As the taste for horticulture is spreading, we may expect that those who devote themselves to raising seedlings will increase in number; and consequently the evil, if not checked, will increase. We should think it very hard to be obliged to put up with two or three bad buds because the dozen had to be made up; and why should we put up with a like absurdity in flowers? It all arises from greediness. The grower is greedy, for he wants to have ever so many new things each year; the sender-out is greedy, for it is very tempting to be able to get double or treble the price for a plant because it is new.

I say nothing of the raiser, because he often times knows but little about the matter; but the grower is only the unconscious victim in the hands of the person who takes these little matters off his hands. We must, then, agitate for a reform. Great changes have taken place. The time for letting out Pelargoniums at five guineas has long since gone by. Even the guinea and a half has fallen to a guinea. But, as I have said, the reform we want is not so much in the price of the flowers as in their number; and the nurserymen who will set his face against the present system will indeed be a public benefactor.—D. Delt.

PHENOMENA IN THE CROSS-BREEDING OF PLANTS

[Having received the following letter from Mr. Darwin we forwarded it to Mr. Beaton, and now publish it with his reply.]

Will Mr. Beaton, who has made such a multitude of most interesting observations of the habits of plants, be good enough to let us know whether varieties of the same species of Composite plants frequently cross each other, and to what extent? It is the first condition for anything like a useful breeding to be that parent plants and the seedlings therefrom, which together with the seedlings of other varieties, may be readily raised from the same species and may therefore be crossed or hybridised. If no, or only a few, varieties are amenable to this condition, the advantage of breeding them would be very great, and we should be able to produce a much larger number of varieties than now exist.

From a knowledge of the natural history of plants, I am well aware that the cross-breeding of plants is a common occurrence. It is a fact which has been known for many years, and is a matter of common observation. And yet, while we know that it is possible, we have no notion of how it is possible. Mr. Beaton, if he pleases, will write to me, and if he does, I shall be much obliged to him. If he does not, I shall be obliged to follow the example of the late Professor of Botany at Cambridge, and I shall write to him, and ask him to write to Mr. Beaton, and to me, and to please me.

I am aware that any two species of Composite plants under cultivation have been crossed by man, or through the agency of insects. Mr. Penny, who first broke down Cineraria cruenta in the White's nursery at Epsom, said it was just to cross with another species, I think to Cineraria. It was made in accordance with the species of cross-breeding. Then again, the seedlings of the two species of Cinerea, which is a species in my own garden, are crossed by the two species of the same species under cultivation, and if it is really so, the effect may be deserbed to come more than to high cultivation. We know the Port Natal Gladiolus (natterens or pittas) could not be crossed here, or on the Continent, with any of the Old Cape species or their seedlings; but in Australia, at Sydney, the cross was easily effected—(Candida longifolia)—but the seedlings were so weak that they could not be kept. We have gone into the hands of European cultivators they experienced no more difficulty in pushing on their crosses in the same manner.

These are three recent instances of the undeceived influence of cultivation and climate on genuine wild species. For the first seven or eight years of high cultivation the Swan River Daisy was brought into cultivation; and when, after all, it varied into ilac and silver-leaved and similar shades. When a species is crossed, the authority varies in the effects of cultivation or climate, the variation is also variable in degree. Some of the varieties reproduce themselves quite true from seed from the first; others, on the contrary, take some years before the colour or habit is fixed, as gourds show when a variable plant comes true from seeds after a long period or years; and some never get fixed, or have not done so yet, and Zinnia is an instance of it. In all these instances some people attribute the changes to crosses fertilisation; they have been crossing their flowers, and they have seen results, and account for them that way, decaying their flowers, in the same way that we do in the case of the permanent kinds or species, which always reproduce themselves in their own kind. That conclusion strikes us at the root of the fallacy which obtains in respect to the best means of improving all our domestic fruits; and yet crossing is an element of great value in improving flowers and fruit, which seems a contradiction, but is explained thus:—Some seedlings from plants that have been crossed for a generation come quite true from seeds; some half true, and some on which no reliance whatever can be placed, or, in our language, they always sport from seed. On those which this sport-crossing has no effect; such, however, as come half true and half sport-crossing—there is a chance of an intermediate condition, and those most varieties which come true from seeds to this effect, and some varieties of the same species come true from seeds, although they will not come true from seed, will produce more good seedlings, or less but effect, than an inferior strain: therefore, if a good flower or good strain of Cinerea is exposed to the pollen of a bad strain, the good breed is immediately deteriorated in the sports crossing. I am not aware that any of the gardens Cinerea come true from seeds, or if any of them could now be crossed with the nearest wild species. The only Composite flower on which I ever spent time is Dahlia amara, the pretty little dwarf Dahila with small shining foliage, and I think I can venture to assert that our climate it is impossible to cross with any of the garden species. I cannot help thinking that the freedom with which Auriculas and Polyanthus will sport among themselves, you cannot drive a seedling from all their races by the pollen of their nearest kindred. When Primula alpina and cinclus, which were introduced the same year (1510) came into general cultivation, I was astonished to find that the cross between the two species produced seedlings which raised the hopes of the cross-breeders, particularly Primula, which, to a common observer, is nothing beyond a large Auricula; but none of the wild species of Primula would touch each other or the garden varieties. Then you see no end of sport seedlings in the Dahlia and in the Primula, in two years the cross between the two species produced seedlings, and yet the rest of their families obstinately hold aloof from each other, and from the sports of their respective kinds.

The old Hollyhocks, or some of them, were fixed varieties; but whether they were so fixed from the first, or induced to fix by a long course of culture by propagation of the roots we do not know. Several species of Hollyhocks, which are not at all like wild flowers, have been crossed, and yet they would come true from seeds. A long course of uniform culture renders some plants harem altogether, as Cucumis, and a long period of years intervenes between the birth of some seedlings and their coming to the age of puberty—to the age of producing seeds, although they may have flowered from the second or third year from the seed. There is one seedling which began to seed; and Dr. Herbert records an instance in which a certain seedling flowered fourteen years before it produced pollen or would seed.

"The relative periods of maturity of the pollen and stigmas,"
seems to have been a wise law from the beginning for the preservation of the kinds of plants in their generations, for there is not a flower in a thousand that is fertilised by its own immediate pollen. The pollen is in advance of the stigma in the flower: it is there by the time the stigma is receptive. Consequently the same or neighbouring stalk is the fertiliser. And here another wise law is in operation: When the stigma is ripe it is exposed to the influence of the pollen of all the plants of its own and every other plant which may be growing near it; and the law is, that the pollen of the flower, or of the plant which is the strongest or best developed, reaches the stigma first, and the fertilisation is thus hastened. If no fertilisation should take place for some time it is able to neutralise any effects that may have been produced by an inferior pollen, or pollen from a weaker flower or sickly or stunted plant—a thing which can be proved any day in the summer by dusting the stigma with its own and nearby pollen, when one kind of pollen only will take effect. And that proves two things in addition to the proof that the best pollen is usually that which reaches the stigma first: it proves that flowers are more often than not fertilised by the pollen of their species, and also proves that the ideas of physiologists are not according to Nature as to the progress of the pollen to the ovary. They say the pollen passes through tubes of extreme tenuity to the ovules. If that were so, and more than one stigma supplied the necessary passage, more than one kind of pollen might find access to the ovules, and more kinds than enough would fertilise the embryo seeds: and the superimposition would not be increased.

In the instance mentioned by Mr. Darwin of Sweet Peas never crossing, they belong to a class of flowers every one of which must, of necessity, be fertilised by its own pollen in the great majority of instances. The carpel, or keel, or lower petal in pea-shaped flowers is, in reality, two petals joined at the edges. The stamens are joined in two columns, and the filaments are folded into each other, forming the imaginary bow of the bow; the stamens and the pistil are compressed within the folds forming the bow; and fertilisation is effected in the dark, and the stigma is perfectly safe from the intrusion of foreign pollen; therefore, so garden Peas can be naturally crossed more than a Sweet Pea, unless, perhaps, a more beautiful one, perhaps, another order of the vegetable kingdom. Some of the varieties of the garden Pea may be crossed resulting from a struggle of that kind, but the great majority of them are the results of the sporting tendencies of the plant itself. This is the true cryptogamy of Nature, of which, however, there are many more perfect instances. The great bulk of the order of Bellflowers, or Campanulas, are real cryptogamy, their fertilisation is effected in the dark before the flower expands: but the Wheat might be said to be the most complete cryptogamy of all the common plants. No kind of Wheat has ever been naturally crossed and never can be. When the Royal Agricultural Society talk about the Wheat being in bloom, they are just one month behind their subject, because the main part of the Wheat is out of bloom before the flowers are opened. If you take the flower of the Wheat, you will at once see the most beautiful contrivances in Nature as means to an end, a departure from the law of Nature, as it were, to preserve food for man. The Wheat is in full flower, and the seed is fertilised while the ear is yet in the folds of the sheath before the Wheat is in ear. At that period the anther might be said to be in season, or to have hardly any length of time to pass before it is shed. But the pollen is shed, the husk of the anther might rot in such close confinement and endanger the safety of the stuff of life now having just received vitality. To prevent famine for lack of Wheat, however, Nature alters her common process in this matter. As soon as the anther is emptied of the pollen the stamen becomes necessity: the fertilisation is effected by the pollen of the embryo seed; and by the time the ear is seen the husk is well nigh out of the scales which enclose the seed, but stops not there nor till the husk is dangling from a white thread far off from the entrance to the seed-case, and when all dangers are thus provided against, the farmer congratulates himself if the weather is fine.