EMBRYOGENESIS IN SPHENOCLEA ZEYLANICA

BY B. G. L. SWAMY AND D. PADMANABHAN

(Department of Botany, Presidency College, Madras)

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INTRODUCTION

Studies on the embryogenesis of angiosperms have suffered from lack of co-ordination between the earlier and later phases of development, leading up to the seedling stage. The vast amount of available data on earlier ontogeny of the embryo have been attempts to recognize the probable range of variability and to relegate the diverse types of developmental patterns into the framework erected by Johansen (1950) or by Souèges (1939, 1948, 1951) on the basis of the planes of walls laid down during the first few divisions of the zygote. On the other hand, those investigators interested in morphogenesis have concerned themselves largely with histological transformations in cell groups attending the blocking out of developmental patterns in relatively older phases of ontogeny, that is, from the late "globular stage" onwards. The only examples that attempt to give a comprehensive picture of the process from the zygote to the mature embryo are by Noll (1935) on Biophytum dendroides and by Steffen (1952) on Impatiens glanduligera. It is only when studies on embryogenesis are executed with such a scope that the processes and factors involved become clear, an understanding of which helps to draw valid generalizations concerning the correlations between embryonal and seedling structures and features. The results of this type of study on Sphenoclea zeylanica are presented in this contribution. A brief account of the development of the embryo of this species has been published by Kausik and Subramaniam (1946), and one of these authors has utilized the type of embryogeny as an evidence for the erection of the family, the Sphenocleaceae (Subramaniam, 1950). In view of the presumed role of the patterns of embryogenesis in systematic discussions, it is desirable to study the embryonic ontogeny in much greater detail.

The French school of angiosperm embryogenesis has evolved a system of symbols for descriptive purposes and this method is currently being followed
in many countries. Although the system is not wholly satisfactory, sometimes being ambiguous and at times involving, it has the advantage of introducing a general uniformity and thereby facilitating easy comparisons. From this point of view the same symbols have been employed here.

In order to facilitate ready reference certain graphic symbols have been superimposed over the text-figures as follows:

- Bolder horizontal lines in longisections—delimitation of the primary tiers ensuing from the filamentous proembryo.
- Bolder vertical lines in longisections—delimitation of periblem and plerome regions.
- Bolder lines in transections—delimitation of quadrant sectors or of periblem or plerome regions.
- Finely stippled cells—epicotylary tissue.
- Coarsely stippled cells—cotyledonary tissue.
- Single-hatched and coarsely stippled cells within the cotyledons—procambium.
- Single-hatched cells elsewhere—plerome derivatives that become incorporated into the shoot apex.
- Double-hatched cells—plerome of the hypocotyl.

**Observations**

**Origin and initiation of cell tiers and initials.**—The division of the zygote nucleus which is followed by a transverse wall leads to the formation of the terminal cell $ca$ and the basal cell $cb$ (Figs. 1, 2). The terminal cell soon assumes a spherical shape and undergoes cytokinesis in vertical plane, while the basal cell divides by a transverse wall resulting in two superposed cells, $m$ and $ci$ (Fig. 3). The next division in the two daughter cells of $ca$ takes place again by vertical walls inclined at right angles to the first partition. The resulting group of four cells (together designated as $q$) represents the quadrant stage (Fig. 4). Simultaneously with the divisions in the terminal cell, the cell $m$ undergoes transverse partitioning to result in $d$ and $f$ (Fig. 4). As a result of transverse partitioning of each of the quadrant cells (Fig. 5), the unit resolves itself into two tiers, $l$ and $l'$, each tier being constituted of four cells. This eight-celled assemblage soon assumes a somewhat spherical shape and represents the octant stage of the proembryo (Fig. 6).

Of the constituent cells of $l$ and $l'$ the diagonally opposite pair of cells in each tier possess identical features in reference to size and shape, the cells