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Observations on Seeds of the Leguminosae: Mimosoideae and Caesalpinioideae

By Duane Isely

Although largely neglected in many taxonomic studies, seeds have been found to yield valuable diagnostic characters. This is true not only at the level of genera and species (e.g. Murley 1946, 1951), but in considering the characteristics of plant families (e.g. Isely 1947, Martin 1946).

In connection with an investigation of the Mimosoideae and Caesalpinioideae of the north-central states, seeds of the species under consideration were studied, and a key based on seed characters prepared (Isely 1955). An extension of these investigations to other species and genera has resulted in the present report. Many of the observations discussed are not new. However, their association, and some of the interpretations therefrom have not previously been presented.

These studies were based entirely on gross morphological examinations of the seeds. Were developmental, histological investigations carried out, they would undoubtedly yield additional and possibly more significant data.

Classification of the Leguminosae.

Taxonomists interpret the Leguminosae in two different ways: (1) on the basis of uniformity of pod structure, as a large group containing three sub-families, or (2) on the basis (primarily) of variability of flower structure, as three separate families. Either viewpoint has its merits; both possess weaknesses and inconsistencies. Seed characters, insofar as they have value, lend weight to neither position. Instead they suggest a grouping into two units: The Papilionoideae, and the Mimosoideae-Caesalpinioideae.

Seeds of the Mimosoideae-Caesalpinioideae.

The seeds, arising from anatropous ovules, are usually longitudinally elongate from a basal hilum; a minority are broadened or otherwise modified so that this orientation is obscured. Often they are somewhat flattened with two faces and an edge.

The seed shape is a function of the embryo form and position. The embryo is straight, with large cotyledons lying flatwise together.
and occupying nearly the full length and width (but not necessarily the thickness) of the seed. The radicle-hypocotyl axis is short and straight. The radicle tip only slightly exceeds the lower margin of the basally cordate cotyledons which largely invest the axis (Figures 1, 2).

The hilum is adjacent to the tip of the radicle, usually offset to one side and thus slightly asymmetrically placed. Insofar as determinable by superficial observations, the micropyle appears to be contiguous to the hilum. The raphe, extending to the distal end of the seed, is discernible in some species. Where persistent, the funiculus may be rather long and sometimes spirally coiled. LaRue (1954) has recently described the funiculus in *Acacia confusa* which doubles back and forth around the seed.

The seed coat is hard and thick, frequently dark brown in color, usually appearing shiny because of a waxy-appearing external layer. As the seeds age, particularly in the Caesalpinioideae, this layer begins to crack, fissure and peel. Often contiguous, curving lines of translucent cracks are thus formed and more or less obscure the cellular surface beneath.

The endosperm is abundant, hard, horny, and translucent on unsoaked seeds, of a leathery texture when imbibed. It is most
conspicuous over the lateral faces of the cotyledons, frequently exceeding them in thickness.

Differences between the Mimosoideae-Caesalpinioideae and the Papilionoideae.

Seeds in the Mimosoideae and Caesalpinioideae arise from anatropous ovules; those in the Papilionoideae from campylotropous ones. This distinction is correlated with corresponding differences in the orientation of the embryo and the shape of the seed. In the Papilionoideae the embryo axis is bent or curved; in some instances, the radicle is short and only turned at right angles to the longitudinal axis of the cotyledons; in others, the radicle-hypocotyl axis is elongate, recurved through $180^\circ$ and directed towards the apex of the cotyledons (Figure 3). The cotyledons are oval to elliptic, not cordate. The seeds rarely possess a longitudinally elongate orientation relative to the hilum.

Barton (1947), studying seed impermeability in the Leguminosae, found that representative seeds of the Caesalpinioideae were rendered permeable by soaking in absolute alcohol, while those of the Papilionoideae were not. It was felt that the seeds of the Mimosoideae might be intermediate in this regard, but since only one genus representing this group was studied, even tentative conclusions should be deferred.

The Mimosoideae-Caesalpinioideae and Papilionoideae cannot be distinguished by presence or absence of endosperm as might be implied from some older literature which indicates that the Papilionoideae lack endosperm. As a matter of fact, all tribes of the Papilionoideae possess endosperm in appreciable or considerable amounts with the exception of the Vicieae and Phaseoleae. On the other hand, although the Mimosoideae and Caesalpinioideae characteristically possess abundant endosperm, there are numerous instances in which endosperm is essentially lacking. One entire tribe, the Piptadenieae, typically possesses seeds without endosperm.

Seed distinctions between the Mimosoideae and Caesalpinioideae.

No fundamental differences between the seeds of these two subfamilies were observed. The only character which is often diagnostic in distinguishing seeds of these two groups is as follows.

Seeds of many species of the Mimosoideae possess a horseshoe-shaped line on each lateral face (Figure 4). The open end of the horseshoe lies towards the base of the seed. In some instances, the line is strong and distinct, in others it is impressed and difficult to discern. In position, it varies from medial to marginal. This marking was not found in any of the members of the Caesalpinioideae observed, although an approach is to be found in *Cassia* in which a closed obovate or oblong area occupies each face of the seed (Figure 5).
OBSERVATIONS ON LEGUME SEEDS

Generic delimitation of Chamaecrista.

Chamaecrista has been variously treated as a section of Cassia, and as a separate genus. Most recent American authors favor the former viewpoint. In another study the relationships of these two groups are discussed, and the recognition of Chamaecrista as a distinct genus advocated. It now appears that the seed characteristics may lend further weight to these arguments.

The seeds of Cassia observed possess an obovate to oblong “face area” on each lateral surface of the seed (Figure 5). This area often stands out clearly because of lighter pigmentation than the rest of the seed. Chamaecrista seeds, on the other hand, possess no such face area. The surface is uniform in appearance and marked with fine pits arranged in lines.

SUMMARY

Seeds of the Mimosoideae and Caesalpinioideae are similar in gross morphology and embryo orientation. They cannot be distinguished except, possibly, on the basis of superficial characters. On the other hand, seeds of the Papilionoideae differ basically and can be distinguished from the above subfamilies with ease. These considerations should doubtless enter into any interpretation of the interrelationships of legume-bearing plants.

Seed characters appear to add further weight to the thesis that Chamaecrista should be segregated from Cassia.

Literature cited


