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MR. DARWIN ON THE FERTILISATION OF PLANTS.

The Effects of Cross and Self-Fertilisation in the Vegetable Kingdom. By Charles Darwin, F.R.S., &c. London: John Murray.

TO MR. DARWIN'S POWER OF OBSERVATION there seems no limit, and this last manifestation of it is in no whit behind the earlier volumes which have proceeded from the same pen. Whether we agree with or differ from him as to the great principles of development and evolution, which owe the position they now occupy in the minds of scientific men mainly to the clearness and force with which he has set them forth, there can be but one opinion as to the value of the observations on which his views are always based. The calm straightforward way in which Mr Darwin puts forward both his facts and the conclusions which he draws from them; and his tone might with advantage be adopted by many of his followers, who so far surpass their leader in the boldness with which they promulgate their views as they fall short of him in the care which they take to substantiate the conclusions on which their opinions are based. One of the most profound thinkers of our time has referred in no gentle manner to those who "state truths in their most paradoxical form, and stretch principles till they are in danger of snapping;" and this phrase admirably characterises some of the younger and more prominent among the disciples who claim Mr Darwin as their leader.

The volume now before us, although not in any way professing to deal with the question of evolution, has a very important bearing upon the subject. It is clear enough that every point which tends in the slightest degree to the advantage of any species, whether we consider the animal or the vegetable kingdom, must have an important bearing upon the part taken by such a species in the "struggle for existence;" and, carrying this principle back a little further, it is plain that this statement is true in a special manner when it bears upon problems connected with fertilisation. Plants are obviously far more convenient than animals for investigation with regard to the matters of the kind which Mr Darwin has in the present volume given us a large collection of most careful observations, upon which he bases certain conclusions to which we shall hereafter refer.

The fertilisation of plants has now for several years attracted considerable attention, Mr Darwin's earlier work, "On the Fertilisation of Orchids" (published in 1862) having brought the subject prominently before the scientific world. In that volume he stated that nature "abhors perpetual self-fertilisation;" in the present referring to this statement, he says: "If the word perpetual had been omitted, the aphorism would have been false; as it stands, I believe it is true, though perhaps rather too strongly expressed." It may be regarded as an established fact that the flowers of the majority of plants are so constructed as to prevent self-fertilisation, and that in many instances this is precluded by most ingenious contrivances. In dioecious plants this is obviously the case; but even in perfect flowers it has been shown that in a great many instances the anthers discharge their pollen before the stigma is prepared to receive it; or, on the other hand, that the stigma is receptive before the discharge of the pollen; and in such of these cases the pollen must be taken to or brought from another flower, either on the same or on another plant, if it is to exert its function of fertilisation. The necessity of cross-fertilisation may be conceived from the fact that, in spite of the normal structure of an hermaphrodite flower, which at first sight would seem to have been constructed with an express view to self-fertilisation, the means already referred to, and many others, absolutely necessitate the co-operation of the organs of two distinct blossoms before seed can be obtained; and yet the production of seed is, as Mr Darwin expresses it, "the chief end of the act of fertilisation."

We are told by the author that the experiments recorded in the present volume were suggested to him by the different appearance of two large beds of the common toadflax (*Linaria vulgaris*), one of which consisted of self-fertilised and the other of crossed seedlings. "To my surprise," he says, "the crossed plants when fully grown were simply taller and more vigorous than the self-fertilised ones;" and a similar contrast was the result of a like experiment upon two beds of carnation (*Dianthus Caryophyllus*). Other plants were then observed, and their testimony in the same direction; and on this, says Mr Darwin, "I determined to begin a large series of experiments with various plants, and these were conducted for the following eleven years; and in a large majority of cases the crossed beat the self-fertilised plants." It is almost unnecessary to say that every possible care was taken to guard against anything which might prove a source of error, or might influence the result of these experiments; and this volume of nearly five hundred closely-printed pages is a monument of patient investigation, and a perfect storehouse of facts connected with the subject of which it treats. Any notice which we could attempt to give of the work, taken as a whole, must of necessity be very inadequate; and it seems, therefore, better to glance at the conclusions at which the author has arrived rather than to dwell upon any of the experiments, interesting and instructive as many of them are.

The first and most important of these conclusions is that to which allusion has already been made—namely, that cross-fertilisation is generally beneficial, and self-fertilisation injurious. "This is shown by the difference in height, weight, constitutional vigour, and fertility of the offspring from crossed and self-fertilised flowers, and in the number of seeds produced by the parent plants." Not only is this amply confirmed by the experiments cited, but the converse is illustrated by some very striking facts—such, for example, as the singular observation that certain plants "which have been naturally cross-fertilised for many or all previous generations suffer to an extreme degree from a single act of self-fertilisation" while, after plants have been propagated by self-fertilisation for several generations, a single cross with a fresh stock restores their pristine vigour. Two other conclusions of importance are indicated by advantages deducible from his observations: "first, that the virtue of cross-fertilisation do not follow from some mysterious individuals having been subjected during previous generations to different conditions, or to their having varied in a manner commonly called spontaneous, so that in either case their sexual elements have been in some degree differentiated; and secondly, that the injury from self-fertilisation follows from the want of such differentiation in the sexual elements." Of course exceptions will always be forthcoming to such general statements as those here laid down, and Mr Darwin himself supplies one or two very striking ones, notably that of the self-fertilised "Hero" strain *Sponox purpurea*, which surpasses crossed plants of the same species in vigour, and the descendants of which exhibited a similar peculiarity.

The various agencies—such as the carrying of pollen by the wind, or by insects—by which the fertilisation of plants is effected, are fully considered in this work; and the chapter on the habits of insects in relation to the fertilisation of flowers is one of the most interesting in the book. Mr Darwin shows that not only do bees—usually visit the flowers of the more than thousand years since before going to another species, but that some of these species are equally discriminating; and he adds: "Humble and hive bees are good botanists, for they know that varieties may differ widely in the colour of their flowers, and yet belong to the same species." Of certain moths and beetles are equally discriminating. How insects, and especially bees, recognise the flowers of the same species is, and is not the only question; the coloured corolla seems to be the chief, but they seem to recognise plants even from a distance by their general aspect, in the same manner as we should do." Memory also comes into play, while a conspicuous corolla is not in itself a sufficient attraction unless nectar is at the same time secreted, together perhaps with some odour emitted. There is also a great deal of interest attaching to Mr Darwin's observations on the perforation of the corolla by bees, the motive of which "seems to be the saving of time, for they lose much time in climbing into and out of large flowers, and in forcing their heads into closed ones." As a general rule, humble bees perforate flowers only when they grow in the numbers and near together; and this observation of similar rule to hold "good in the Himalayas." "The explanation of this fact," says Mr Darwin, "is not difficult. Flowers growing in large numbers afford a rich booty to the bees, and are conspicuous from a distance. They are consequently

visited by crowds of these insects, and I once counted between twenty and thirty bees flying about a bed of pentstemon. They are thus stimulated to work quickly by rivalry, and, what is much more important, they find a large proportion of the flowers which their nectaries sucked dry. They thus waste much time in searching many empty flowers, and are led to bite the holes, so as to find out as quickly as possible whether there is any nectar present, and, if so, to obtain it." The influence of insect visits upon cross-fertilisation has been already referred to, and is well known; but comparatively few are aware that in some parts of the world birds fulfil an important office in this direction. In South Brazil various species of *Abutilon* are fertilised by humming birds, who also visit the flowers of *Brugmansia*, and, like the bees of which we have just been speaking, "often penetrate its large corolla, in order to obtain the nectar in an illegitimate manner." "It appears, indeed, that the bee-like humming birds are specially adapted to the various kinds of flowers which they visit; on the *Cordillera* they suck the *Salvia*, and lazebrate the flowers of the *Taconium*. In Nicaragua Mr Belt saw them sucking the flowers of *Maracajava* and *Erythrina*, and thus they carried pollen from flower to flower. In North America they are said to frequent the flowers of *Impatiens*." At the Cape, in Australia, and in New Zealand certain flowers are visited by birds.

But we must close our notice of this most interesting book, and we do so with a strong recommendation to our readers to take the first opportunity of consulting it for themselves.

SPORT AND TRAVEL IN NORTH AND SOUTH AMERICA.

The Two Americas: an Account of Sport and Travel. Notes on Men and Manners in North and South America. By Major Sir Ross Macdonald, Bart., F.R.G.S. (late R.M.L.I.). With Illustrations. London: Sampson Low, Marston, Hooper, and Rivington.

It is not often that an author of a book upon travel and sport comes before the public so well qualified for his work as Sir Ross Price. Having been an officer in the Royal Marines for many years, he combines the precision and terseness of a military man with a knowledge of the out-of-the-way corners of the earth rarely to be found among any class of men save sailors. Passionately fond of sport of all kinds, a capital shot and a good fisherman, he brought to his assistance during his sojourn in the two Americas the experience gained in Australia, India, China, Africa, and various other parts of the world. It is not, therefore, surprising that his book should be valuable as well as interesting, giving the reader, by the numerous comparisons he is able to make, a juster idea of the capabilities of the countries visited than he would be otherwise able to obtain, whether as regards sport or more serious subjects. It must, however, always be borne in mind that Sir Ross Price travelled rapidly, and that, although his impressions of men and manners are no doubt very much that would be formed by an ordinary English gentleman with the same length of time at his disposal, yet, in many cases, he is not always to be depended upon. The book, itself is fairly well written, though sometimes a little rough and involved in style, showing that he is but a beginner at the trade of bookmaking, but it carries with it a favour of truthfulness and impartiality, which go far to compensate for such slight errors of composition as exist.

The journey of which it contains an account naturally divides itself into two portions—the voyage in H.M.S. *Rocket* to Esquimaux in Vancouver Island, and the author's subsequent overland wanderings through the Southern States of North America. It had been his intention to fish during the summer months in the various rivers of Vancouver, British Columbia, and Alaska; but the extraordinary length of time occupied in reaching Esquimaux disturbed his calculations, and rendered it impossible to accomplish all that he had originally proposed. We will first note the more salient features of the voyage. Leaving England on Oct. 4, 1874, on board the gunboat *Rocket*—whose commander, being an old acquaintance, had offered him a passage—*Madira* was reached without incident, and after a short stay they proceeded to St. Vincent, one of the Cape Verde Islands, where they touched for fuel. Here some shooting was had at "bustion quails," but they do not seem to have afforded much sport. The sea fishing, however, was found to be first-rate, and the account given of it is highly interesting. Stout bamboo rods were used, with the lines fastened half-way down and leading to the top, in much the same way as obtains among the fishermen on some of our own coasts; the bait was legs of crabs or barnacles, and the fish were of many and mostly unknown varieties, the only one mentioned by its scientific appellation being the porcupine fish (*Diodon hystrix*). The remainder of the voyage to Rio passed much as such voyages do, the only thing worth recording being a fire which was discovered in one of the coal bunkers—curiously enough, at the very moment when the vessel was about to be refilled, by the most convenient method for filling, by all the pumps, a large bath made out of a sail, which was to be used for ducking Neptune's victims in on the occasion of crossing the line. Fortunately, no great difficulty was experienced in extinguishing the smouldering coal. Rio de Janeiro with its magnificent harbour receives its due share of notice, and there are some graphic descriptions of the scenery in the environs; but its beauties are so well known that the reader, like the author, will be glad to push on to Monte Video. Here, falling time for a visit to Buenos Ayres, an excursion was made to Santa Lucia, a small town some thirty miles distant from the port. Sir Ross speaks very highly of the natural capabilities of the country, but adds that "it is so handicapped by a miserable Government, that industry becomes paralysed and life insecure."

On the 23rd of December they left for the Straits of Magellan, and this portion of the voyage is by far the most interesting. A fortnight after sailing they made the strait which leads to Port San Julian, being forced to resort to its shelter against a strong south-westerly gale. Here they landed in pursuit of four ostriches, which were seen close to the ship, but were unable to get within shot; and, though they also saw a herd of guanaco, the cloister in of the day prevented their being stalked. On the following morning Sir Ross again landed and shot all day; but, though he wounded a guanaco, it got away, and the only result of his exertions was a goose, a partridge, a few wild duck, and several bandurria, the latter being a large and handsome species of ibis.

The next place where they anchored was Possession Bay, and here, after missing one, the author at last succeeded in killing a male guanaco. It is worthy of notice that he finds fault with the shooting of his Express rifle at distances over 200 yards, though he considers its execution all that could be desired at shorter ranges.

Passing onwards through the "first narrows" with the Patagonian coast on one side and *Terral del Fuego* on the other, they reached Gregory Bay, where Lieut. Harris and Sir Ross had some good wildfowl shooting. Great numbers of upland geese were seen, the low hills being covered with wild celery and califate berries (*Berberis arifolia*), which form their principal food. The surface of one small loch they came upon was simply covered with wildfowl of all descriptions, and in a short space of time three geese, seventeen duck, five snipe, five waterhens (*Falica chilensis*), one teal, and one grebe were knocked over—not a bad performance for a before-breakfast bag, especially as a number more, which fell into the lake, could not be recovered, owing to their retriever being unable to force his way through a network of floating lilies which edged the lagoon. Space will not permit our following the author through all the various windings and halts of this passage. The reader will, however, find much to interest and amuse him; and some of the sketches of the magnificent scenery through which they passed prove that, with a little experience, Sir Ross would take no mean place among descriptive writers. He strongly recommends anyone "with a predilection for yachting, a love of nature in its most charming garb, and a fondness for sport," to make a cruise between Monte Video and the western entrance to Magellan. From Cape Corrientes to Punta Arenas, a distance of over a thousand miles, there is not a single harbour in whose immediate vicinity a sportsman, using his yacht as a base for operations, might not obtain shooting to almost any extent."

When anchored in Puerto Buena, a harbour on the eastern shore of the channel, the author did a little gold prospecting, having heard that the precious metal was plentiful at Punta Arenas, which they had lately left. Apropos of this there is a story of his companion Martin, a servant of Lieut. Harris, which will best be given in his own words.

Shortly after, on looking back, I found him paddling about in a large splash of rain water, which had accumulated in a slight hollow in the mountain side. "Hullo!" I shouted, "what are you doing there? It is getting too late for dawdling." "I am a-looking for gold," was the answer. "Why, you snuff," I replied; "you are seeking in a splash of rain water, that did not exist yesterday, and may be dry to-morrow." "Well," he sang out, with a grunt of discontent; "you said as how I might find it when I seed quarts, and I be certain shure there be gallons here; but I never does