VAUCHERIA AVERSA.

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All of our forms of Vaucheria are plants of exceedingly delicate structure. This together with their generally unicellular structure renders them especially liable to a certain type of injury. Risk of injury in this genus is extensive, but varies in certain species which live in rapidly running water or those which are terrestrial. The author found that filaments of *V. aversa* which were twisted so as to produce sufficient injury, a wall was formed in from two and one-half to four hours. In more severe injury, of this kind, however, a longer time was required for wall formation; for in one experiment where the filaments were twisted almost flat, an average of six hours was necessary.

The species of Vaucheria considered here is not as common as the other species of Vaucheria generally found in this locality.[1] It is a form that has been observed by the writer only once in the last few years and for that reason was not included in the list of algae previously cited.[1] It happens as somewhat smaller fuzzy clumps than are ordinarily recognized in some species found in running water. Low magnification shows that *V. aversa* forms comparatively few branches. These, however, are produced from all sides, rendering its appearance decidedly fuzzy, especially when placed in still water. This fuzzy appearance is less marked in rapidly running water since the filamentous branches are continuously washed in the direction of the flow of the water.

The broad filaments vary somewhat in diameter, some being more and some less than 100 u. as stated by Wolle.[2] The specimens were found by the writer growing in a stream where the velocity of the water was seven and one-half miles per hour. With this velocity of the water a clean green clump of *V. aversa* having a weight of eight grams and a volume of 35 cc. exerted a pull of 5.5 grams (average derived from experiments.) These facts account for the short clumps of filaments and agree with the observations of Klebs. An experiment in which two algal clumps were used each five cm. in length, gave the following result. One clump, in running water with a velocity of seven and one-half miles per hour, grew .5 cm. in length while the other mass, in still water, grew 1.5 cm. under favorable conditions in ten days.

The filaments of Vaucheria are not as easily broken or killed by a gradual continuous pull, as one might suppose, for the writer has shown that a force of 4,400 gravities acting for two hours did not kill the plants nor break the walls although the contents were driven to the centrifugal end of the unicellular filaments. An actively growing filament, without branches, 100 u. in diameter and 3 mm. long weighs

[1] Andrews, F. M. A List of Algae. Proc. Acad. Sci. 1909; pp. 375-380.
[2] Wolle, F. Fresh Water Algae of the U. S. p. 149, 1887.

"Proc. Ind. Acad. Sci., vol. 36, 1926 (1927)."

about .0009 gr.; therefore the increase in weight in air by the application of 4,400 gravities would be about 4.05 grams. This weight may be reached by gradual application and in a few cases, raised to 5.5 grams before the filaments actually broke, as was ascertained by attaching masses of gypsum of known weight. As would be expected, considerable variation in the strength of filaments of apparently the same size and vigor was demonstrated by the weight method. Part of the time that this plant was under observation, a heavy snow was on the ground and a general air temperature of —10°C. prevailed. The water, where the plants grew however, was not frozen, since it came from a power house and had a temperature of 60°C.

An average temperature of 11°C. surrounding the plants, was maintained at the time of experimentation.

With a temperature of 8°C. in still water, the formation of a few zoöspores was observed in plants from this stream. The zoöspores, however, increased in number when a temperature of 24°C. was attained by artificial means, but complete absence was observed above that point. Klebs found a minimum temperature of 3°C. and a maximum of 26°C. for zoöspore formation in the species studied by him. That running water decreased zoöspore formation, was also shown by Klebs, where in contrast to still water oxygen becomes a variable quantity. The effect of carbon dioxide, however, on zoöspore formation requires further study. Klebs also raises the question of the effect of excreted substances, on zoöspore formation but similar questions follow concerning the various substances given off by roots and other plants. Masses of *V. aversa* brought into the laboratory lived for weeks in the light, without notable change in vigor, when the water was frequently or continually renewed, but produced, under these conditions, only a few zoöspores. When, however, these specimens were darkened for 11 to 48 hours, numerous zoöspores were formed in still water as Klebs has shown for *V. repens*. Too much dependence on zoöspore formation, as influenced by darkness in this plant must not be assumed, however, since in *V. aversa*, and in other species of the genus, only a few or no zoöspores may be formed, at times. No certain experimental data has been ascertained that offers a satisfactory explanation for this.

An interesting fact was the large amount of oil that the specimens of *V. aversa*, here discussed, were able to stand. This oil came from the power house, above mentioned, in large quantities. The plants when taken to the laboratory were washed at first in a large amount of slowly running water for two days, and at other times for several hours on each of several subsequent days. This washing removed most of the large amount of densely adhering dirt. *V. aversa* resembles therefore, in this respect, *V. clavata*, which according to Kerner may collect and hold 100 times its weight of mud on the filaments of a mass. This mud is arrested, however, only by the dead plants. The washing failed to remove a considerable quantity of the oil which could be seen in clear droplets adhering to the filaments. The submerged form of this and other algae had no oil attached. Of the zoöspores that were formed when the plants were darkened for 11

hours, some did not germinate but others began to germinate in 5 to 10 hours. As usual one or two tubes were produced. In some other cases three or four tubes were produced, but in one spore, five tubes, normal in all respects, were sent out.

The chloroplasts of *V. aversa* were unusually numerous. Those filaments on the upper side of the clumps were crowded with chloroplasts. Frequently the ends of the filaments which are often more or less clear were very densely crowded with chloroplasts to the very tip. The filaments near or on the under side of the mass of *V. aversa*, showed about one-fourth the number of chloroplasts of the filaments on the upper side. An estimate of a piece of a crowded filament, exposed to light from the top side of a mass, showed about 12,000 chloroplasts, while a similar piece of a filament from the under or shaded side was estimated to have only about 3,000. This recalls the considerable difference between the number of chloroplasts in palisade cells which is often more than four times those of the spongy parenchyma of the same organ, as shown by Haberlandt. A comparison often shows 10 to 12 times the chloroplast surface exposure for *V. aversa* as for *Spirogyra longata*, which has but one chloroplast. This difference, however, would not be so great in a multi-chloroplast cell of Spirogyra.

A LIST OF ALGAE OF MONROE COUNTY, INDIANA II.

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In the 1909 "Proceedings of the Indiana Academy of Science" the writer[1] published "A List of Algae" most of which were found in Monroe County, Indiana. At that time 187 species were recorded. Since 1909 the writer has recorded other species of algae from Monroe County, Indiana, that has come to his attention, and append them in the following list.

It is clear that no complete list of algae, or other plants, may be made by the observations of a single year. The varying conditions of moisture, light, nutrition, temperature and other factors render it possible or impossible for the various types to appear. The different combinations of these conditions cause, at times, the meager development of only a few species or a prolific growth. Or, these conditions may cause repetition of the appearance or disappearance of the various forms in the same year or part of a year. *Vaucheria aversa*, which has occurred only once in the immediate vicinity of Bloomington in the last few years, constitutes a striking example of an algal form illustrating the influence of the untenable conditions that have prevailed over the greater part of a series of years. The same is true of other forms not mentioned heretofore for this county.

[1] Andrews, F. M. Proc. Acad. Sci. 1909 : 375-380.