stonington, Conn.

*Polysiphonia nigrescens*, Grev. I collected beautiful specimens of a slender variety of this plant at New Brighton, N. Y.

*Polysiphonia Harveyi*, Bailey. A distinct and beautiful species which I found growing in considerable quantity on leaves

of *Zostera* at Stonington, Conn. Its habit distinguishes it at a glance from all other species, yet it is difficult to frame a description of it which will serve to characterize it; the following, however, are some of its principal characters. Frond two to four inches, rising by a single filament from a spreading root and almost immediately giving off one or more robust branches. These in their turn give off, at irregular intervals, long branches which are beset with short robust ramuli, the ultimate divisions of which are acute cones, at the apices of which a few slender fibres are attached. The plant is articulated throughout. Its color when fresh is reddish brown, when dry it appears nearly black. The fruit has not yet been observed. I take peculiar pleasure in making use of this beautiful plant to associate the name of Harvey with those of the other distinguished Algologists to whom species of *Polysiphonia* have been dedicated.

*Dasya elegans*, Ag. Spec. 11, 117 = *D. pedicellata*, Agardh, Syst., 211. To the localities of this beautiful plant previously given, I can now add Charleston, South Carolina, at which place it has been collected by Prof. Gibbs; and Fort Hamilton, New York, where it is very abundant.

Unless I am greatly mistaken, Agardh's *Sphaerococcus Torreyi* was founded on a battered specimen of this plant. I judge so from the examination of a fragment of the original specimen still preserved in Dr. Torrey's Herbarium.

*Dasya Wurdemanni*, Bailey. This species from Key West, which Harvey thinks is new, I would dedicate to Dr. Wurdemann to whom we are indebted for so many fine specimens of the Algæ of Florida.

*Spyridia filamentosa*, Harv. Key West, also abundant at Stonington, Conn.

*Gracilaria dura*? Ag. Key West.

*Gracilaria Helminthochorton*, J. Ag. Key West.

*Digenea simplex*, Ag. Key West.

*Halodictyon* sp.? "An imperfectly developed specimen from Key West, the only known species is from the Adriatic." Harv. *Rhodymenia palmata*, Grev. A small much divided variety has been collected at Charleston by Prof. Gibbs.

*Rhabdonia Baileyi*, Harv. mss. I found this plant several years ago at Staten Island, but for want of fruit-bearing specimens, its proper relations could not be determined. From the examination of dried specimens without fruit, Harvey at first supposed it to be a species of *Chrysimenia*, but after studying the fructification which I was recently fortunate enough to detect on specimens at Fort Hamilton, N. Y., and which I sent to him preserved in Goadby's solution, he was enabled to determine its true characters. He says, "It is not a *Chrysimenia*, the fruit and structure being that of the *Cryptonemea*, not *Chondriae*. Oddly

enough it agrees in structure with some Algæ from Van Diemens Land, on which I lately founded the genus *Rhabdonia*. The *tetraspores* only of the Tasmanian species are known, and the American specimen has only *favellidia*. The tetraspores ought to be ellipsoidal, divided by transverse rings, and to occur dispersed through the smaller branches."—Very fine specimens of this plant with abundance of fruit may be found in July, near Fort Hamilton and Bath, Long Island, N. Y.

*Chondrus Brodiaei*, Grev. Newport, R. I.

*Chondrus Norvegicus*, Lamour. Massachusetts Bay. G. B. Emerson.

*Ptilota plumosa*, Ag. Very fine specimens of variety  $\alpha$ , have been given me by Miss Saltonstall of Salem, who collected them in Massachusetts Bay. At Newport I could only find variety  $\beta$ , which is a much less elegant plant.

*Corallina officinalis*, Linn. Very abundant on shores of New England.

A number of species of *Corallineæ* collected at Key West by Dr. Wurdemann were presented to me by Prof. Gibbes, but as it is only recently that the vegetable nature of these bodies has been established, few of them are included in Algological works, and the determination of the species is attended with much difficulty; I hope, however, to present, at some future time, a list of our North American species.

#### CHLOROSPERMEE.

*Dasycladus clavæformis*, Ag. Key West.

*Acetabularia crenulata*, Lamour. Key West. Common.

*Conferva melagonium*, Web. et Mohr. Near Beverly, Mass. Dr. Asa Gray!

*Cladophora prolifera*. Key West.

*Cladophora prasina*, Harv. mss. "Its recent affinity is to *C. rupestris*." Harv. Abundant on rocks below low water mark in the Hudson River at West Point.

*Caulerpa concinna*, Harv. mss. Key West. "A most charming new species, allied to *C. Webbiana*, Mont., but very distinct. Most of the species are tropical." Harv.

*Anadyomene flabellata*, Ag. Key West. Rather common.

*Ulva latissima*, Linn. Key West.

*Dictyosphaeria favulosa*, Decaisne. Key West.

*Bryopsis plumosa*, Ag. New Brighton, N. Y., Miss Saltonstall! Charleston, S. C., Prof. L. R. Gibbes!

*Ectocarpus viridis*, Harv. mss. Charleston, S. C., Prof. Gibbes! "Not in fruit and therefore a doubtful species, but its color very remarkable." Harv.

*Enteromorpha compressa*, Grev. Charleston, S. C. Prof. L. R. Gibbes!

*Enteromorpha clathrata*, Grev. Staten Island, N. Y.

*Porphyra vulgaris*, Ag. Charleston, S. C. Staten Island, N. York.

*Porphyra laciniata*. Fort Hamilton, N. Y.

*Gnathum leve*, Bailey. I propose this name for a small microscopic plant which I have found growing in considerable abundance as a parasite on stems of *Nitella*. The whole Alga consists of a single irregular branching layer of green cells, which like those of *Coleochæte scutata* are closely adherent to the plant on which it grows, but it has no trace of the setiform processes belonging to that species. It appears to grow both by the addition of new cells and the spontaneous division of the old ones. In many of the cells one or more small vesicles, (zoospores?) similar to those in the spiral threads of *Zygnema*, were observed. No other traces of fruit have been seen. Its place in the systems must be near *Coleochæte*. Abundant on stems of *Nitella*, in ponds near West Point, N. Y.

*Lyngbya fulva*, Harv. mss. I found this forming erect tufts in small pools of water between high and low-water mark, in cavities of the granite blocks, composing the pier at Stonington, Conn. Whether its color has been affected by exposure to air and sunlight, I cannot say. Harvey says, "I do not know any thing like it."

*Lyngbya crispa?* Ag. A plant which grows in immense quantities in salt water ditches, near Hoboken. It appears to me to be identical with English specimens marked *L. ferruginea*, Ag., which I received from J. Ralfs, Esq., but Harvey says, "it agrees better with some specimens of *L. crispa*, Ag., under which name, probably more than one species are confounded."

*Oscillatoria Friesii?* Ag. A common plant forming erect tooth-like fascicles half an inch in height, among mosses on damp ground near West Point. I sent it by the name of *O. Friesii* to Harvey and he remarks concerning it, "this looks different from *O. Friesii*, but comes near it. It is, probably, a different species. But in the fearful confusion that reigns here, I have no fancy for making more names."

*Tetraspora lacunosa*, Chauv. in Duly. Bot. Gall. I am informed by Dr. Montagne that this is the same as the plant which I had named *T. perforata*, under the supposition that it was an undescribed species.

*Lemania Americana*, Harv. mss. This species is founded on an Alga which grows in rivers in Virginia, and which I had supposed to be only a variety of *L. fluviatilis*, Ag. Harvey remarks that "the European plant is very much more simple with distant nodules, the American one is much branched and quite moniliform."

*Hydrodictyon utriculatum*, Roth. This plant which is one of the most interesting of the fresh water Algæ, grows abundantly in ditches near the West Point Foundry.

From the above list it appears that the number of species of Algæ now known to occur in the United States, is as follows:

Melanospermæ, . . . . .	31
RhodospERMæ, . . . . .	59
ChlorospERMæ, . . . . .	82

or in all, 172 species, exclusive of Byssoidæ, Desmidiaceæ and Diatomaceæ. When it is considered that the study of our Algæ has as yet hardly commenced, it is reasonable to expect that very large additions will be made by further research.

We append to this article by Professor Bailey, a few observations on Algæ and the modes of preserving them, taken from "The Dublin University Museum."—EDS.

*Directions for Collecting and Preserving Algæ*; by Dr. Wm. H. HARVEY.

(From a Report by the Directors of the Dublin University Museum.)

"General Character of the Algæ.—The Algæ may, for popular purposes, be divided into four principal groups, viz. :—

"1. Fuci, or Olive-colored Sea-weeds, which are generally of large size, and leathery texture; sometimes membranaceous and leafy, and more rarely of a gelatinous or filamentous nature.

"2. FLORIDEÆ, or Red-colored Sea-weeds; cartilaginous and fleshy, membranous or gelatinous sea-weeds; often filamentous; of a red, purple, brown-red, or livid greenish-red color.

"3. CHLOROSPERMS, or Green Sea-weeds; membranaceous or filamentous; rarely somewhat horny plants, of a green color and simple structure.

"4. CORALLINES; vegetables coated with a crustaceous epidermis composed of carbonate of lime, either red or green when fresh, becoming white and often brittle on exposure to the air. (These must not be confounded with the true *zoophytes*, which often assume the appearance of plants.)

"Places of Growth, and Mode of Collecting.—The Algæ are found, in greater or less abundance, from the extreme of high-water mark to the depth of from thirty to fifty fathoms. Those within the reach of the tide are to be collected at low water, especially of *spring tides*, the most interesting species growing frequently at the verge of low-water mark, either along the margin of rocks partially laid bare, or, more frequently, fringing the deep

tide-pools left by the recess of the tide on a flattish rocky shore. Those which grow at a greater depth than the tide exposes, must be sought by *dredging*, or by dragging after a boat an iron cross furnished with numerous strong hooks, on all shores where such contrivances can be applied; but where dredging for deep-water plants is impossible, the collector must trust to finding his *desiderata* among the heaps of weed thrown up on flat shores after a gale. Even after ordinary tides many delicate species float ashore, and may be collected along the beach in a perfect state. Therefore, after visiting the more rocky places at low water, the sandy or shingly beach should always be inspected at the return of the tide. In collecting from heaps, care should be taken to select those specimens which have suffered least in color, &c., from exposure to the air, rejecting those that are *bleached* white.

"Collectors should be provided with one or two strong glass bottles with wide mouths, or with a hand basket lined with japanned tin, for the purpose of bringing home the smaller and more delicate species in *sea water*. This precaution is often absolutely necessary, many of the filamentous *florideæ* decomposing with rapidity if exposed, even for a short time, to the sun and air, or if allowed, to become massed together with plants of a coarser texture. All these delicate kinds,—to distinguish which can only be learned by experience,—must be brought home in sea water, and kept in it until they can be arranged for drying.

"A common vasculum, a basket, or a bag, will serve to bring home the larger and less delicate kinds; but even these should not be left so long unsorted as to allow of their becoming clotted together.

"In collecting algæ from their native places of growth, great care should be taken to pluck the whole plant from the very base, and, if it have an obvious root, to gather the specimen with its root attached. This is of much importance, and apt to be neglected by young collectors, who are satisfied with plucking branches or scraps, which often afford no just notions of the mode of growth, or natural habit of the plant from which they have been plucked, and which, in many cases, are wholly insufficient for the first purpose of a specimen, that of ascertaining its position in the system. In many of the leafy *fuci* (*sargassa*) the leaves which grow on the lower and on the upper branches are quite different; and were a lower and an upper branch to be plucked from the same individual, they might pass for portions of different species. It becomes of moment, therefore, to gather, when it can be done, the *whole plant, including the root*. It is true that the larger kinds may be *judiciously* divided; but the young collector had better aim at selecting moderate sized specimens of the entire plant, than attempt the division of large specimens, unless he keep in view that *every specimen should be an*