INSECT RATING PLANTS.*

Mr. Darwin's works are always most valuable, and always contain matter for grave reflection and careful study, available to those who understand the topics with which they deal. His greater works, to which he owes his high fame as a discoverer, and his still higher if not more enviable reputation as the joint author of the most striking of the many novel theories of the age—his books on the Origin of Species, have this further advantage and attraction, that they can be understood if not fully appreciated by men of ordinary culture and of a slender acquaintance with either science or natural history. But his later writings are often more technical and difficult, and the work before us, a monograph on insectivorous plants, dealing with a single species of vegetable monstrosities or natural curiosities, will be unintelligible to nine in ten of those who read the Origin of Species with interest and profit. A clever student might, with Mr. Darwin's permission, easily abridge and popularise the volume in such a fashion as to render its information available to the world at large; giving merely the general results of the vast multitude of chemical experiments which are here recorded, putting the facts that affect the main argument in a clearer light, and reducing the history of the half-dozen genera of plants described into simpler and fewer words; also, perhaps, drawing a few inferences which Mr. Darwin has omitted. But all the material of such a work, and very much more, is contained in this volume, and a judicious reader may extract from it in a couple of days all that can be understood by one who is neither chemist nor botanist. To those who are, the work is a new treasure of great value; but a mere fragment dealing with one exceptional phase of nature's operations, and contributing little to any general theory or large speculation regarding the fundamental principles by which those operations are governed.

It has been long known to botanists that there are certain plants endowed with special apparatus for catching and killing insects; but how and why they catch them, and whether the captives serve in any and in what way as food to the captors, was imperfectly understood. Mr. Darwin has solved these questions. He shows that the leaves which catch insects are provided with means of digesting and absorbing the greater part of the animal matter they seize. It is not that the dead insects are conveyed to the ground and serve as manure to the roots. The plants in question are for the most part possessed only of very few and slight rootlets, calculated to collect water, and little else, for the supply of the plant. The insects do not fall to the ground. They are clasped and held by the leaf, its tentacles, or its margins; it secretes and pours upon them a liquid analogous to the gastric juice, which enables the animal stomach to liquefy and digest food to be absorbed by the vessels which carry on the intermediate processes of nutrition, a liquid containing the two essential agents in digestion, pepsine or an equivalent, and acid juices; and then it absorbs the liquefied nourishment, and passes it into the general body of the plant. The leaf generally dies after digesting a certain very limited amount of animal matter; and it is plain that it forms for the time being a mouth and a stomach for the plant at large, which reverses the ordinary course of nature, and feeds vegetable tissues with animal nutriment, instead of digesting vegetable food into the nutriment of animal tissues.

Of these vegetable insect eaters, the first in order and most familiar is the common Drosera or sundew. It grows in boggy and damp heathy situations; it sends forth a slender root of one or two small fibres; and put out leaves of inconsiderable size, their upper surface covered with minute tentacles or bristles, each having a long head, which is in structure a secreting gland. Those in the centre of the leaf are small and stiff; those towards the margin grow longer and more flexible in proportion to their distance, so that the bristles of each half of the leaf can close over an object resting just on that side of the centre, or all can close together over one caught in the centre itself. All the glandular tops of these tentacles are covered with a viscid matter, in which an insect sticks fast. If the prey be caught by central tentacles, the outer close inwards upon it; if by an outer one, this gradually bends in towards the centre, and the others close in around it, so that in either case the ultimate position of the prey and disposition of the leaf is the same:—

"When an insect alights on the central disc it is instantly entangled by the viscid secretion; and the surrounding tentacles, after a time, begin to bend, and ultimately clasp it on all sides. Insects are generally killed, according to Dr. Nitschke, in about a quarter of an hour, owing to their tracheæ being closed by the secretion. If an insect, adhered to only a few of the glands of the exterior tentacles, these soon become inflected, and carry their prey to the tentacles next succeeding them inwards. These then bend inwards, and so onwards, until the insect is ultimately carried by a curious sort of rolling movement to the centre of the disc. Here, after an interval, the tentacles on all sides become inflected, and bathe their prey with their secretion, in the same manner as if the insect had first alighted on the central disc. It is surprising how minute an insect suffices to cause this action. For instance, I have seen one of the smallest species of gnat (Culex), which had just settled with its excessively delicate feet on the glands of the outermost tentacles, and these were already beginning to curve inwards, though not a single gland had as yet touched the body of the insect.

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It takes the leaf nearly a day, or more, to clasp the insect, and twice or thrice that time to make its meal and allow the tentacles to re-expand. For some time afterwards it is torpid, like an animal gorged with food, and if another insect is caught the motions are slower and the period of digestion longer; and if too fortunate and too frequently fed the leaf perishes. It is a notable fact that a *touch*, even if sharp, will not cause the tentacles to bend inward, while a resting weight, however small, has that effect. They are meant to catch insects by their viscid secretion, and, once caught, the creature can hardly escape.

"The fact of a single touch, or even of two or three touches, not causing inflection must be of some service to the plant, as during stormy weather the glands cannot fail to be occasionally touched by the tall blades of grass, or by other plants growing near; and it would be a great evil if the tentacles were thus brought into action, for the act of re-expansion takes a considerable time, and until the tentacles are re-expanded they cannot catch prey. On the other hand, extreme sensitiveness to slight pressure is of the highest service to the plant; for, as we have seen, if the delicate feet of a minute struggling insect press ever so lightly on the surfaces of two or three glands, the tentacles bearing these glands soon curl inwards, and carry the insect with them to the centre, causing after a time all the circumferential tentacles to embrace it. Nevertheless, the movements of the plant are not perfectly adapted to its requirements; for if a bit of dry peat, or other rubbish, is blown on to the disc, as often happens, the tentacles clasp it in a useless manner. They soon, however, discover their mistake and release such innutritious objects."

The opposite is the case with the exotic Dionæa Muscipula (Venus's Flytrap). Here a number of filaments rising from the middle of the leaf are so sensitive that a single touch upon them causes the two lobes of the leaf to come together, enclosing the prey that has touched the filaments in a sort of reticule-shaped prison, the interior walls of which are covered with absorbent and secretive glands, possessing much the same powers as those of Drosera, though acting in so different a manner. The Dionæa leaf catches larger prey than the Drosera, digests more slowly, is more torpid after re-expansion, more easily gorged, and performs its functions more seldom, and for shorter a period. When it has digested four or five insects its powers seem to be totally exhausted, and its life ended. It is even less dependent on roots than the Drosera, and can dispense with soil entirely, if there be a sufficiency of insects within its reach. The leaf is edged with spikes, which perform a curious and important part in selecting the prey most suitable to the conditions under which the "fly-trap" acts.

"We are now prepared to understand the use of the marginal spikes, which form so conspicuous a feature in the appearance of the plant (fig. 12, p. 287), and which, at first, seemed to me, in my ignorance, useless appendages. From the inward curvature of the lobes as they approach each other the tips of the marginal spikes first intercross, and ultimately their bases. Until the edges of the lobes come into contact, elongated spaces between the spikes, varying from the 1-15th to the 1-10th of an inch (1.693 to 2.54 mm.) in breadth, according to the size of the leaf, are left open. Thus an insect, if its body is not thicker than these measurements, can easily escape between the crossed spikes; when disturbed by the closing lobes and increasing darkness, and one of my sons actually saw a small insect thus escaping. A moderately large insect, on the other hand, if it tries to escape between the bars will surely be pushed back again into its horrid prison with closing walls, for the spikes continue to cross more and more until the edges of the lobes come into contact. A very strong insect, however, would be able to free itself, and Mrs. Treat saw this effected by a rose-chafer (Macrodactylus subspinosus) in the United States. Now it would manifestly be a great disadvantage to the plant to waste many days in remaining clasped over a minute insect and several additional days or weeks in afterwards recovering its sensibility, inasmuch as a minute insect would afford but little nutriment. It would be far better for the plant to wait for a time until a moderately large insect was captured and to allow all the little ones to escape, and this advantage is secured by the slowly intercrossing marginal spikes which act like the large meshes of a fishing net, allowing the small and useless fry to escape."

We pass over a variety of plants more or less akin to those already described, and having no remarkable characteristics of their own, among which the Aldrovanda vesiculosa, a kind of aquatic Dionæa, of small size and not very interesting structure, is perhaps the most important. Enough that all seem to possess the digestive and absorbing power which chemical and microscopic investigation have clearly traced in their typical representatives. Except the Drosera, these plants are not very numerous, and their species are few, a fact arguing, in the system of the author, a tendency to extinction; suggesting to us rather their character as monstrosities, exceptions to the general tendency of nature, which must naturally be rare. Pinguicula vulgaris is a mountain plant, which catches its prey much as does the Drosera, by means of a viscid secretion, but instead of retaining it, and absorbing its liquefied contents by means of a number of inflected tentacles, the margin of the leaf itself curves inward upon the captured insect, and holds it while the glands drench it with the digestive fluid and gradually absorb the meal.

The last of the genera of insect-eating plants mentioned by Mr. Darwin is the rootless water-plant Utricularia, some of whose species produce upon their narrow, repeatedly-divided, stem-like leaves a number of bladders, which have the same power of catching and digesting minute animals. U. neglecta and vulgaris are inhabitants of foul ditches and in numerous bladders of about 1-10th inch in diameter collect a considerable amount of animal matter in the shape of the minute and almost microscopic crustaceous and other produce of stagnant water. The entrance of the bladder is provided with a valve, which can only open inwards, and by means of which the infinitesimal creatures on which the plant lives find their way in, but cannot get out again. Another Utricularia is epiphytic, rooted in the moss and decayed bark of tropical trees; and this also catches small insects in bladders of a somewhat larger size.

Mr. Darwin forbears to connect his discoveries in this direction with his general theory, and we have no wish to challenge his adherents on the subject. But the existence of these insect-eating plants does seem to us to militate against the theory of infinitesimal changes, each perpetuated by its beneficial action on the life of the species. For it is only when the tentacles and filaments and valves which render seizure possible have become so far complete as to capture at least a few insects, and when the powers of digestion have been acquired, that the plant can benefit by these exceptional developments. And by what influences were the successive changes in this direction sustained and increased, while of no use, till they reached the point of high elaboration at which they become useful, except by that very intellectual providence and controlling purpose which it is the paramount object of Darwinism to exclude?

* Insectivorous Plants. By Charles Darwin, M.A., F.R.S., &c. With Illustrations. London: Murray, 1875.

THE ROYAL AGRICULTURAL SOCIETY'S SHOW.

(FROM OUR OWN CORRESPONDENT.)

TAUNTON, SUNDAY.

Taunton is a quiet place; in its silent Sunday dress it is especially peaceful. The street decorations (symbols of a coming great day) dangle and swing in the breeze in graceful festoons, and gorgeous flags strangly contrast with the general quietude which prevails. Taunton is a pretty place. It contains a strange admixture of old, quaint looking houses, and some highly modernised architecture in public buildings. The external features of the town are of a strangely composite character, and the country around is varied and picturesque. It is a small town of big people—in their way. The local authorities do their best to act with becoming dignity in welcoming the Royal show; the general public with condescending servility in presence of their visitors who require accommodation. Board and lodgings are clean and comfortable, but certainly not cheap. As the contents of a gallon cannot be put in a pint, so Taunton cannot find house-room for the people who would, if they could, make it their home for the next few days. But there are plenty of places within easy distance by rail where the weary may rest at night without paying too much for their sleep—such as Wellington, Bridgwater, Chard, Ilminster, and so forth. Taunton is a small town at which to hold a Royal show. It contains only a little upwards of 15,000 inhabitants. It is neat and clean, and has lately, of course, been considerably refurbished in anticipation of the coming event. A great deal of sweeping and dusting, painting and varnishing has been performed during the last few days. In a sanitary point of view the Royal Agricultural Society does good service to the small towns it visits, as it induces good wives to overhaul their premises from roof to basement in expectation of visitors, invited and uninvited; those who have to pay as strangers or are provided for as friends. There is some excuse for high charges for provisions and apartments in small towns on occasions like this, for the inhabitants have to pay smartly for the honour of receiving the society, and it is not to be wondered at that they do all they can to recoup themselves. Unlike the usual practice of peripatetic exhibitions, the Royal Agricultural Society does not speculate largely on its chance of local support. It requires a guarantee fund from the town that solicits its presence; like the street musician of old before the act that relieved Mr. Babbage became law, who would not move on with his hurdy-gurdy under one shilling, the Royal Agricultural Society will neither pipe nor dance to the sweet wooing of any town under a sum of about 2000*l*. Large towns like Birmingham, Manchester, or Wolverhampton can, with little effort, comply with the necessary conditions of cash down or promised. But 2000*l* for 15,000 inhabitants is a goodly sum to make up. Taunton has never been honoured by a visit from the society before, and the inhabitants, in their anxiety to profit by it, are over-reaching themselves by exorbitant charges, thus driving out into neighbouring towns the best class of visitors, who would be prepared to pay large, but not exorbitant prices for accommodation. The nearest town to Taunton which the society has visited was Exeter, some 25 years ago. The Bath and West of England Society for many years was sole possessor of the district, and was of course jealous of the incursions of the larger but younger society. Recently, however, the whole of the southern counties have been included in the area commanded by the Bath and West of England Society. It is therefore now enabled to travel beyond its original confined limits, and does not consequently suffer and become checkmated by the movements of the larger exhibition, or, to change the phrase, become absorbed in the larger luminary. The south-western division of England this year has by rotation been the district favoured by the Royal Agricultural Society. The midland counties will next year be honoured by it, and Birmingham the place of meeting. Although the society is rich in funds and has a good balance at the bankers' it very properly does not always look to the most paying results. The manufacturing districts are more remunerative to it than the agricultural. They will, probably, lose money at Taunton, but it will be well recouped for the deficit at Birmingham. Its presence, too, in a purely agricultural neighbourhood is calculated to, perhaps, produce greater good than in a manufacturing town, stimulating local breeders and others to follow in the course of progressive agriculture. The practical business of the society's meeting here may be said to have commenced on Monday last, when a series of implement trials were entered for competition for special prizes. The implements were one or two horse mowers, haymaking machines and guards and feeders for thrashing machines. The contests for the mowers have been carried on daily under very severe tests. They had to be tried by the dynamometer to ascertain the power of draught. They were carefully examined in every part by the judges and the society's engineer as to their mechanical construction, durability, and workmanship; they were repeatedly tried in fields containing heavy crops of hay and clover, and on ground presenting many irregularities of surface. Ultimately five implements were selected for final trials in the class for one-horse mowers, two being exhibited by Messrs. Hornsby, and one each by Messrs. Samuelson, Walter A. Wood, Harrison, Macgregor, and Co. There were nine two-horse machines for final competition, four by Messrs. Hornsby and Son, two by Messrs. Samuelson, and one each by Messrs. Walter A. Wood, Harrison, Macgregor, and Burgess Key. The majority of these performed admirable work. The difficulty with the one-horse mowers was that they were generally too heavy for one horse. The two horse mowers were, on the whole, tolerably successful. The contest lies between the best English and American makers. The judges completed their work yesterday evening but have not yet announced their awards. Their decisions are looked forward to with great interest. The haymaking machines and the horse-rakes were tried after the mowing, and in these there were several novel and improved applications. The first and second prizes for haymakers were ultimately awarded to Messrs. Ashby, Jeffrey, and Lake, of Stamford. The prizes for self-acting hay-rakes fell to Messrs. W. N. Nicholson and Son, first, and to Messrs. Houghton and Thompson, second. W. N. Nicholson and Son took all the prizes for horse-rakes, not self-acting. The trials of threshing machines were carried on in the show yard during the week, not only on account of their number and the high character of the manufacturers, but also from the fact that special prizes were offered for protective guards and combined guards and feeders to the drums of the machines, for preventing accidents to human life. The machines were tested for speed and general efficiency, as well as for the improvements in the working of the guards. The successful competitors for the guard alone were Messrs. J. P. Fyson and W. Tasker and Sons; and for the combined guard and feeder, Messrs. Clayton and Shuttleworth and Marshall and Sons. The society places at the disposal of their judges ten silver medals annually to be awarded for any special novelties in the show yard of interest to the agricultural public. The awards for such articles have not yet been announced. The show yard was open to the public yesterday, but, as it was half-a-crown day, and as the cattle classes were not filled, the attendance was small. The implements were all in order, and arranged in the stalls but cattle were received up to four o'clock p.m. yesterday afternoon. The yard is about two miles from the station of the Bristol and Exeter Railway, and the way thither is through the centre of the town. Usually there is a railway siding close to the show yard for the delivery of cattle and implements. In the present instance there was no such accommodation. It is a serious drawback, as the conveyance of heavy implements and fat cattle is expensive, even for a short distance. With this exception, the railway accommodation is all that can be desired. Cheap trains will run daily into the town during the week, and every facility will, in this way, be offered to the public, far and near, to visit the Royal show. The band of the Royal Marines will play daily. The ground selected is of a most suitable character, covering about 55 acres of ground. The entries are not so numerous as in former years, but the society's show is always big enough. Even a run through it in one day is a wearisome task. The implement department is always sufficiently large. Indeed, the tendency of late has been to make this department too much of the character of a huge bazaar. A great many of the stalls exhibit a class of articles having but a remote bearing on general agricultural machinery. Egg beaters, corkscrews, knife cleaners, and glass cement are useful things in their way, but neither carving-knives nor toasting-forks are likely to greatly influence the progress of British agriculture. Public judging of the animals will commence at nine o'clock to-morrow. The classes of cattle, horses, sheep, and pigs are of very excellent character. Several knotty questions will have to be decided for their owners to the satisfaction, it is to be hoped, of the public, although all the exhibitors are not likely to be equally pleased with the result.

Mr. John Forster is, we understand, engaged on a Life of Swift, and a new edition of his works.—*Academy.*