

primary root begins; but also here the hypocotyl and primary root are of short duration as in *Ranunculus*. *Dionæa muscipula* Ellis (Fig. 22) belongs to the same type, and differs from most of the other Droseraceæ by the presence of a distinct primary root, which aborts in most of these. It is interesting to notice that the first leaf succeeding the cotyledons already shows the peculiar structure so very characteristic of *Sarracenia* and *Dionæa*.

In these types, mentioned above, I have shown some of the most striking modifications observable in the hypocotyl and the primary root, while the cotyledons themselves merely differ in respect to their shape. In the subsequent types, on the other hand, we shall see that some modification may, also, be noticed in these. Let us begin with *Dentaria laciniata* Muehl. (Fig. 30). Of the two cotyledons only one becomes raised above ground by means of its long petiole, while the other one is short-petioled with the blade enclosed by the seed*; the blade of the green cotyledon is obovate, large in proportion to the size of the seedling. We notice, furthermore, the short, slender primary root, which persists only through the first season. The hypocotyl is very short, and the plumule soon develops into a small, conical tuber, of which the first leaf generally pushes out during the first season as a long-petioled leaf with a green, mostly bicleft blade. In regard to the secondary roots, these show a very rare position since they break out from the axils of the cotyledons, one from each. In this way *Dentaria laciniata* represents a very interesting type of seedling, dicotyledonous, it is true, but with the normal development of only one of these. The European species of *Dentaria* are, also, interesting, since both cotyledons are hypogeic in *D. pinnata* Lam., but epigeic in *D. bulbifera* L., and *D. digitata* Lam. From this we learn that the structure of cotyledons may be very distinct even among closely related species.

A still more remarkable type is exhibited by *Podophyllum peltatum* L. (Fig. 31) in which the long petioles of the two cotyledons form a tube at the base of which the plumule is located; the primary root is well developed, and persists for several years. During the first season the seed-leaves are the only ones of the plant that are visible, the plumule staying dormant until next spring. This type is known from several other plants, and Miss Sargent has given quite a comprehensive list of these, from which the following may be enumerated: Several species of *Anemone*, *Trollius*, *Eranthis*, *Delphinium*

* A similar case has been observed and described by Hill in geophilous species of *Peperomia*.