ORIGIN OF COTYLEDONS IN THE LEGUMINOSAE

ROBERT STRATTON, Oklahoma A. and M. College, Stillwater

As a general rule, in the study of the embryo of the garden bean and that of the garden pea, the student is told that the cotyledon of the garden bean is a modified leaf while that of the garden pea is a modified stipule. The embryo of the bean has the cotyledons on opposite sides of the stem while the garden pea has them on the same side of the stem. Since both belong to the same family, why should there be a difference as to what they really are?

Let us examine the young seedling in each case. In the bean the cotyledons are brought above the ground in germination of the seed, while in the pea they remain below the ground. This differenc in behavior is due to differences in shape and to the fact that in the bean the hypocotyl elongates whereas in the pea it does not. This does not necessarily change their origin from the standpoint of evolution.

In the development of the bean seedling the first true foliage leaf is unifoliate, or in other words, a compound leaf consisting of one leaflet, namely, the terminal leaflet. There are two of these leaves placed oppositely on the stem similar to the arrangement of the cotyledons. The next leaf above the two unifoliately compound leaves is alternate and pinnately trifoliate, as are all the succeeding leaves. Thus it should appear very clear that each cotyledon of the bean is the modified end leaflet of a compound leaf.

In the development of the garden-pea seedling the first or lowest structures above the cotyledons occupying the same position at the nodes as the leaves would occupy are two scalelike structures at each node on the same side of the stem alternately arranged in pairs. These are followed by a pair of leafletlike parts called by most botanists enlarged stipules. Above these will follow the foliage leaves each consisting of two so-called stipules, two lateral leaflets, and a tendril at the end. These so-called stipules are morphologically basal lateral leaflets.

Since the garden pea has no terminal leaflet, the lateral leaflets must serve the various functions performed by a leaf. Therefore, it seems to me

very logical to regard the cotyledons of the garden pea to be the modified pair of outer leaflets of the leaf. If this is true, then it seems reasonable to conclude that in the legume family the cotyledons are normally modified leaflets and not modified leaves in some cases and modified stipules in others.

But some botanists will say, "How about the legumes that have simple leaves?" Some say the redbud *(Cercis canadensis)* has simple leaves; but does it have simple leaves? If one will examine the redbud leaf closely, it will be observed that there is a petiole and a petiolule, indicating that the blade of the redbud leaf is an enlarged end leaflet. Therefore, it is a unifoliately compound leaf. The genera *Hardenbergia* and *Kennedia* have some species with leaves reduced to one leaflet.

I have observed the leaves of many different genera of the Leguminosae and the overwhelming majority of them show definitely that their leaves are compound. There are, however, a few genera, such as *Chorizema, Crotalaria, Genista,* and *Ulex,* that include some species that show little or no evidence of having compound leaves. In these, one is led to believe that either the petiole or the petiolule has become so short that it is not evident. Hence the unifoliate compound leaf becomes a simple leaf, since I define a simple leaf as one showing no evidence of being composed of one or more leaflets.

From this discussion it appears evident that the so-called simple leaf in the Leguminosae has been derived from a compound leaf by the loss of all the lateral leaflets.

My conclusion, therefore, is that the cotyledons of these species of legumes that appear to have simple leaves have been derived by modification of leaflets just as have those with definitely compound leaves.