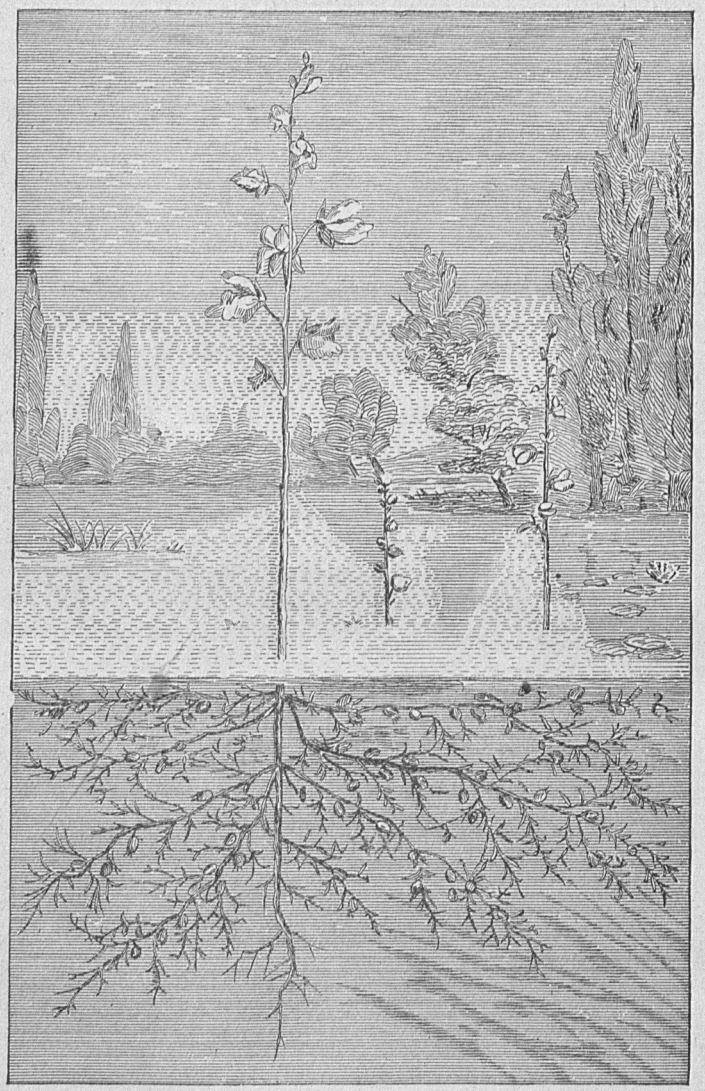
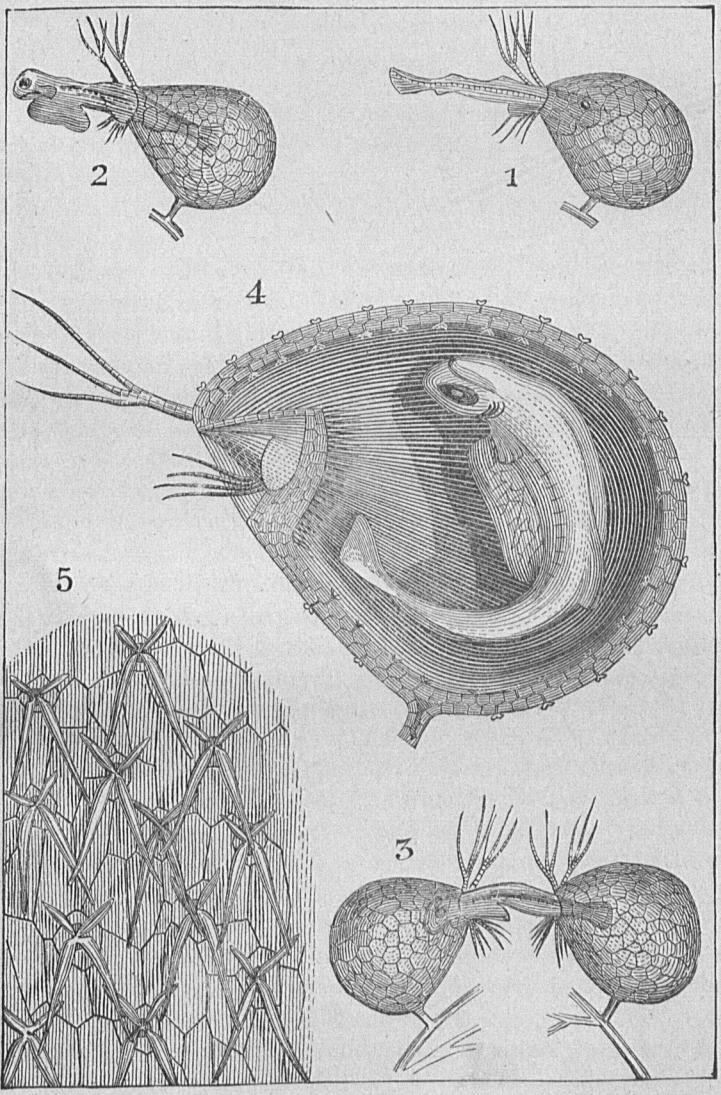


The Fish-catching Bladderwort (*Utricularia vulgaris*).



Details of the mode of capture of a fish by the *Utricularia vulgaris*.

Vol. V, No. 23. Washington, D. C. Sept. 15, 1885.

118.—PISCIVOROUS PLANTS.*

By E. HALPÉRINE.

The so-called carnivorous plants for some years, especially since Charles Darwin† made his interesting researches, have attracted the attention of naturalists, not only on account of the curious phenomenon itself, but more particularly because of the philosophical conclusion which may be drawn from it.

It is known that the ordinary plants draw from the soil by means of their roots the nutritive inorganic elements which they need, and absorb by means of their leaves and stems the carbonic acid of the atmosphere. It has thus been said that the plants play the part of intermediate working agents, transforming inorganic matter into organic elements such as alone can serve as food for beings belonging to the animal kingdom.

Although it was already known that nitrogenous manures or fertilizers of an organic nature were just as indispensable for the formation of plants, botanists were nevertheless surprised to learn that in carnivorous plants the absorption of organic elements was no longer going on as usual by means of their roots alone, but also by their leaves, which are more or less adapted to these new functions, secreting a genuine gastric juice, and transforming organic matter by a chemical process identical with the digestion of animals.

In fact all the experience, and the facts observed by Charles Darwin and his son Francis, by Hooker,‡ F. Cohn,§ Mrs. Treat, of New Jersey, and many other naturalists, prove sufficiently the fact of animal digestion by the leaves in these plants, particularly in *Dionœa muscipula*, and in different kinds of the *Rossolis* or *Drosera*. Many other plants, like the *Aldrovanda*, *Drosophyllum*, the *Pinguicula*, and the *Utricularia*, of which we shall have to speak specially, have also been mentioned as carnivorous plants. Professor Hooker adds the *Nepenthes*, and Drs. Mellichamp and Canby also class among them the *Sarracenia* and the *Darlingtonia*. It should be observed, however, that these last two kinds, as well as the *Utricularia*, cannot, properly speaking, digest nitrogenous matter. They simply absorb the products of the decompo-

* "*Plantes piscivores.*" From *La Nature*, No. 632, Paris, July 11, 1885. Translated from the French by HERMAN JACOBSON.

† Insectivorous Plants.

‡ J. D. Hooker: Address to the department of zoology and botany of the British Association. Belfast, August 21, 1874.

§ F. Cohn: *Beiträge zur Biologie der Pflanzen*. Part III, Breslau, 1875.

sition of the animals which they capture by means of their bladders, which constitute genuine traps, acting like mouse-traps when in the air, and like fish-traps when in the water or in a very humid soil.

As regards other carnivorous plants, nothing is wanting to make the analogy of their digestion with that of animals complete. There is the preparatory act, the capture of the living prey, and the essential act characterizing digestion, namely, the dissolution of an acid and of a special juice over food of a proteinous nature; that is, food that among its component parts contains nitrogen. Numerous experiments made by many botanists, especially those made by Francis Darwin,* have clearly shown, in spite of the doubts expressed by other naturalists, that animal matter, absorbed in the manner described, enters directly into the composition of these plants, and is exceedingly useful if not indispensable to their normal development.

Among the victims commonly found in the traps of carnivorous plants, as far as known till quite recently, there were only insects and small crustaceans. But a short time ago Mr. Simms, of Oxford, brought to Professor Moseley† a vessel containing a specimen of *Utricularia vulgaris* (Plate 1), and a number of small *Leuciscus rutilus*,‡ recently hatched. Many of these small fish were dead, and were held firmly between the valves of the bladders of this voracious plant. The English professor, being interested in this remarkable discovery, procured another specimen of the *Utricularia* and a supply of eggs and young of the *Leuciscus rutilus*. Six hours later he noticed that more than a dozen of the young fish had been seized by the plant. In most cases the fish are seized by the head (Plate 2, Fig. 1), and sometimes by the tail (Plate 2, Fig. 2). One of the little fish had even been seized by the belly, and another by its two extremities by two bladders at a time (Plate 3, Fig. 3). These last-mentioned facts seem to confirm the opinion of Mrs. Treat that the carnivorous plants seize the animal of their own accord, and from this opinion she draws the conclusion that there actually exists in these plants a characteristic nervous tissue. But numerous experiments made by Charles Darwin with one of these plants, the *Drosera*, by applying to it acids, alkalies, and alkaloids of various mineral or organic salts, show too great a diversity in their results to allow us to draw therefrom any definite conclusion. Mr. Planchon says with regard to

* "Insectivorous Plants" in Nature, January 17 and June 6, 1878. In the carnivorous plants, which Darwin subjected to a meat diet, the weight of the non-blooming part attained the proportion of 121, that of the floral stems 240, that of the seed grains 380, and of the young plants produced from slips 251, while in other plants it was only 100.

† Bull. F. C., vol. iv, p. 259.

‡ The *Utricularia* is a dicotyledonous monopetalous plant, belonging to the family of *Utricularia* or *Lentibularia*. Several varieties of this plant, especially the *Utricularia vulgaris, U. neglecta, U. minor*, &c., are also found in France, and even, though rarely, in the neighborhood of Paris, in ponds in the woods of Meudon, in the forest of Compiègne, &c.

this subject:* "The physiological equivalent of nerves is perhaps found in some of the elements constituting the tissue or the cellular contents of plants, which cannot be denied *a priori;* but sensibility, properly so-called, presupposes a perception of pleasure or pain, which, without further proof, cannot be attributed to the most excitable plant."

However this may be, once seized, the victim cannot escape from the jaws of the voracious plant. The numerous glandular thorns (or "processes," as Darwin calls them) which are found on the inside of the bladder, and protrude obliquely and in the back (see Plate 2, Fig. 5), resembling the barbs of a hook, prevent the prey from escaping, and by every movement entangle it still more in this trap. After having been swallowed completely the animal begins to decompose, assumes a viscous appearance, and is rapidly absorbed by the same glandular thorns which have in the beginning aided in the capture of the little fish. This is at least the supposition at present entertained by most botanists. Mrs. Treat, however, thought she could see in the bladder of the *Utricularia* a stomach, digesting in the same manner as in the *Drosera;* but Darwin entertains grave doubts as to the correctness of this opinion, for he has observed flesh and hardened portions of the white of an egg remain for three days in the space where the little animals died, without undergoing any change. He is rather inclined to think that they died of asphysia, after having entirely consumed the oxygen of the water in the bladder. He admits, however, that some special juice may accelerate the decomposition of the dead fish, in the same manner as the juice of the papaw-tree, well-known in the tropical regions, at first softens and afterwards rapidly decomposes meat exposed to its action. Planchon says, "We have here reached the vague line where different modes of nutrition seem to combine and intermingle." Whatever the process may be, when it is once changed the animal matter enters definitely into the composition of the carnivorous plant.

The beautiful *Utricularia*, whose handsome yellow flowers form an ornament of ponds, both in the Old and the New World, is therefore a genuine piscivorous plant. But curious and interesting as the discovery of this new phenomenon in plant life may appear at first sight, it is in reality only a special illustration of a general law, a necessary adaptation to the conditions of the element in which the plant lives.

In all the so-called carnivorous plants the roots, according to the observations of Darwin, are very little developed, and scarcely suffice to draw into the plant the water and the salts found in it in a dissolved condition. It is therefore quite natural that these plants should endeavor to obtain by some other process the nitrogen which is necessary for their life, and that their leaves should aid in performing the functions which their roots cannot entirely fulfill. In reality we must say,

*J. E. Planchon: "*Plantes insectivores*" in *Revue des deux Mondes*, February, 1876, p. 648.

with Van Tieghem, that all plants are carnivorous, and we add that it cannot be otherwise, for how could we in any other way explain the various transformations and the infinite changes of matter which constitute the marvelous equilibrium of nature?

119.—NOTE ON THE CLAMS OF THE PACIFIC COAST.

By R. E. C. STEARNS.

[Letter to Prof. S. F. Baird.]

I have examined the box of clams which just came to hand from Donald Macleay, esq., president of the board of trade of Portland, Oreg.

Mr. Macleay states that they are the Eastern clams, and found at Shoalwater Bay, Washington Territory, which is correct as to their original (indirectly) and present habitat. I was aware of the presence of these clams at the locality given by Mr. Macleay, some months ago, and it would be wise to put the matter on record. Captain Simpson, a public-spirited citizen of San Francisco, of the firm of Simpson Brothers, extensively engaged in the lumber trade, employing a great many vessels in their business, informed me that he had at one time (or at various times) sent up the coast by their captains a quantity of *Mya arenaria* for planting in Shoalwater Bay, and it, *Mya*, had multiplied wonderfully, and now (at the time of our conversation, May, 1884) this clam was abundant there. The clams planted by the direction of Captain Simpson were obtained by him in San Francisco, where *Mya* now "rules the roost," its increase in San Francisco Bay and excellent quality having nearly superseded the native clams, *Tapes* (or *Cuneus*) and *Macoma;* the latter being now seldom seen on the stalls of the fish-markets.

Mya arenaria, as I have heretofore stated,* was first detected on the eastern shore of San Francisco Bay, in 1874, by Henry Hemphill, who collected some rather small and somewhat delicate specimens. These he turned over to Dr. Wesley Newcomb, then of Oakland, Cal., for examination. Dr. Newcomb regarded them as a new species which he described as *Mya hemphillii.*† The largest specimen found at that time by Dr. Hemphill was scarcely two-thirds the size of the average of those now on the market stalls.

Following the completion of the transcontinental railroad about the year 1869–'70, some of the oyster firms in San Francisco commenced importing small oysters, *Ostrea virginica*, from the Atlantic side by the car-load for planting in San Francisco Bay, where in a season or so they attain a good merchantable size, and become exceedingly fat and of fine fine flavor. With these importations of small oysters, the spat of *Mya*

*American Naturalist, May, 1881.

†Proc. Cal. Acad. Sciences, November, 1874.