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NOTE ON A POINT IN THE HABITS OF THE DIATOMACEÆ AND DESMIDIACEÆ.

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Although most writers on the subject are in the habit of stating that many of the genera of Diatomaceæ in the living state are free, or non-adherent to other larger algæ or submerged substances, yet always since I first began the study of the Protophytes, as is well known to my fellow-students with whom I have from time to time discussed the subject, I have held that all species are, at some period of their existence in an adherent or attached condition, growing upon, for the most part, aquatic vegetation of a larger size. I have also frequently expressed the opinion that the adherent condition of any species was but temporary and conditional; otherwise I could not see how the wide distribution of forms, such as *Cocconeis scutellum*, an extremely widely diffused marine species usually found attached to larger algæ, or *Tabellaria flocculosa*, an equally cosmopolitan fresh water species found almost invariably attached, was provided for, as no motile spores of any kind are known to exist in this family, although such may be the case.

At the outset of my studies of these extremely interesting organisms I naturally accepted the classification laid before me by the authorities on the subject, and referred the forms I found to one or the other of the divisions of free or attached genera, and, in fact, went

so far as to construct and adopt terms expressing these two conditions. The adherent forms I grouped under the general head of Epiphytaceæ and the free under that of Eleutheraceæ. As my studies progressed, however, I was continually meeting with cases in which this arbitrary mode of division would not apply, and the natural conclusion come to was that the method was defective, as it did not agree with facts. At last I have thus to publish my conviction that such a division of the Diatomaceæ into free and attached genera does not exist in nature, and that most, if not all species are free at one peri d of their existence and attached at another. I have seen several species which are almost universally ranked as fixed species existing in a natural state free and possessed of motion which they never displayed in their attached condition. Although it is not my intention at the present time to go very deeply into this subject, yet I desire to record that I have noted the following instances of such occurrences among others of similar kind. *Gomphonema acuminatum* and a *Cocconema*, the species of which was not at the time determined, moved about in a vigorous manner when found naturally detached, and also when freed from their stipes by violence. Again, several years ago I made a gathering of *Schizonema cruciger*, a species which consists of siliceous frustules enclosed within tubes of membranous material growing upon other submerged matter, having its frustules free and swimming actively about upon the surface of the water without any signs of investing tubes, which, however, were found empty but standing erect and adherent at the bottom of the ditch inhabited by the *Schizonema*. I have noticed that bare stipes of an *Achnanthes*, without any pendent frustules, are by no means uncommon, and also *Gomphonema* stipes can be found in the same condition. In such cases, doubtless, the freed frustules might be found near by, and, in fact, I have in what may be called "free" gatherings, floating upon the surface of the water, observed *Cocconeis*, *Achnanthes*, and other forms which, at one time I was in the habit of classifying as Epiphytaceæ. Once I freed, by violence, *Schizonema Grevillei* and a *Synedra* which accompanied it, and they both moved about in a rather lively manner, although the motion of the *Schizonema* was much more vigorous than that of the *Synedra*. This was not remarkable, as the frustules of *Schizonema* and *Homœocladia* are well known to be freely moveable within their investing tubes, although I do not remember to have seen the fact of their activity without that enclosure recorded. The observance of these facts of the motion of the detached frustules of such well-known forms as *Schizonema*, *Gomphonema* and *Achnanthes*, calls up in the mind the question of the individuality of the Diatomaceæous frustule, and it is a point to which I would call the attention of students as one deserving and, in fact, calling for further and

searching investigation. If the whole frond of a *Homœocladia* with its myriads of enclosed frustules is an individual, then is the usually free *Nitzschia*, a single frustule of which can not be morphologically distinguished from a single detached frustule of *Homœocladia*, also an individual? and is a *Navicula* an individual as well as the group of similar forms enclosed within the tube of a *Schizonema* or the gelatinous frond of a *Mastogloia*? Again is a *Cyclotella* an individual as well as the long chain of discs which go to make up the frond of a *Melosira* or *Podosira*? Upon this point I shall, hereafter, have more to say, merely begging the record of an observed fact bearing thereon by students of this extremely interesting, and, I am convinced, important branch of natural history.

I desire to place on record that I have seen at least two, apparently and generally acknowledged free species of Desmidiaceæ, attached to a submerged aquatic moss. One was a *Closterium*, species not determined, which was for a long time (as during the most of last summer the specimens were growing in one of my aquaria) attached pretty firmly, by means of a true stipes or stalk of no great length, to the leaves of the moss, and that so strongly that it required some considerable force to detach it. By rocking the covering glass upon the slide, upon which the specimen of moss was placed during observation by means of the microscope, the *Closterium* could be made to swing about from side to side upon its stipes without becoming detached. The other species, observed at the same time, was a *Micrasterias*, and this was fixed, generally in pairs, to the same moss, by its broadest side, or by both valves, so as to present a "front view" (as it is termed when speaking of Diatomaceæ), to the observer, thus presenting an analogy to the genus *Epithemia* of that family which occurs growing after the same manner; *Cocconeis*, on the contrary, is attached by means of the whole of one of the valves. The stipes of the *Closterium* was, of course, at the end of the frustule where the valve comes to a point, after the manner of a *Cocconema*, which genus *Closterium* resembles much in form. In neither of these cases do I designate the species, as that I deem hardly of importance, the mere fact of Desmidiaceæ being found under such conditions being the important one. At the same time, it is as well to mention that these species were thus found during the month of August, or in the midst of the summer, the same forms having been observed free and moveable in the early part of the spring.

I have now to place upon record, my opinion that the Desmidiaceæ are governed by very much the same law as applies to their apparently near allies the Diatomaceæ; that is to say, that they are all at some period of their existence attached, and at another free.