

abortion travels downwards and outwards, and all the flowers become rudimentary; but the abortive stamens and pistils are not so small in the lower as in the upper flowers. In the *Viburnum opulus*, on the other hand, the outer flowers naturally have their organs of fructification in a rudimentary state, and the corolla is of large size; under cultivation, the change spreads to the centre, and all the flowers become affected. In the compositæ, the so-called doubling of the flowers consists in the greater development of the corolla of the central florets, generally accompanied with some degree of sterility; and it has been observed⁸⁶ that the progressive doubling invariably spreads from the circumference to the centre,—that is, from the ray florets, which so often include rudimentary organs, to those of the disc. I may add, as bearing on this subject, that with Asters, seeds taken from the florets of the circumference have been found to yield the greatest number of double flowers.⁸⁷ In the above cases we have a natural tendency in certain parts to be rudimentary, and this under culture spreads either to, or from, the axis of the plant. It deserves notice, as showing how the same laws govern the changes which natural species and artificial varieties undergo, that in the species of *Carthamus*, one of the Compositæ, a tendency to the abortion of the pappus may be traced extending from the circumference to the centre of the disc as in the so-called doubling of the flowers in the members of the same family. Thus, according to A. de Jussieu,⁸⁸ the abortion is only partial in *Carthamus creticus*, but more extended in *C. lanatus*; for in this species only two or three of the central seeds are furnished with a pappus, the surrounding seeds being either quite naked or furnished with a few hairs; and lastly in *C. tinctorius*, even the central seeds are destitute of pappus, and the abortion is complete.

With animals and plants under domestication, when an organ disappears, leaving only a rudiment, the loss has generally been sudden, as with hornless and tailless breeds; and such cases may be ranked as inherited monstrosities. But in some few cases the loss has been gradual, and has been effected partly by selection, as with the rudimentary combs and wattles of certain fowls. We have also seen that the wings of some domesticated birds have been slightly reduced by disuse, and the great reduction of the wings in certain silk-moths, with mere rudiments left, has probably been aided by disuse.

With species in a state of nature, rudimentary organs are extremely common. Such organs are generally variable, as several naturalists have observed; for, being useless, they are not regulated by natural selection, and they are more or less liable to reversion. The same rule certainly holds good with

⁸⁶ Mr. Beaton, in 'Journal of Horticulture,' May 21, 1861, p. 133.

⁸⁷ Lecoq, 'De la Fécondation,'

1862, p. 233.

⁸⁸ 'Annales du Muséum,' tom. vi p. 319.