pleasant, having broken off very many flowers that were just opening. Where this occurred the foliage has assumed a stiff, robust habit, while others, still retaining their flowers, have a lank, attenuated appearance.

To return to the Haarlem bulb fields, we find that although the soil is naturally very sandy, it is made more so by constant dressings of the sand brought from the dunes or sand-hills, and this, with the heavy dressings of cow manure, enables the cultivator to grow the same crop on the same piece of ground every second year, yet it may be considered as a three years' rotation. When the ground is well manured Potatos are planted, then Hyacinths after the Potatos are taken up, and the next autumn Tulips take the Hyacinths' place, at least this is the system I understood one celebrated cultivator (Mr. F. Van Velsen, jun.) pursued, and his bulb garden may be considered second to none, as no finer flowers were to be seen anywhere. In many cases the robust character of the plants was very apparent. In this establishment was raised that splendid Hyacinth, the King of the Blues; it bears a splendid spike, and for late pot-work is invaluable. Mr. F. Van Velsen has a large stock of this fine variety, as well as of many others. Some of the more effective varieties seen were, of doubles, Eclipse, carmine, extra fine; Noble par Merite, blush, purple eye; Anna Maria, blush, pink eye; and Madame de Stael, pale rose. Amongst single varieties the following were the most conspicuous:—Amy, bright red, fine for massing; Masterpiece, very fine rose; Robert Steiger, Von Schiller, Vuurbaak, bright red, very effective; General Havelock, a fine black; King of the Blues, before mentioned; Mimosa, fine large dark variety; Regulus; William the First; Bird of Paradise, a very fine yellow; Grande Vedette; La Grandesse, a very fine white; La Vestale, Mammoth, Theba, Themistocles, Charles Dickens, Havelock, and Tollens. My visit was rather early to see the Tulips in perfection, still enough was seen to give an idea of the magnificence of the whole; the Duc Van Tholl varieties were very charming, and Canary Bird, single yellow, is very fine and highly recommended; the varieties of Claremonde, rose striped and gold, are very good; Proserpine and Van der Neer should be in every collection. *George Thompson, Crystal Palace.*

FERTILISATION OF PLANTS.*

(*Continued from p.* 535.)

5. ALTHOUGH in many cases it would appear that intercrossed plants are absolutely more fertile than the self-fertilised, yet Mr. Darwin raised during his experiments some highly self-fertile varieties, which "yielded more seed and produced offspring growing taller than their self-fertilised parents, or than the intercrossed plants of the corresponding generation." Such were "Hero" and the white variety of Mimulus, and a pale variety of Dianthus, while equal-styled Primulas proved more fertile than ordinary plants of the same species legitimately fertilised by pollen from a distinct individual. The ratio of the intercrossed opponent to "Hero" was only 100 : 100.6, but in the eighth generation two other "Heroes" appeared, whose ratios were as 100 : 111 and 100 : 150. Their offspring, however, were not preserved.

6. Mutual adjustments of the essential organs, as well as special constructions, are often to be met with, which thus secure self-fertilisation. Mr. Meehan thus describes Melampryum americanum:—"The curved apex of the pistil is clasped by the stamens and held in contact with the pollen, just as in a cleistogamous Violet." The same occurs with small-flowered Epilobiums, while the styles of Malva rotundifolia curl backwards, as H. Müller has described, and it is the same in other small-flowered species, in order to intertwine amongst the anthers. In Salvia clandestina the elongated stigmas curl back in a similar manner, and lie between the anther-cells, which burst, not downwards, as in other species, but sideways, facing the stigma. The position of the filaments in a position arching over the pistil is very common, as in small-flowered Ranunculi, Potentillæ, &c. Such positions appear to be often the normal ones while in the bud, and have thus been retained after the flower has expanded. In flowers with a large number of stamens, Buttercups, &c., the outer stamens burst first, but if the pistil be not crossed, then the inner which dehisce later, perform the function.

7. Inconspicuous flowers are very numerous, and, as H. Müller observes, "must be self-fertilising, or they would become extinct;" and it is observable that they form the majority of our weeds, are excessively vigorous and amongst the commonest of plants. Their origin appears to be by degradation from conspicuous conditions, as many of them have irregular flowers, such as Fumaria officinalis and small-flowered Clovers, which could only have arisen originally by insect agency. I do not agree, therefore, with Prof. Dyer, who regards cleistogamous flowers as "probably survivals of the original type" (*Nature*, Feb. 15, p. 331), for in all cases I consider them as degraded forms of their more conspicuous congeners, but reverting to self-fertilisation. I cannot, therefore, accept Mr. Darwin's conclusion that some plants "have actually had their flowers purposely rendered inconspicuous;" I take it to be simply and purely a result consequent on the absence of insects.

9. With regard to the facts of intercrossing and of self-fertilisation we must be careful not to confound the means with the end. Crossing does *per se* no good unless it bring new constitutional elements. This Mr. Darwin clearly proves. But I do not think he seems to see that self-fertilisation is not injurious except in the sense that a plant cannot introduce into itself fresh vigour. But when self-fertillsing plants are introduced into other countries, then they may become excessively vigorous, as the British weeds have done in New Zealand.

And it is a significant fact that while, with scarcely an exception, such plants are self-fertilising weeds, their conspicuous allies are wanting. Thus Malva rotundifolia has established itself in New Zealand, Society Islands, Sandwich Islands, Abyssinia and Japan, but M. sylvestris and moschata are conspicuous by their absence, excepting the former, which is in Japan, proving that there is no *à priori* reason why it should not have gone elsewhere. Euphorbia Peplus and helioscopia are present in New Zealand, both of which Mr. Bennett showed were self-fertilising, but no other species is known. Rosa rubiginosa is the most conspicuous flower, but oddly enough this is the only British Rose which has established itself in America.* Once more, five of the small flowered species of British Stellaria are scattered about the world, one of which, the highly self-fertile S. media or Chickweed, is found in New Zealand, Tasmania, Kerguelen Island, Auckland and Campbell Islands, South Africa, South America, South Australia, Tropical Asia, Hong-kong, Japan, Madeira; but the larger flowered proterandrous S. Holostea is conspicuous by its total absence from any of these far-distant localities. The inference would appear to be that the necessary insects required to cross conspicuous proterandrous species not being there, such plants have died out, if formerly introduced; and the self-fertilising weeds have thus proved themselves "the best fitted to survive in the struggle for life," in accordance with Mr. Darwin's remark on p. 407. "If any entomophilous species ceased to be visited by insects it would probably perish, unless it were rendered anemophilous" [or self-fertilising].

The next four headings (10 to 13) refer to the relative vigour displayed by self-fertilised plants, and as each has been already alluded to in previous papers little need be now added; I would, however, allude to the case of Lobelia fulgens. Of this plant three pots containing twelve self-fertilised individuals beat their intercrossed opponents in the mean ratio of 116 : 100, while in five pots all the intercrossed beat their opponents in the mean ratio of 100 : 73.5—the total mean ratio for intercrossed compared with the self-fertilised being as 100 : 91, that is, very nearly equality. Now this case, together with that of Hero and the white Mimulus, would seem to show that when a large number of plants are cultivated or grown for many years, self-fertilised plants may arise quite equal, or even superior to the intercrossed; and as many of Mr. Darwin's experiments were made on single or very few generations, and with even less than ten plants, the above lessens very considerably the relative value of such cases.

14. There is a section in chapter viii., p. 303, headed, "On the Transmission of the Good Effects from a Cross, and of the Evil Effects from Self-fertilisation." The test was in the heights of the plants raised by the intercrossing both the previously intercrossed and also self-fertilised plants. Of the fifty-four species cultivated Mr. Darwin selects three only: the first, Nemophila, which unduly favoured self-fertilisation, must be struck out, as Mr. Darwin says of it, "This experiment was quite worthless." The second is Viola tricolor: the previous generation gave the ratio of the heights of the intercrossed to the self-fertilised as 100 : 42, but of the descendants from both derived by crossing and producing "an abundance of very fine capsules," it was as 100 : 82. That is to say, the self-fertilised had improved by the cross, but that the intercrossed had inherited its advantage. The third and last example given is Lathyrus odoratus. The first two generations gave the usual ratios as 100 : 80 and 100 : 88 respectively, and the ratio of the heights of their offspring (now derived in both cases from an intercross) as 100 : 90. Hence, the same remark applies to this as to Viola. Mr. Darwin adds:—"These two lots of seeds were likewise tried by being sown under very unfavourable conditions in poor exhausted soil, and the plants whose grandparents and great-grandparents had been crossed showed in an *unmistakeable manner* [my italics] their superior constitutional vigour." Turning back to page 159, it appears that some seeds were sown in the same pot with a Brugmansia, others in poor soil in a shady place in the shubbery. The ratio of the heights of the first lot was 100 : 88, of the others 100 : 98—that is, practically the same; for Mr. Darwin elsewhere considers 96 to 104 as equivalent to 100. I do not see, therefore, that the results quite justify the above description. The points which are clearly proved are, first, that constitutional superiority gained by intercrossing is transmitted to the offspring; and, secondly, that nothing here tends to prove the descendants of the self-fertilised to be worse off than their progenitors. Indeed, when we read that Mr. Knight's varieties of Peas, originating from a cross, were subsequently propagated in abundance as a marketable product for sixty years, and that solely by self-fertilisation, it is difficult to see what is meant by "the evil effects;" we may rather ask, was not the "cross" somewhat beholden to the power of self-fertilisation to be able to be kept up so long? Then the question suggests itself, Was the dying out of these varieties or of Mr. Laxton's due to degeneracy, or mainly to fresh varieties competing with them in the market and superseding them?

If we regard the undoubted benefits derived by crossing as a positive good, then it would seem fairer to say that self-fertilisation gives purely negative results.

If two people marry who are consumptive, we might in justice speak of the evil effects or injuriousness of the union, as revealed in their consumptive children. But of the great number of habitually self-fertilising plants, which by their vigour and abundance get called troublesome weeds, as Senecio vulgaris, Cardamine hirsuta, and Stellaria media, &c., nothing can possibly be said which justifies those terms. Hence the heading above quoted should have been "On the Transmission of the Good Effects from a Cross" alone, or with the addition, "and of the correlative negative results of self-fertilisation."

The general inference appears to be this, that self-fertilisation is *per se* not injurious in the ordinary sense of the term, as implying, for example, weakness of constitution, but only in that a plant cannot introduce by that agency fresh constitutional elements; such being the case, the average vigour of such plants remains stationary. If, however, it can acquire such, in nature by migration to a different locality, artificially by made soil, then the self-fertilised may completely outstrip the intercrossed and beat them in every way. The sole, but doubtless a great, advantage of crossing, lies in such being an important means of introducing fresh constitutional peculiarities. On p. 438 Mr. Darwin observes, "That certain plants, for instance Viola tricolor, Digitalis purpurea, Sarothamnus scoparius, Cyclamen persicum, &c., which have been naturally cross-fertilised for many or all previous generations, should suffer to an extreme degree from a single act of self-fertilisation is a most surprising fact." The inference, however, I would draw is, that these plants probably represent a condition approximating absolute self-sterility, and one generation is not enough for them to recover their full self-fertility; absolute self-sterility having been reached by some species, the number of which "is not at present large" (p. 341). Hence I would group both kinds under the one common cause of sexual differentiation, due to insect agency. Viola seems to show—if I may express it metaphorically—that Nature found

* *Cross and Self-Fertilisation of Plants.* By C. Darwin. Murray.

* From a list of British plants in New Zealand, by Kirk, in *Transactions of New Zealand Institute*, 1868, vol. i., p. 157.

she had gone a little too far, and ran the risk of having no offspring at all, and so adopted cleistogamous flowers as well.

This leads me to contest another of Mr. Darwin's conclusions. On p. 455, in the passage beginning "It is an extraordinary fact" [to end of paragraph], he regards the more or less self-sterility of many species as due "to the sexual elements not having been sufficiently differentiated;" but in *Animals and Plants under Domestication*, vol. ii., p. 140, he gives, what seems to me, the correct explanation, that "the sexual elements of the same flower have become differentiated in relation to each other, almost like those of two distinct species," and he further adds, in direct opposition to his present work:—"We may conclude that it has been naturally acquired for the sake of effectually preventing self-fertilisation." This he now rejects (see p. 345).

Fig. 87.—New Orleans Cotton.

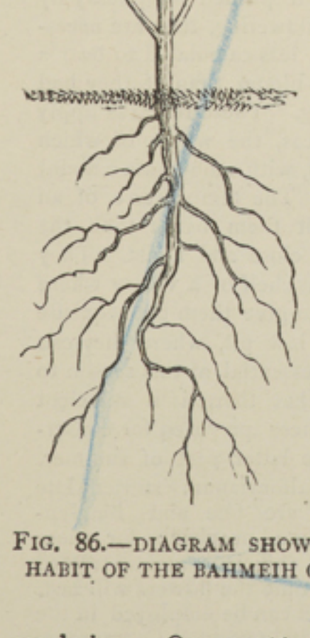

Fig. 86.—Diagram showing the habit of the Bahmeih Cotton.

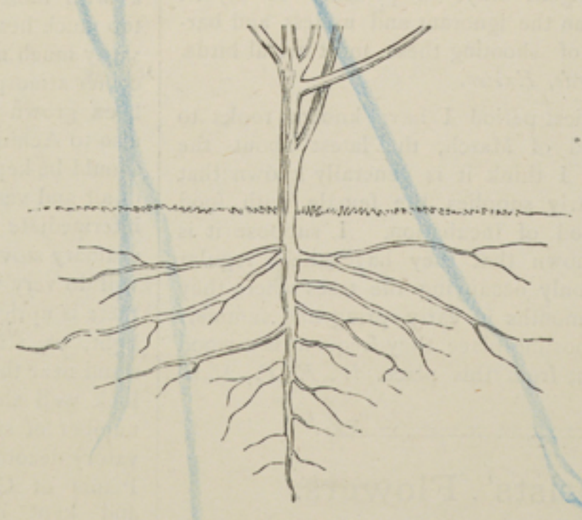

Fig. 88.—Root of ordinary Cotton plant.

When we consider what the plants are which are thus absolutely or more or less self-sterile, we find them scattered about and in no way of—in other respects—low type, as correlation would, *à priori*, lead us to expect; *e.g.*, Eschscholtzia, Corydalis, Reseda, Lobelia, Verbascum, Passiflora and Orchids, as Oncidium, &c. Now these have either allied species partially or quite self-fertile, or may often become so on changed conditions, that instead of their sexes being not sufficiently, I should prefer Mr. Darwin's former explanation that they were too highly differentiated, and that when they become self-fertile, as Eschscholtzia in England, it is a recovery of, or reversion to, self-fertilisation. Such is my impression: readers can now form their own conclusions as to which they may think is the more probable. *George Henslow.*

A NEW VARIETY OF COTTON.

M. Delchevalerie, the Inspector of Agriculture of Cairo, laid before the recent Congress of Amsterdam some specimens of a new Cotton plant found growing in Egypt. In a field of Cotton, among which were found some Bahmiehs (Hibiscus esculentus), a certain Cheik-el-Celed of the environs of Chibui-el-Kom, in Lower Egypt, noticed some specimens of fastigiate Cotton plants, quite different to the others, and similar in habit to the Bahmieh, or Bamia plant. The stems are about 8—10 feet high, straight, and with relatively few branches, and those ascending not spreading as in ordinary Cotton plants. Hence the planters of that region did not hesitate to call them "Kotn-Bahmieh." They collected the seeds carefully, in order to plant them separately. The following year they obtained nearly half a *feddau* (about half an acre) of them, of which the seeds were collected in the same way, and Egypt this year already possesses important plantations of this new variety of Cotton. The first samples which arrived in the market of Alexandria were distributed among several merchants, who sent them to Liverpool, where they were classed above "fair Cotton," and nearly fetched the price of "good fair."

M. Delchevalerie, in a note addressed to the Congress, suggested the idea that this Cotton is a hybrid production between Hibiscus esculentus and the Egyptian Cotton itself, and he proposes this summer to make some experiments at Cairo, in order to ascertain if this be so. If this hybridisation has really taken place between the Hibiscus (Abelmoschus) esculentus and the Cotton, the fact will be of great importance from a scientific point of view, for it may give rise to other experiments in artificial fertilisation between other genera of the same family. Similar facts are not unprecedented in the records of horticulture. However this may be, the new Cotton plant is taller than the ordinary Cotton. It is erect, and scarcely branched, with the exception of two or three small branches at the base, which allow of the plants being planted closer. It has not the shrubby form of the ordinary Cotton plant, which has numerous branches, themselves branched and producing here and there at the joints a capsule of cotton on a long peduncle, as seen at fig. 87. On the contrary, in the new Cotton plant, the principal branch is straight and not branched: see fig. 86. The capsules grow on the principal stem in clusters in the axils of the leaves, and are likewise borne on long axillary stalks. The roots are more tap-shaped than those of the ordinary Cotton, whose root fibres moreover spread more horizontally (fig. 88). And what is more important is, that the new variety produces much more Cotton. The cultivators of this new Cotton plant have assured M. Delchelaverie that they have obtained fifteen quintals of it per *feddau*, in the rich soil of the Delta, while the ordinary Cotton does not produce half that quantity. M. Delchevalerie informs us that he has instituted a series of experiments at Cairo on the cultivation of this new Cotton plant, and he has kindly promised to let us know in due season the results of his researches concerning this important question.

We have already alluded to this Cotton, specimens of which may be seen in the Kew museum, though by no means equal to those exhibited at Amsterdam. Young plants are also growing at Kew and with Col. Trevor Clarke.