

## THE INSECT'S MORALITY.

—[See Darwin's translation, July 7, 1875.]

In the statement of Mr. Darwin's data, the reference to the *Proctor's History of the World of Insects* (p. 55) of John Marshall is the failure of "M. Irving."

This statement has been so often repeated that it is high time it should be reconsidered, or it will shake the morality of a *History of Insects*, Bishop Milner's name, or the names of "our friends" (Middletown Street, New York, 1855).

The story of the 100 *Virgins* has never been told in a lifetime save a passage of Matthew Paris, p. 520-521, *Worm*, 1688, which is as follows:—

"*Virgines Morsæ* . . . in hunc modum adhibetur, ut agnoscatur in terra illa universalem, ad quendam modum, hincque quo ratiōne agnoscatur."

I have in vain to detect John Marshall's character, if his numerous incomes the above passage and others (e.g. the *History of Insects*, p. 520) give simple evidence. But to suppose that in the thirteenth century it was possible for any one dead to hold 100 *Virgins* is an enormous absurdity. It is well that an effort should be made to prevent its repetition. R. F. LEACH.

## SCIENCE.

*Insectivorous Plants.* By Charles Darwin, M.A., F.R.S. (London: John Murray, 1875.)

All investigators will welcome Mr. Darwin's new work on this subject. It is needless to say that his observations have been made with his microscope and patience which so eminently characterize all that he does, and it is pleasant to notice that in the present work he has been aided notably by two of his sons, George and Francis Darwin.

The insectivorous habit of certain plants appears to have been first observed by our countryman Ellis, in the case of *Drosera*, as long ago as the year 1796; and somewhat later, in 1779-80, those of *Drosera* were independently described by Roth and Thunberg. From that time until recently, little was added to our knowledge of the subject. Indeed, the habit recorded were almost ignored, and even as lately as 1853 Thwaites boldly asserted that they were not true. The observations of the earlier authors, however, have not only been confirmed, but several additions have been made to the list of insectivorous species.

The modes by which insectivorous plants capture their prey are very different. In *Drosera* small insects are caught by a sticky secretion; in *Drosera* they are enticed into a trap with a springy, sticky, or glandular trap, in some of which are sometimes, but in a separate hole, found with other plants, probably because in that respect it is possible; in *Sarracenia* death is their snare, and they fall into a pit of destruction, the walls of which they are unable to climb; in *Dionaea* the leaves are in two halves, each with certain filaments so sensitive that when they are touched the two halves close like a trap.

The mechanism of *Dionaea* is very remarkable. Mr. Darwin placed a bit of filtering paper weighing 1/10 of a grain, so as to rest on three glands. Each gland, however, had only to support 1/10 of a grain, and yet all the three tentacles were stirred towards it. Again, he took two pieces of wax, 1/1000 of a grain, one being 1/10 of an

inch in length, and weighing 1/10 of a grain, and the other 1/10 of an inch in length, and weighting a trifle more. When he placed on two glands, on opposite sides of the same leaf, and in an hour and ten minutes these two tentacles were inclined half way towards the centre, while all the other tentacles of the same leaf remained motionless. The smallest particle which he found to have any effect weighed only 1/10 of a grain; and it is indeed wonderful that a pressure so infinitesimal should have been able to produce such a result. For we must remember that in order to induce the movement of the tentacles, the pressure must produce some change in the walls of the glands, extending them to transmit a water current throughout the whole length of the stalk, which consists of about twenty cells.

As to the sensibility of these plants to a touch is remarkable, still more marvellous in their susceptibility to chemical stimuli. A line 1/10 of a grain of carbonate of ammonia, given to a single gland, suffices to produce a well-marked effect. A minute drop, containing 1/10 of a grain of phosphate of ammonia, if held for a few seconds in contact with the gland, causes it to be inflated, and if a half is left unremoved for a few hours in a solution so weak that each gland could only absorb 1/10 of a grain, even this is enough to excite tentacles into movement. Mr. Darwin truly observes that there are perhaps the most remarkable facts recorded in his present work. Although, as he himself points out, there is nothing so delicate in them—since, in fact, every time we perceive an object, we have evidence that much smaller particles act upon our senses—will, the specialized nature and perfection of the sensitiveness of *Dionaea* is the more astonishing, as it possesses no nerves, nor as would appear from the chemical tests applied by Mr. Darwin, any diffused matter analogous to nerves.

The specialized nature of the sensitiveness possessed by *Drosera* and *Dionaea*, and by certain other plants, well deserves attention. A gland of *Drosera* (says Mr. Darwin) "may be touched by one, twice, or ten times, without any effect being produced, while the continued pressure of an extremely minute particle excites movement. On the other hand, a particle of glass (having only a corner laid on one of the filaments of *Drosera*) with no effect, but if touched only once by the slow movement of a delicate hair, the latter dies, and this difference in the nature of the sensitiveness of these two plants stands in manifest adaptation to their mode of trapping insects."

The remarkable also on the action of rain and wind are very interesting.

"In the case of *Dionaea* amongst drops of water, it appears, as in this Indian case, falling from a height on the filaments, did not cause the blades to close; though these filaments were afterwards proved to be highly sensitive. The blade, as in the case of *Drosera*, the gland is inhibited in the further closure of rain. Drops of a solution of salt or sugar, or even to a fluid source of water were repeatedly allowed to fall from a height on the filaments, but produced no effect, unless they allowed to them. Again, I observed that a few drops of a few minutes with my almost hair against the filaments without any effect, each touching being confined with a weak influence as to back in a heavy job

of wind. We thus see that the sensitiveness of the filaments is of a specialized nature, being related to a momentary touch rather than to prolonged pressure, and the touch must not be from fluids, such as rain or water, but from some solid object."

As regards the means by which the movements are effected, Mr. Darwin expresses his opinion that in *Drosera*,

"as in the whole, the belief that the walls of such cells contract, some of them contract might being at the same time forced upwards, perhaps would be best with the observed facts. If this view is rejected, the most most probable one is that the fluid contents of the cells shrink, owing to a change in these osmotic state, with the consequent sinking in of the walls. As before, the movement can hardly be attributed to the elasticity of the walls, together with a previous state of tension."

The quantity of insects destroyed by these plants must really be very great. Each leaf of a *Drosera* is capable of catching and eating many insects. Those of *Drosera* are not quite so voracious. Mrs. Tread, who has made many valuable observations on these plants, informs Mr. Darwin that she has known several leaves which caught three insects each; most of them, however, were not able to digest the third, but perished in the attempt. Five, however, managed three insects, but died of indigestion over a fourth. In addition to *Drosera* and *Dionaea*, Mr. Darwin describes several other insectivorous plants, especially *Aldrovanda*, *Dionaea*, *Sarracenia*, *Hobbitia*, *Helleborus*, *Pinguicula*, *Utricularia*, and *Gratiola*. In *Utricularia*, most species of which are water plants, there are several varieties, which constitute regular traps, having a hanging stem, which readily admits the entrance of minute insects, and which causes the animalcules, but ultimately prevents their escape. But although most of the species of *Utricularia* are aquatic, one species, *Utricularia montana*, from the tropical parts of South America, is said to be epiphytic. Nevertheless, its roots are also provided with filaments, which contain water, and appear to capture numerous minute animalcules.

Mr. Darwin says that "what tempted animals of such diverse kinds to enter the cavity beneath the lower tentacles, and then force their way through the little slit-like orifice between the valve and on into the bladder filled with water, I cannot conjecture." May I venture to suggest that when the earth is dry, little animalcules will be attracted to these reservoirs of water, just as, in the plains of South Africa, large game will travel miles to ponds, in order to quench their thirst?

*Utricularia*, however, though so doubt it derives an advantage from the force of the animals which it has captured, cannot be said to digest them. *Drosera*, as we have seen, when it has captured an insect, secretes an acid fluid, which acts upon the animal source. *Utricularia* secretes no such substance, but simply benefits by the ordinary process of decay.

Another point of great interest, which has been brought into prominence by Mr. Darwin's researches, has been the extraordinary similarity which exists between the digestive processes of animals, and the manner by which *Drosera* absorbs nutriment from its victims.

Extraneous as these microscopic plants may at first sight appear to us, we must remember that ordinary plants of the higher classes habitually possess their assimilatory, to a great extent, from dissolving natural and vegetable matter. Others, such as the mushrooms, are sustained by the juices of living plants. Between these and Travers, which kills and destroys insects, there is no doubt a great gap, but it is to a certain extent bridged over by the case of *Trichothia*, which, as Mr. Darwin has shown, does not truly destroy, but merely absorbs the products of the decay of animals which it captures. As regards the gradual process by which ordinary plants may have acquired microscopic habits, Mr. Darwin points out that,

"In them exist several plants the plants of which nature, as it is to be feared, digest animal matter, but in the case of animals and vegetable fossils, it is possible, perhaps, from the first stage onwards that of digestion. It might however happen, under certain conditions, that a plant, after having acquired the power of digestion, should degenerate into one capable only of absorbing animal matter in solution, or in a state of decay, or in the final product of decay—namely, the salts of ammonia. It would appear that this has actually occurred in a particular plant with the leaves of *Albizzia*, the same parts of which possess abundant organs, but no plants fitted for the assimilation of any digestive food, these being confined to the lower part."

On this point, therefore, Mr. Darwin is in the main agreed with Dr. Hooker, who, in his interesting address to the British Association at Bath, said—

"The distinction between plants which absorb dissolved substances, and those which make a similar use of solid structures, is not very great. We may imagine that plants which actually assimilate the assimilation of insects in some parts of their structure, and the practice which developed because it was found to be useful."

Both Dr. Hooker and Mr. Darwin agree in deriving from the interesting facts, in a line of which selection has been made, at this circumstance, that although, to use Dr. Hooker's words,

"the process of photosynthesis are in general extremely different from those of animal nutrition, and involve very simple processes, yet the complexity of plants is not absolutely proportional to the number of parts such as that by which the products of animals is assimilated, since the products of their photosynthesis of microscopic plants will find their place, in one more 425 in the continuity of Nature."

ELIAS LITTLE.

Several Greek inscriptions of the British Museum. Edited by C. F. Newton, Keeper of the Greek and Roman Antiquities. Part I. ALEXA. Edited by the Rev. E. L. Davis, M.A. (Oxford). Printed by order of the Trustees at the Clarendon Press, 1873.

(Review Notice.)

In our first article we dealt with the general character of Mr. Hicks's work in this important volume. In connection with it, however, a somewhat extended notice, though they cannot be adequately described in an article of the length available in this journal. We

must content ourselves with referring to what is most important, but the whole deserves careful reading, and will, if we include not, suggest several new lines of study in the rising generation of English scholars. The material of antiquities, German, French, and Greek, as well as English, that Mr. Hicks exhibits is very satisfactory and inspiring. Of the eight chapters into which the material is divided, the first, second, and fourth are the fullest of interest. The first consists of dozens of the city and people and temple of Athens, and of several *Albizzia* forms. Of these we may make special reference to no. 2 on the re-decoration of the of the *Albizzia*, which Mr. Hicks, on paleontological grounds dates as not later than 450 B.C., since five years earlier than (though his placed it), and to no. 5, which he sets is probably supplementary to the decree passed on the re-decoration of *Albizzia* in 425 B.C., doubling the tribute of the subject-ally. The reality of this proceeding was contended by Heron (vol. ii, p. 149 note), but is now generally accepted, and is treated by Mr. Hicks as an acknowledged fact. There is, however, still some room in doubt the statement as to exact date if recorded in the direct form—*Albizzia* in 425 doubled the tribute of the subject-ally. Our authorities here are Aristotle at Page 2, Pseudo-Aristotle in *Metaphysics* 17, and Aristotle in *Metaphysics* 106, and the date of the date themselves which may be found in Kirchoff on 27 (the other place of the year 425) and 228-274, and in a third table pp. 492-494. No authorities and authorities contradict the tribute during the Peloponnesian War was more than 1,200 talents, while we know that in the time of Pericles it was about 600. Pseudo-Aristotle also refers the increase directly to *Albizzia*, but his statement is in uncorroboratedly incorrect, for he says that he had not doubted the contributions of out of the allies. Now the tribute that alone this not to be true, for in twenty-five years since it remained nearly the same, and in so on the amount of 1,200 talents, and it is not the tribute of *Albizzia*. Undoubtedly the tribute are too heavy to enable us in many places, but wanting only some where the figures for each year are preserved, the tribute of the year 425 is just about half as large again as that of the preceding year, not double. The portion of it, the *Albizzia*, is to be valued more than double, and here the tribute is less numerous. But then it must be remembered that make the proportion for the other states considerably lower. While, therefore, we may believe that the tribute was raised during the war to a maximum of 1,200 talents, it is certainly not proved that it was done at one blow. A great increase no doubt took place in 425, and perhaps at the instigation of *Albizzia*. If so it will have been almost his first and its public life, and one of very characteristic and scarcely honorable ability.

Chapter II, on Finance, contains some remarkable documents from the Acropolis, illustrating the speech of Pericles on this subject in a striking manner (Thucyd. I. 103). Such are the accounts of distributions of money from the store 428-415 and 412, chiefly from the *Diplotheion*, or chamber behind the Parthenon, the great treasury where the tribute of the *Albizzia* confederacy was stored. In the first of them, no. 21, there the entry of 800 talents for the way in Sicily, according to Heron's excellent translation, indicates the sum sent out for the support of the force of Sicily in the spring of 424 (cp. Thuc. vi. 74, 93, and 74). In the latter Mr. Hicks inclines to trap "payments made on account of the troops engaged in Sicily, such as *Albizzia* and *Chios*" (Thuc. vi. 85, 84). Two others of these documents are lists of the several treasures of the Perseus, or vessels at the eastern entrance of the Parthenon, consisting almost entirely of silver cups and bowls, of lamps and mirrors. Two more represent the contents of the *Hekateion* or cella, which contained a rather large variety of vessels, and generally of gold. The last inventory there covers more than half the period of the great war, i.e. 425-411 inclusive, and are good specimens of such documents, which are found in an almost continuous series from the dedication of the temple to the fall of Athens (425-404). The British Museum possesses no list of the treasures of the *Hekateion* in its present division, the *adyton* or Parthenon proper, in which the gold and ivory statues was deposited, of a late order than the last mentioned event. In these lists only elsewhere things are remarked there is no mention of the statue itself or of the silver-footed chair of Herakles. The Museum has, however, no various documents belonging to this subject, of the time probably of the severely which succeeded (no. 22). Mr. Hicks has the credit of being the first to edit this remarkable fragment (Heron, vol. ii.), which seems to be not only an inventory of the various sacred treasures before this time kept distinct, but also an account of distributions made to officials called *Albizzia*, who must have succeeded for the time to the functions of the *Hekateion*, or as indication of the treasury of the confederacy. While on the subject of temple treasures we must refer to the inventory of Arsenius Hieronymus—namely in *Antiquaria*—which described a most wonderful repository of women's clothes dedicated to that goddess by the mothers and mistresses of Athens between the years 220-233 (cp. 84). Mr. Hicks shows clearly that many of them were in actual use, and makes some suggestive remarks on the circumstances under which they were probably placed there.

The commentary on no. 23, by Mr. Newton, deserves special attention. It contains a very full description on the *Hekateion* and its divisions into the various compartments of the temple of Athena Polias and Parthenon, and on the position of the sacred wooden statue, the sacred *alabastra*, and the *adyton*, which made this building the true centre of *Albizzia* religion, though sanctified by the Perseus.