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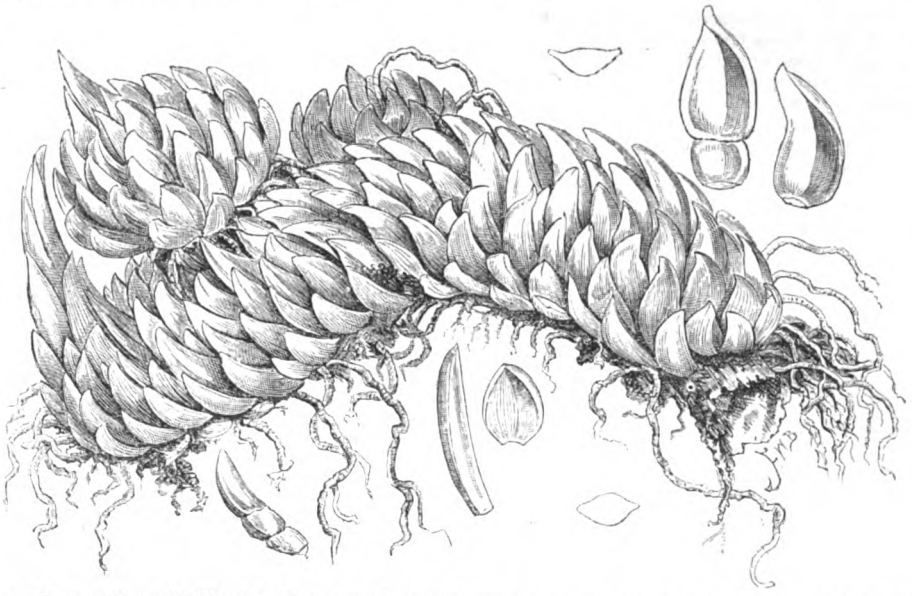
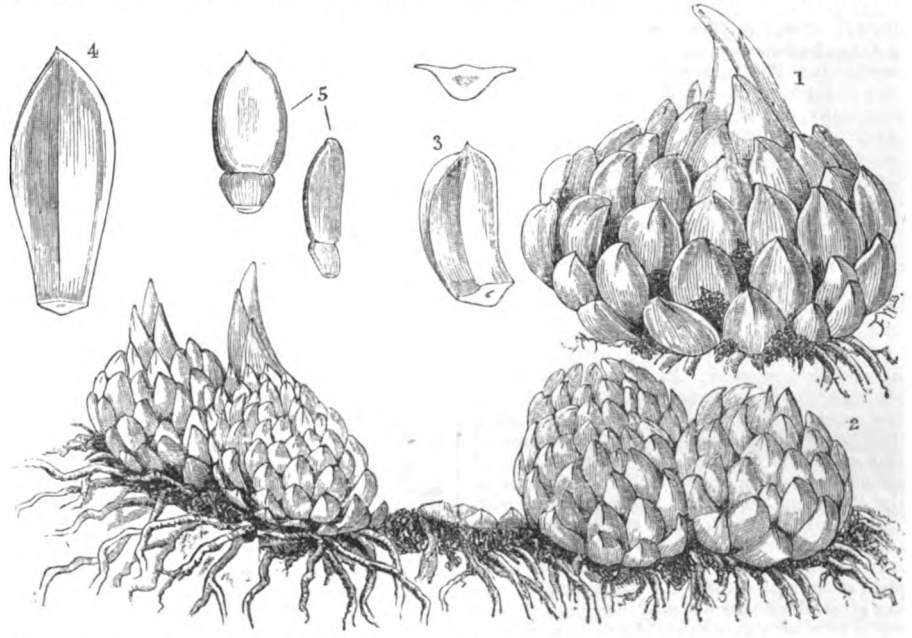
DARWIN ON ORCHID FERTILIZATION.*

The first edition of this remarkable book, which was published early in 1862, gave an impetus to the study of plant-life in its relation to insects, and since its appearance the subject has been pursued with advantage by Lubbock, Bennett, Müller, and others. Although not so valuable to practical horticulturists as the recently-published "Cross and Self-Fertilization of Plants," by the same author, this book is nevertheless most instructive, and a work which may be read with advantage by all who are interested in the higher branches of plant-life. The following extract, relating to the production and vitality of Orchid seeds, will, we feel sure, be read by many with much interest:—



21*. L. pardalinum (California); from a good-sized cultivated specimen; the small figures show entire and jointed scales and sections of the variably-shaped scales, &c.; colour, white or yellowish, rarely suffused with pink. [See p. 156.]

The final end of the whole flower, with all its parts, is the production of seeds, and these are produced by Orchids in vast profusion. Not that such profusion is anything to boast of; for the production of an almost infinite number of seeds or eggs is undoubtedly a sign of lowness of organization. That a plant, not being an annual, should escape extinction, chiefly by the production of a vast number of seeds or seedlings, shows a poverty of contrivance, or a want of some fitting protection against other dangers. I was curious to estimate the number of seeds produced by some few Orchids; so I took a ripe capsule of Cephalanthera grandiflora and arranged the seeds on a long ruled line as equably as I could in a narrow hillock; and then counted the seeds in an accurately measured length of one-tenth of an inch. In this way the contents of the capsule were estimated at 6020 seeds, and very few of these were bad; the four capsules borne by the same plant would have therefore contained 24,080 seeds. Estimating in the same manner the smaller seeds of Orchis maculata, I found the number nearly the same, viz., 6200; and, as I have often seen above thirty capsules on the same plant, the total amount would be 186,300. As this Orchid is perennial, and cannot in most places be increasing in number, one seed alone of this large number yields a mature plant once in every few years. To give an idea to what the above figures really mean, I will briefly show the possible rate of increase of O. maculata: an acre of land would hold 174,240 plants, each having a space of 6 in. square, and this would be just sufficient for their growth; so that, making the fair allowance of 400 bad seeds in each capsule, an acre would be thickly clothed by the progeny of a single plant. At the same rate of increase, the grandchildren would cover a space slightly exceeding the island of Anglesea; and the great grandchildren of a single plant would nearly (in the ratio of 47 to 50) clothe with one uniform green carpet the entire surface of the land throughout the globe. But the number of seeds produced by one of our common British Orchids is as nothing compared to that of some of the exotic kinds. Mr. Scott found that the capsule of an Acropera contained 371,250 seeds; and judging from the number of flowers, a single plant would sometimes yield about 74,000,000 seeds. Fritz Müller found 1,756,440 seeds in a single capsule of a Maxillaria; and the same plant sometimes bore half-a-dozen such capsules. I may add that by counting the packets of pollen (one of which was broken up under the microscope) I estimated that the number of pollen-grains, each of which emits its tube, in a single anther of Orchis mascula was 122,400. Amici estimated the number in O. morio at 120,300. As these two species apparently do not produce more seed than the allied O. maculata, a capsule of which contained 6200 seeds, we see that there are about twenty pollen-grains for each ovule. According to this standard, the number of pollen-grains in the anther of a single flower of the Maxillaria which yielded 1,756,440 seeds must be prodigious.



21. L. superbum (America—Eastern United States); from a cultivated specimen 1. Bulb, natural size. 2. Rhizome-bearing bulbs, about one-half natural size. 3 and 4. Variable entire scales. 5. Ditto jointed scales, section, &c. Colour, white, delicately suffused with salmon-pink. [See p. 156.]

What checks the unlimited multiplication of the Orchideæ throughout the world is not known. The minute seeds within their light coats are well fitted for wide dissemination; and I have several times

* "The Various Contrivances by which Orchids are Fertilized by Insects." By Chas. Darwin, M.A., F.R.S. Second Edition. London: John Murray.

observed seedlings springing up in my orchard and in a newly-planted wood, which must have come from a considerable distance. This was especially the case with Epipactis latifolia; and an instance has been recorded by a good observer of seedlings of this plant appearing at the distance of between eight and ten miles from any place where it grew. Notwithstanding the astonishing number of seeds produced by Orchids, it is notorious that they are sparingly distributed; for instance, Kent appears to be the most favourable county in England for the Order, and within a mile of my house, nine genera, including thirteen species, grow; but of these one alone, Orchis morio, is sufficiently abundant to make a conspicuous feature in the vegetation; as is O. maculata in a lesser degree in open woodlands. Most of the other species, though not deserving to be called rare, are sparingly distributed; yet, if their seeds or seedlings were not largely destroyed, any one of them would immediately cover the whole land. In the tropics the species are very much more numerous; thus Fritz Müller found in South Brazil more than thirteen kinds, belonging to several genera, growing on a single Cedrela tree. Mr. Fitzgerald has collected within the radius of one mile of Sydney in Australia no less than sixty-two species, of which fifty-seven were terrestrial. Nevertheless the number of individuals of the same species is, I believe, in no country nearly so great as that of very many other plants. Lindley formerly estimated that there were in the world about 6000 species of Orchideæ, included in 433 genera.

The number of the individuals which come to maturity does not seem to be at all closely determined by the number of seeds which each species produces; and this holds good when closely related forms are compared. Thus Ophrys apifera fertilizes itself, and every flower produces a capsule; but the individuals of this species are not so numerous in some parts of England as those of O. muscifera, which cannot fertilize itself, and is imperfectly fertilized by insects, so that a large proportion of the flowers drop off unimpregnated. Ophrys aranifera is found in large numbers in Liguria, yet Delpino estimates that not more than one out of 3000 flowers produces a capsule. Mr. Cheeseman says that with the New Zealand Pterostylis trullifolia, much less than a quarter of the flowers, which are beautifully adapted for cross-fertilization, yield capsules; whereas with the allied Acianthus Sinclairi, the flowers of which equally require insect aid for their fertilization, seventy-one capsules were produced by eighty-seven flowers—so that this plant must produce an extraordinary number of seeds; nevertheless in many districts it is not at all more abundant than the Pterostylis. Mr. Fitzgerald, who in Australia has particularly attended to this subject, remarks that every flower of Thelymitra carnea fertilizes itself and produces a capsule; yet it is not nearly so common as Acianthus fornicatus, the majority of the flowers of which are unproductive. Phajus grandifolius and Calanthe veratrifolia grow in similar situations. Every flower of the Phajus produces seeds; only occasionally, one of the Calanthe, yet Phajus is rare, and Calanthe common.

The frequency with which throughout the world members of various Orchideous tribes fail to have their flowers fertilized, though these are excellently constructed for cross-fertilization, is a remarkable fact. Fritz Müller informs me that this holds good in the luxuriant forests of South Brazil with most of the Epidendreæ, and with the genus Vanilla. For instance, he visited a site where Vanilla creeps over almost every tree, and although the plants had been covered with flowers, yet only two seed-capsules were produced. So again with an Epidendrum, 233 flowers had fallen off unimpregnated, and only one capsule had been formed; of the still remaining 136 flowers, only four had their pollinia removed. In New South Wales Mr. Fitzgerald does not believe that more than one flower out of a thousand of Dendrobium speciosum sets a capsule; and some other species there are very sterile. In New Zealand over 200 flowers of Coryanthes triloba yielded only five capsules; and at the Cape of Good Hope only the same number were produced by 78 flowers of Disa grandiflora. Nearly the same result has been observed with some of the species of Ophrys in Europe. The sterility in these cases is very difficult to explain. It manifestly depends on the flowers being constructed with such elaborate care for cross-fertilization, that they cannot yield seeds without the aid of insects. From the evidence which I have given elsewhere we may conclude that it would be far more profitable to most plants to yield a few cross-fertilized seeds, at the expense of many flowers dropping off unimpregnated, rather than produced many self-fertilized seeds. Profuse expenditure is nothing unusual under Nature, as we see with the pollen of wind-fertilized plants, and in the multitude of seeds and seedlings produced by most plants in comparison with the few that reach maturity. In other cases the paucity of the flowers that are impregnated may be due to the proper insects having become rare under the incessant changes to which the world is subject; or to other plants which are more highly attractive to the proper insects having increased in number. We know that certain Orchids require certain insects for their fertilization, as in the cases before given of Vanilla and Sarcochilus. In Madagascar Angræcum sesquipedale must depend on some gigantic moth. In Europe Cypripedium calceolus appears to be fertilized only by small bees of the genus Andrena, and Epipactis latifolia only by wasps. In those cases in which only a few flowers are impregnated owing to the proper insects visiting only a few, this may be a great injury to the plant; and many hundred species throughout the world have been thus exterminated; those which survive having been favoured in some other way. On the other hand, the few seeds which are produced in these cases will be the product of cross-fertilization, and this, as we now positively know, is an immense advantage to most plants.

A NEW TEXT-BOOK OF BOTANY.*

It might be supposed that students were already sufficiently supplied with "text books" of botany, but the appearance of the present volume seems to show that this opinion is not shared by all authors and publishers. The fact that "the original of the work is the recognised Text-book of Botany in use in the technical schools of Germany," and the translator's belief that no work of the same scope is to be found in the English language, have combined to produce the publication of this latest addition to our list of text-books; and, if it be admitted that any addition was required, we think that the present is the most useful which could have been made. It is handy, very compendious and comprehensive, and illustrated by between five and six hundred woodcuts, some of which are as "old familiar faces" to us, so often have we encountered them in botanical works; moreover, and this is noteworthy, there is a very good index; and the only fault we have to find with the get-up of the book is that the margins are somewhat too narrow. With regard to the contents, it appears to us that the editing has been very judiciously executed, the additional notes of the editor being to the point, and giving in some cases important information not to be found in the original work. The section in the classification of Phanerogams has been entirely rewritten; and there is a brief but very useful epitome of Grisebach's conclusions upon geographical distribution, which is the more acceptable, as there is at present no English translation of that author's important work, and is accompanied by a coloured map. It would be beyond our purpose to enter into anything like a detailed notice of this Text-book; but we can strongly recommend it to readers as being really what it professes to be—the most compendious work embracing the whole range of Elementary Botany which has yet appeared in the English language.—J. B.

The Cactus.†—This little volume consists of a series of essays by Mr. Croucher and others, culled by Mr. Allnutt from various sources and arranged in book form for the use of amateurs who have a taste for Succulent Plants, the whole being illustrated by a tinted plate as a frontispiece. Many of the woodcut engravings are, however, old and worn, and might have been omitted with advantage. To amateurs and window gardeners who wish to grow a few Succulent Plants, and who are desirous of gaining some general knowledge of their history, this little work will be useful; but a really comprehensive work on Succulent Plants, corresponding to the French works by Labouret and Lemaire, still remains to be written.

Glazing Without Laps.—In spite of all the novelties that exist in the way of glazing, the old and really inconvenient plan of having laps and using putty still remains the common mode of glazing horticultural structures. All lapped glass should have sufficient space left under the lap to admit of some thin substance being run up between to clear out the dirt that will assuredly accumulate there. Would it not be possible to have panes of glass made exactly to size, with perfectly even ends and slightly hollowed in the centre like glass pantiles? Then, if a very narrow groove were ploughed out of the side of each bar, these glass tiles might be slid up to the top and so filled up until the bottom of each pair of bars was reached. In this case all the rainfall would naturally keep to the centre of the glass, but in the present mode of glazing the water prefers the puttied sides, and, working beneath these, causes a drip. The system of fixing glass with putty ought long since to have been abolished.—D.

* "Text-book of Structural and Physiological Botany." By Otto W. Thome. Translated by Alfred W. Bennett, M. A. London: Longmans, 1877.

† "The Cactus and other Tropical Succulents, &c." By H. Allnutt. London: 200, Fleet Street.