

kind of rhizome which has been called a "pseudo-rhizome," and is known from many plants, especially with epigeic cotyledons, *Galium* for instance. To this type belongs, also, *Aristolochia* *Serpentaria* L. (Fig. 28), where the cotyledons remain enclosed within the seed; where the primary root is well developed, but where there is no hypocotyl, and finally where the vegetative reproduction is effected by only one bud arising from the axil of one of the cotyledons. *Aristolochia* differs from *Phryma* in another respect, by the first leaf succeeding the cotyledons being scale-like, instead of showing approximately the same structure of the final leaves as in *Phryma*.

The most frequent type is, however, the one in which the cotyledons may or may not remain within the seed, and where the primary root develops as a strong persisting root supporting the aerial, woody stem, as in many trees of various genera. *Sassafras*, *Lindera*, *Quercus*, *Aesculus*, *Prunus*, etc. In these the primary shoot remains as the only one, no cotyledonary buds being developed, and the earliest leaves may possess a distinct blade, or they may be developed merely as small, scale-like organs as in *Carya*, *Juglans*, *Sassafras* and others.

Finally may be mentioned the very singular seedlings of *Persea gratissima* Gärtn., and *Garcinia Cochinchinensis* Choisy. In the former the cotyledons are very large, and remain enclosed, each subtending an axillary bud, ready to develop, if the plumule should become injured. The plumule bears in this species two pairs of opposite leaves with petioles and small blades, while the succeeding five or six leaves are almost scale-like, and very different from the ultimate. *Persea* thus demonstrates the fact that in seedlings with enclosed hypogeic cotyledons, there may be an alternation of various forms of leaves, while in *Juglans* and *Carya*, for instance, all the first leaves are scale-like.

Still more remarkable is the seedling of various members of the *Guttiferae*, especially of *Garcinia Cochinchinensis* Choisy. No cotyledons are developed, and the primary root soon dies off being replaced by a few very strong secondary roots, developing from the apex of the very large, bean-shaped hypocotyl. In this type the hypocotyl contains a broad parenchyma traversed by numerous resiniferous ducts, and filled with deposits of starch.

These dicotyledonous seedlings, thus, illustrate no small variation in respect to the development of cotyledons, hypocotyl, and root; furthermore, in regard to the young foliage succeeding the cotyledons. We have seen that in many trees, for instance *Carya*, *Sassafras*, *Quercus*, etc., the earliest foliage consists merely of scale-like leaves, while in *Liriodendron*, *Catalpa* *Platanus*