INSECT-EATING PLANTS.

An Interesting Abstract of Darwin's New Book.

The Carnivorous and Insectivorous Members of the Vegetable Kingdom Hunted Up and Described.

How They Eat and How They Digest--What Is Food and What Is Poison For Them --Their Habits, Tastes, Surfeits and Peculiarities.

The great reputation of Dr. Darwin, and his undoubted ability in certain branches of natural science, entitle all his writings to respectful attention, and to the consideration due a man of his scientific attainments. His previous writings on the Origin of Species and the Descent of Man, have been very severely criticised, but with all the ridicule heaped upon him, and the adverse criticism of his opinions and conclusions, none of his detractors have scaled the heights of science to which he has attained, and he stands pre-eminent as one of the first, if not the very first, scientist of the day. The research necessary in order to prepare for publication even the least of his volumes, involves the labor of years. In all his scientific examinations he displays a degree of critical acumen, and a patient sifting and discriminating of facts that entitle him to great credit as an original investigator, and as a theorist of no mean order. His last work, "Insectivorous Plants," published by Appleton & Co., New York, and presented us for examination by Gray, Baker & Co., 407 North Fourth street, St. Louis, in the multiplicity of its facts and figures, in the careful and scientific arrangement of data, and in the general plan and scope of the work, shows that in his old age he has lost none of his ability, but rather that his vigor has increased with his years.

INSECT-EATERS.

It has long been known that certain plants possessed the power of catching and killing insects, but until late years it was never suspected that these insects so caught contributed to the nurture of the plants, or that the latter themselves derived any benefit from their captures. Dr. Darwin, acting on a principle he had found to hold good in every other branch of science, that nothing was done without a cause and no motive power was ever wasted, was the first man to undertake a scientific examination of the phenomena displayed by this class of vegetable life, and to arrange his observations in such form as to afford data for the future historian of such branches of science. To the unscientific man the watching of a few insignificant plants may appear a small matter for observations continuing through a series of years, but let us remember that all science has its origin in just such patient observations as these, the result of which Mr. Darwin has given to the public.

The bulk of his observations is given to the *Drosera rotundifolia*, or common sundew, but he included in his examinations all other plants whose leafy apparatus was specially adapted to the capture and destruction of insects. During the summer of 1860 he was surprised to find how many insects were caught by the sundew. He had previously heard that insects were so captured, but nothing further on the subject had been brought to his notice, and until that time he had given the matter no special attention. As the plant was extremely common in England, he at once began his researches, and continued them at intervals ever since up to the present time.

The leaf of the sundew is quite small, but round and covered with a number of tentacles, of varying lengths, the longest being at the edges of the leaf, and the shortest at the center. Each plant has from two to six leaves, and each leaf an average of 192 tentacles. These somewhat resemble hairs, and have at the end furthest from the leaf a sort of gland producing a viscid fluid. This proving attractive to insects, they alight, and entangle their limbs in the drop of secretion, which in appearance resembles dew, and are at once secured. The tentacles, excited by the presence and struggles of the insect, turn toward the center of the leaf, and if the fly or other insect chance to alight on an outer gland, the supporting tentacle inflects toward the center, carrying its prey along with it, which is then passed by a curious rolling motion on to the center of the leaf, when the filaments from every side bend inwards, thus inclosing the victim.

This process so quickly described is slowly performed, the inward inflection often requiring several hours, and in some cases days, for its perfect performance. There is, however, no necessity for haste, since the insect is generally dead in a few minutes from suffocation by the thick secretion. Being conveyed to the center of the leaf, the tentacles remain inflected over it often eight or nine days, the gummy fluid all the while being secreted in abundance; they then slowly unclose, and at the end of two weeks are again in position for another victim. It is worthy of notice that at each succeeding capture the tentacles act with less rapidity than before, and if overcrowded with prey, the leaves will die in the attempt at inflection.

THEIR DIGESTION.

It is evident that the plants of this character are benefited by their captures, since their roots are very small—not at all proportioned to the size of the plant—and seem, from Darwin's examinations, to draw little from the earth but water. That the insects caught are digested there is abundant evidence. The drops of fluid at the extremities of the tentacles become intensely acid when inflected over an exciting object, and in other ways indicate the possession of all the properties of a true gastric juice. Darwin's investigations show, moreover, that not insects alone, but any nitrogenous substance, is sufficient to excite the leaf to vigorous action.

He experimented with almost every conceivable substance, and faithfully recorded the results of his observations. Meat, flour, insects, bits of glass, wood, cork, sponge, paper, thread, moss, and quill, coal cinder, infusions of cabbage, mushrooms, and a hundred other articles, were all placed on the leaves, and over them all the tentacles became more or less inflected. Not satisfied with these experiments, Darwin tried the effect of various acids, alkalies and salts, and with effects as various as the experiments. It is almost inconceivable how a man could take so much pains in investigating the properties of a little leaf not more than half an inch in diameter.

He finally ascertained that the gastric juice of the sundew had the property of dissolving any and all nitrogenous substances, but that gluten and inorganic bodies eluded its power. Although the tentacles of the plant were excited by them, the excitement was neither so great nor so long continued as when bodies containing nitrogen were used. Little cubes of beef and of the albumen of egg, one tenth of an inch square, were dissolved and assimilated; and in general all nitrogenous substances, which the human gastric juice would affect, were also acted on by the secretion of this singular little plant. When a cube of roast meat was placed on its leaf, and the process of digestion inspected with a microscope, it was shortly found that the edges of the cube were gradually eaten away, and the whole finally dissolved.

The pressure on the glands at the ends of the tentacles is the cause of the movement along the whole stalk; but motion can be excited by a pressure so inconceivably small as to be altogether imperceptible by any other means. Darwin weighed a hair, and then divided its length into such small pieces that each one weighed only the millionth part of a grain, and yet a piece of hair of this weight caused the tentacle to inflect very perceptibly. The glands appear to be acutely sensible to the slightest pressure, though an occasional touch causes very little inflection.

SELF-PRESERVATION.

The quality of sensitiveness to pressure, associated with an insensibility to touches or sudden jars, is of great value to the plant, since much useless labor of expansion and contraction is avoided. Darwin found that not even the slightest inflection was caused by drops or even by streams of water falling on the leaves; which fact is important, since it shows the plant is not affected by rain. As it must often be brushed by the swaying leaves and foliage of other plants, insensibility to sudden touches is also of some utility. Though one or two quick touches did not excite the tentacles to action, a succession of sudden jars caused a very slow and uncertain inflection.

The effect of heat on the leaves was to stimulate them to more energetic action, until a certain degree was reached, after which, of course, the plant died. It is thus evident that the leaves are more vigorous in a warm than during a cool day, and this also is a wise provision, since insects are more abundant in warm than in cool weather. Immersion in cold water had no effect on the tentacles, and subjecting them to the action of various acids in a state of dilution invariably caused the tentacles to inflect.

A singular fact was observed, that the more poisonous the acid, the stronger and quicker the inflection. Alkalies and salts caused sometimes inflection and sometimes expansion, the effect not being constant. It is worthy of note that a solution of meat or of cabbage caused the leaves to become inflected as strongly as living insects, showing clearly that it is the nitrogenous principle which exercises the exciting influence. All substances which contained even a trace of nitrogen were greedily seized, but others, though they were covered by the tentacles, were soon rejected.

Darkness appeared to have no influence over the tentacles, since they acted as readily in the dark as in the light. When innutritious substances were grasped, the plant soon discovered its mistake and released them. Small, shelly beetles were apparently hard to digest, for sometimes the tentacles would remain inflected over them for ten or twelve days before re-opening. When the beetles were afterwards examined, all the nutritious portions had disappeared, had been digested, and only the shells were left. This circumstance evidently shows the similarity of the plant's secretion to the gastric juice of animals, since it is well known that the latter has no effect on the shells of beetles.

OVERFEEDING.

The effect of overfeeding these plants is the same as of overfeeding animals. The digestive power of the leaves becomes impaired, and the leaves, and sometimes the entire plant, die from surfeit. On each successive trial at digestion the effort became feebler and the inflection of the leaves slower and less decided than before, until in the third or fourth attempt the leaf died. This fact was more evident in an American plant of similar species, many leaves of which could not digest even one large insect, and few could manage the third. So plants can be overfed, and suffer from the effects of stuffing as acutely as animals. Dr. Darwin tried to make the sundew digest pure gluten, but it could not be done. The tentacles were readily inflected, and gave symptoms of strong excitement, but the stimulant was too powerful; the glands which were in contact with the gluten turned black and died, and the plant in other ways gave evidence of excessive stimulation. While the leaf may be unduly stimulated, it may also be narcotized. The vapor of camphor, ether, alcohol, chloroform and other substances, in large doses, proved poisonous, while in small portions it acted as a narcotic, greatly delaying the subsequent action of the leaf. As a rule, whatever injured or destroyed animal life, also impaired or destroyed the life of this singular little plant.

A great variety of experiments were made to ascertain how the sensation was communicated from one part of the leaf to the other portions, but on this branch of the subject Dr. Darwin could ascertain nothing conclusive. That the plant had organs analogous to nerves could not satisfactorily be determined. Sensation was communicated in some way, but how, is still doubtful. The only portions of the leaf which possess feeling are the tentacles, because irritation of the under sides of many leaves produced no result whatever. When a tentacle was beheaded, so that the gland was cut off, the remainder still retained power for one or two inflections, but no more, and soon died. Crushing the gland with a pair of fine pincers had the same effect as beheading the tentacle.

Experiments which Dr. Darwin made with the pollen of flowers on the leaves of the sundew, show that the leaves have a strong appetite for this substance, and that it is quickly dissolved. Placing seeds of different plants on the tentacles, the latter became inflected, and remained so for a considerable time: the seeds, on removal, showed no apparent change, but when planted refused to germinate, thus confirming Darwin's supposition that the secretion had penetrated their coats and affected their substance. Thus, pollen, which must often be blown on the leaves, is relished, while seeds which may occasionally lodge there bestow but little nourishment on the plant, and insects, which always abound, are its natural food.

OTHER FLY-CATCHERS.

Besides the sundew, there are several other plants in various parts of the world which possess the power of capturing insects. Chief among these is "Venus' fly-trap," a plant found in the eastern part of North Carolina. Its leaves form two lobes, each fringed by a row of spikes, and on the inside of the leaf there is a sort of fragrance very attractive to insects. These enter, and with a sudden snap, the leaf closes over them and remeans closed until they are digested. The operation of digestion usually occupies several days; the leaf then slowly uncloses, and remains somewhat torpid for some time. Instances have been known where a leaf digested four or five insects, but very seldom can it manage more than two.

The difference in constitution of the sundew and Venus fly-trap shows each well adapted to its own necessities. The former has no need of rapid motion, because its prey is already entangled by its thick secretion; the latter has no secretion, and, consequently, needs to capture the encroaching insect at the instant the latter touches its leaf. Strange to say, the Venus fly-trap is not caused to close by drops of rain, and has thus the advantage of absorbing ammonia from the rain water. The secretion in the leaf of this plant, after a capture has been made, is very copious, acid, and similar in character to the secretion of the sundew. When the leaf has been powerfully stimulated by living insects, the fluid is so abundant as sometimes to roll in drops off the leaf.

There are numerous other plants which possess capturing power, but only one more will be noticed. This is a marine plant, which bears on its stalk leaves hollow, and closely resembling a small inverted balloon. The mouth is uppermost, and consists of a small slit in the top of the leaf. The marine insects have a habit of prying into every minute aperture, and attempt to enter this one. Its inclosing lobes resist pressure to a certain extent; then suddenly opening and retracting draw the offending insect into the interior, whence it never escapes. This plant does not immediately kill the insect, but allows it to live sometimes for days. It is probably benefited by the decaying matter from the dead bodies of the captured insects.

On reading a volume containing so much research on so apparently trivial a subject, the curiosity is naturally excited to conjecture what particular theory the author is endeavoring to build or to bolster up. Fortunately, in this case the task is not difficult. Mr. Darwin, as is well known, is an evolutionist, and his whole life has been spent in an endeavor to prove that all existence has been developed from primordial cells, by regular and continual gradations and progressions. Any fact, then, that will serve as the connecting link between the animal and vegetable kingdoms is precious in his eyes, and so important to him as to be worthy of the most careful examination. In the investigation of the characteristics and habits of insectivorous plants, he has, therefore, shown the same patience and the same diligence as when searching for the evidences of the "Descent of Man." While his latest work, like other scientific productions, will not be widely popular, it is, nevertheless, a contribution of no mean value to the aggregate of scientific knowledge.

IN Italy a traveler has got himself in trouble through owning a too intelligent horse. This animal, whenever any person was met or overtaken on their road, threw himself in the same so as to stop his progress. Some people handed out their purses at once; some produced pistols and opened fire. It is supposed his former owner was a gentleman of the road.

MR. MORAN, United States Minister to Portugal, is ill. His indisposition is attributed to the privations he experienced during the wreck of the steamer Boyne.