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MOVEMENTS OF CLIMBING PLANTS.*

This essay first appeared in the "Journal of the Linnean Society," and is now given to the public in an enlarged form, illustrated by some good woodcuts. The work is entirely devoted to the relation of a mass of facts concerning climbing plants which have come under Mr. Darwin's own careful observation. These plants the author divides into four heads: those that twine spirally round a support, those endowed with veritable organs which, when they touch it, clasp it, those which ascend by means of hooks, and those which ascend by rootlets. Neither of the two latter classes, however, exhibit any special movements, and the principal portion of Mr. Darwin's work is therefore devoted to plants belonging to the first two classes. Of Bignonia Tweediana the author says:

This species is closely allied to the last, and behaves in the same manner; but perhaps twines rather better round a vertical stick. On the same plant, one branch twined in one direction and another in an opposite direction. The internodes in one case made two circles, each in two hours and thirty-three minutes. I was enabled to observe the spontaneous movements of the petioles better in this than in the two preceding species: one petiole described three small vertical ellipses in the course of eleven hours, whilst another moved in an irregular spire. Some little time after a stem has twined round an upright stick, and is securely fastened to it by the clasping petioles and tendrils, it emits aërial roots from the bases of its leaves; and these roots curve partly round and adhere to the stick. This species of Bignonia, therefore, combines four different methods of climbing generally characteristic of distinct plants, namely, twining, leaf-climbing, tendril-climbing, and root-climbing. In the three foregoing species, when the foot-like tendril has caught an object, it continues to grow and thicken, and ultimately becomes wonderfully strong, in the same manner as the petioles of leaf-climbers. If the tendril catches nothing, it first slowly bends downwards, and then its power of clasping is lost. Very soon afterwards it disarticulates itself from the petiole, and drops off like a leaf in autumn. I have seen this process of disarticulation in no other tendrils, for these, when they fail to catch an object, merely wither away.

When plants climb by means of irritable organs, such organs may consist of modified leaves, branches, or, as in the case of the Vine, of flower-peduncles; but these different classes sometimes graduate into one another. The power of climbing appears to depend upon the curious rotatory movements performed by the growing plants. Hofmeister has observed that the shoots and leaves of all plants, while young, move after being shaken, and Körner also has noticed that the flower-peduncles of a large number of plants, if shaken or gently rubbed, bend to one side. This rudimentary power of movement has, in Mr. Darwin's opinion, been specialised and perfected in the case of climbing plants; and he thinks that leaf-climbers were, in the first instance, twiners, and subsequently became capable of grasping. It appears clear that the curious rotatory movements which are performed by the growing shoots of climbing plants, and which are sometimes in the direction of the sun, but more often take the opposite course, are essential to the power of climbing. Of these rotatory movements Mr. Darwin gives a most graphic account. For instance, speaking of an Asclepiadaceous plant, belonging to the genus Ceropegia, he says:

I allowed the top to grow out almost horizontally to the length of 31 inches; this now consisted of three long internodes, terminated by two short ones. The whole revolved in a course opposed to the sun (the reverse of that of the Hop), at rates between five hours fifteen minutes, and six hours forty-five minutes, for each revolution. The extreme tip thus made a circle of above 5 feet (or 62 inches) in diameter, and 16 feet in circumference, travelling at the rate of 32 or 33 inches per hour. The weather being hot, the plant was allowed to stand on my study table; and it was an interesting spectacle to watch the long shoot sweeping its grand circle, night and day, in search of some object round which to twine.

In some cases, the plants really behaved as though endowed with sense, Mr. Darwin says:

Several times I watched cases like the following: A tendril caught a thin stick by the hooks of one of its two extreme branches; though thus held by the tip, it still tried to revolve, bowing itself to all sides, and by this movement the other extreme branch soon caught the stick. The first branch then loosed itself, and, arranging its hooks, again caught hold. No other branches, as the tendril then stood, could possibly have touched the stick. But, before long, the upper part of the main stem began to contract into an open spire. It thus dragged the shoot which bore the tendril towards the stick; and as the tendril continually tried to revolve, a fourth branch was brought into contact. And, lastly, from the spiral contraction travelling down both the main stem and its branches, all of them, one after another, were ultimately brought into contact with the stick. They then wound themselves round it and round one another, until the whole tendril was tied together in an inextricable knot.

The sensibility of some tendrils is very remarkable. In one case Mr. Darwin found that a loop of thin thread, only 1-16th of a grain in weight, caused a temporary flexure. In another a touch with a pencil, so gentle as only just to move a tendril borne at the end of a long flexible shoot, was sufficient to cause it to become perceptibly curved in four or five minutes. Mr. Darwin says:

Whilst the tendrils are revolving more or less regularly, another remarkable movement takes place, namely, a slow inclination from the light towards the darkest side of the house. I repeatedly changed the position of my plants, and some little time after the revolving movement had ceased, the successively formed tendrils always ended by pointing to the darkest side. When I placed a thick post near a tendril, between it and the light, the tendril pointed in that direction. In two instances a pair of leaves stood so that one of the two tendrils was directed towards the light and the other to the darkest side of the house; the latter did not move, but the opposite one bent itself first upwards and then right over its fellow, so that the two became parallel, one above the other, both pointing to the dark; I then turned the plant half round, and the tendril which had turned over recovered its original position, and the opposite one which had not before moved, now turned over to the dark side. Lastly, on another plant, three pairs of tendrils were produced at the same time by three shoots, and all happened to be differently directed; I placed the pot in a box open only on one side, and obliquely facing the light; in two days all six tendrils pointed with unerring truth to the darkest corner of the box, though to do this each had to bend in a different manner. Six wind-vanes could not have more truly shown the direction of the wind than did these branched tendrils the course of the stream of light which entered the box. I left these tendrils undisturbed for above twenty-four hours, and then turned the pot half round; but they had now lost their power of movement, and could not any longer avoid the light. When a tendril has not succeeded in clasping a support, either through its own revolving movement or that of the shoot, or by turning towards any object that intercepts the light, it bends vertically downwards and then towards its own stem, which it seizes together with the supporting stick, if there be one. A little aid is thus given in keeping the stem secure. If the tendril seizes nothing, it does not contract spirally, but soon withers away, and drops off. If it seizes an object, all the branches contract spirally. I have stated that after a tendril has come into contact with a stick, it bends round in about half an hour; but I repeatedly observed, as in the case of B. speciosa and its allies, that it often again loosed the stick; sometimes seizing and loosing the same stick three or four times. Knowing that the tendrils avoided the light, I gave them a glass tube blackened within, and a well-blackened zinc plate: the branches curled round the tube and abruptly bent themselves round the edges of the zinc plate; but they soon recoiled from these objects with what I can only call disgust, and straightened themselves. I then placed a post with extremely rugged bark close to a pair of tendrils; twice they touched it for an hour or two, and twice they withdrew; at last one of the hooked extremities curled round and firmly seized an excessively minute projecting point of bark, and then the other branches spread themselves out, following with accuracy every inequality of the surface. I afterwards placed near the plant a post, without bark but much fissured, and the points of the tendrils crawled into all the crevices in a beautiful manner. To my surprise, I observed that the tips of the immature tendrils, with the branches not yet fully separated, likewise crawled just like roots into the minutest crevices. In two or three days after the tips had thus crawled into the crevices, or after their hooked ends had seized minute points, the final process, a most curious one, commenced.

Mr. Darwin found in several plants that a shower from a syringe, which instantly caused the leaves of a Mimosa to close, had no effect upon the tendrils of a Passion-flower; whereas a loop of thread weighing 1-32 of a grain, which caused the tendrils to become curved, had no effect upon the leaves of a Mimosa; a fact which curiously shows how the

* "Movements and Habits of Climbing Plants." By Charles Darwin, M.A., F.R.S., &c. Second edition, revised. London: John Murray.

sensitiveness has become differentiated in different plants. In Mr. Darwin's opinion leaf-climbing plants were originally twiners, and tendril-bearers were originally leaf-climbers; and certainly the disposition of the climbing species in the different natural order lends a strong support to this view.