

Structure and Evolution of Devonian Seeds

introduction

- ❖ Morphologically a seed consists of a central body termed the nucellus, which is surrounded by one or two sheathing integument or seed coats.
- ❖ The term seed and ovule are often used interchangeably since it is often difficult to determine whether or not fertilization has taken place.

OLDEST DEVONIAN SEED

- ❖ To date the oldest known seed plant is *Elkinsia polymorpha*. A seed fern described from the late Devonian (Rothwell 1989).
- ❖ Ovules are isodiametric and up to 6.5 mm long with the integument constructed of four or five lobes that are only in the basal region.

YOUNGER DEVONIAN CUPULATE

- ❖ The seed of *Archiosperma arnoldi* are flask shaped and about 4.2mm long at the apex of each seed the integument is serrated into a number of lobes that form a rudimentary.

SEED EVOLUTION

- ❖ The seed of *Brisinghia* (pant nautiyal & mukerjee unpublished) are unique in showing forking in their two lateral horns which presumably represent the free portion of the forking telomes forming their integument.
- ❖ That the megasporangia of *Lepidocorpon* and *Miadesmia* become wrapped in their sporophylls and obviously that was another parallel mode of formation of seed like organs.

EVOLUTION OF THE INTEGUMENT

- ❖ The synangial hypothesis was based on fossil evidence and was proposed by Benson (1904) who believed that the integument evolved from the sterilization of the outer ring of sporengia in a radial synangium.

EVOLUTION OF POLLEN CAPTURE

- ❖ Another important innovation in the evolution of the seed habit perhaps the most important was a method to capture pollen at the distal end of the nucellus (megasporangium) in many but not all early seed.
- ❖ The pollen receiving mechanism appears to be a hollow pollen chamber formed by the distal end of the nucellus which is surrounded by a funnel like projection termed the salpinx or logenostome. Inside the pollen chamber is a parenchymatous central column attached to a membranous pollen chamber floor.

POLLEN

- ❖ It is interesting that pollen grains extracted from late devonian and mississippian pollen organs differ little either in their morphology or wall ultrastructure from the isospores of homosporous plant or the microspores of the certain heterosporous plant.
- ❖ Gymnosperms port etal(1996) to describe cordaite and seed fern pollen that he interpreted as containing grains that are beloved to have germinated from the proximal surface.

DEVONIAN SEED STRUCTURE EVOLUTION

- ❖ Gymnosperms were originated during middle devonian somewhere around 380 million years ago this can be said due to the extraction of seed from that period from north America and England these were popularly called as devonian seed and one considered to be belonging to early gymnosperms so some of them are as follows devonian seed in 12 name.

- *Runcaria heinzelinii*
- *Elikinsia polymorpha*
- *Moresentia zaleskye*
- *Archaeosperma arnoldii*
- *Xenotheca devonicus*
- *Spermasporites allenii*
- *Hydrasperma tenuis*
- *Pullaritheca longei*
- *Karriya mattonii*
- *Ruxtonia minuta*
- *Spermolithus devonicus*
- *Dorinnotheca streelii*

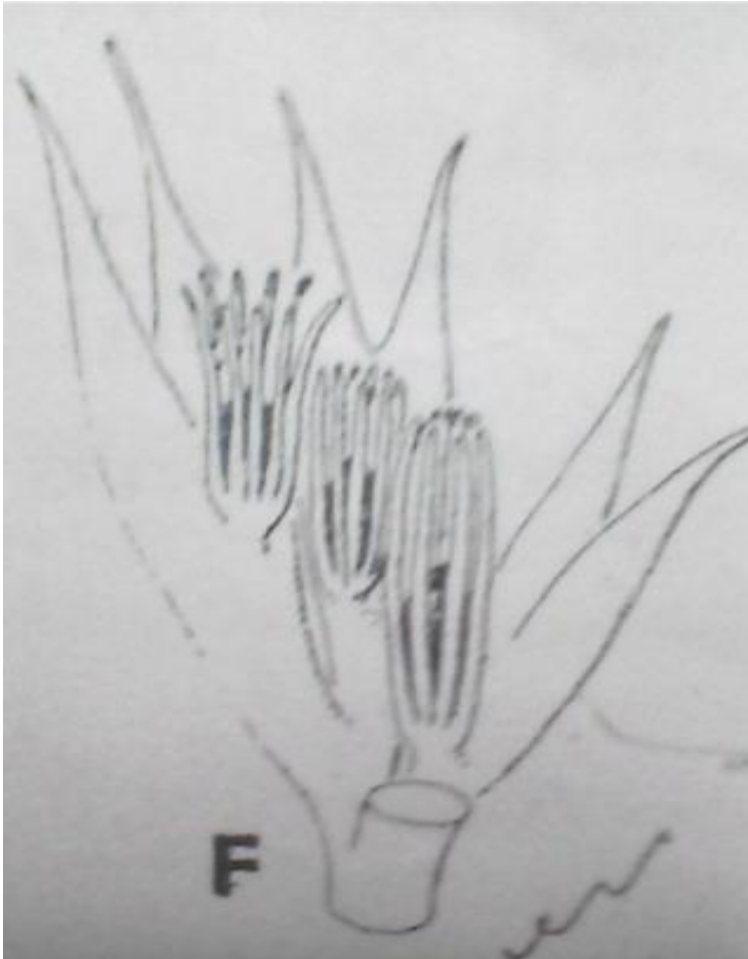
Elkinsia polymorpha



- ❖ Each integumentary lobe is vascularized by small teret strand. In the distal region the integumentary lobes are widely separated and surround a cellularized extension of the nucellus that presumably functioned as a pollen receiving mechanism .

Elkinsia polymorpha

Moresnetia zaleskey



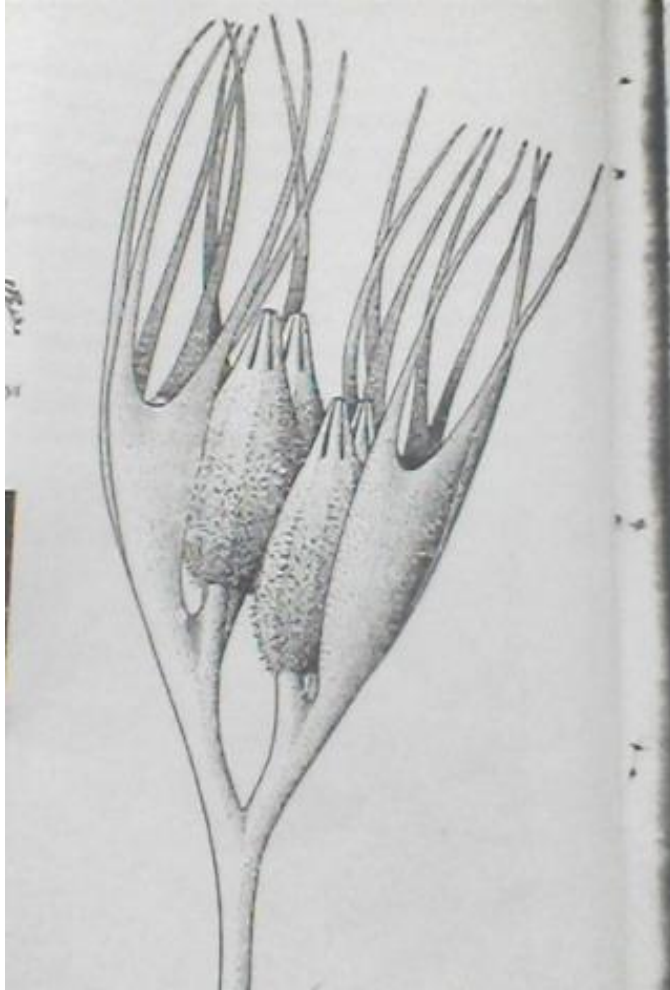
M. zaleskey

- ❖ In *M. zaleskey* from Belgium each cupule contains up to four ovules. Individual ovules were organized much like those of *Elkinsia* with 8-10 free integumentary lobes.

Xenotheca devonica

- A slightly younger seed is *Xenotheca devonica* described from north devonian, southern england and the upper devonian old red sandstone near cardiff south wales ed sandstone near cardiff south wales

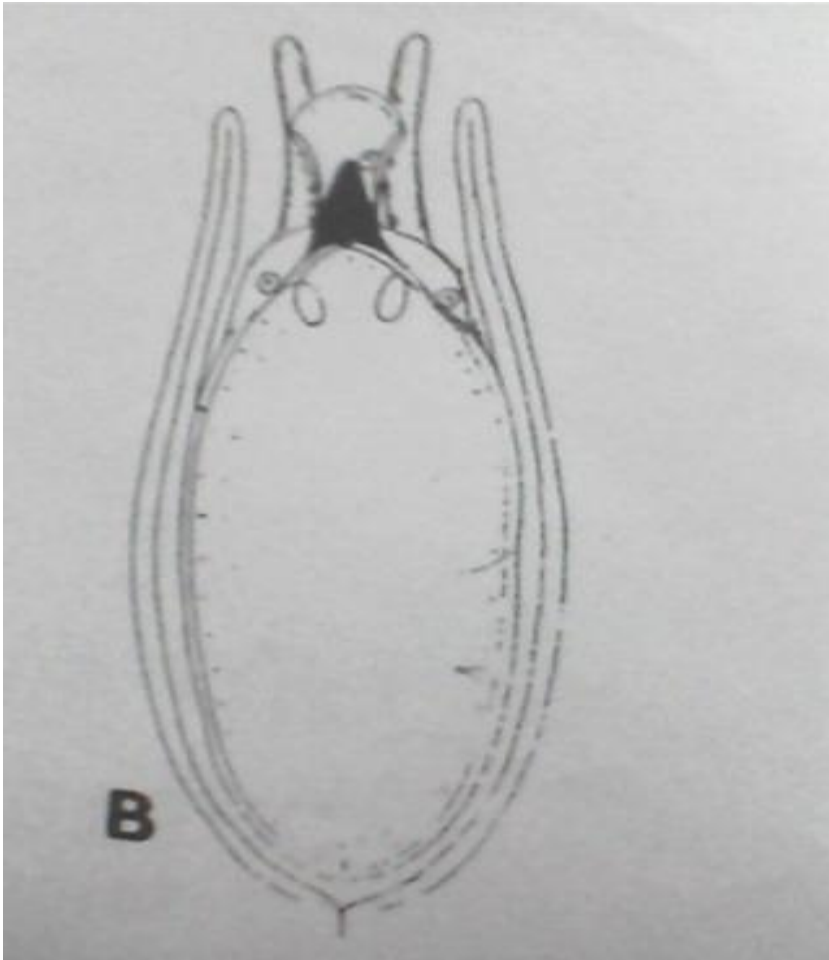
Archaeosperma arnoldii



*Archaeosperma
arnoldii*

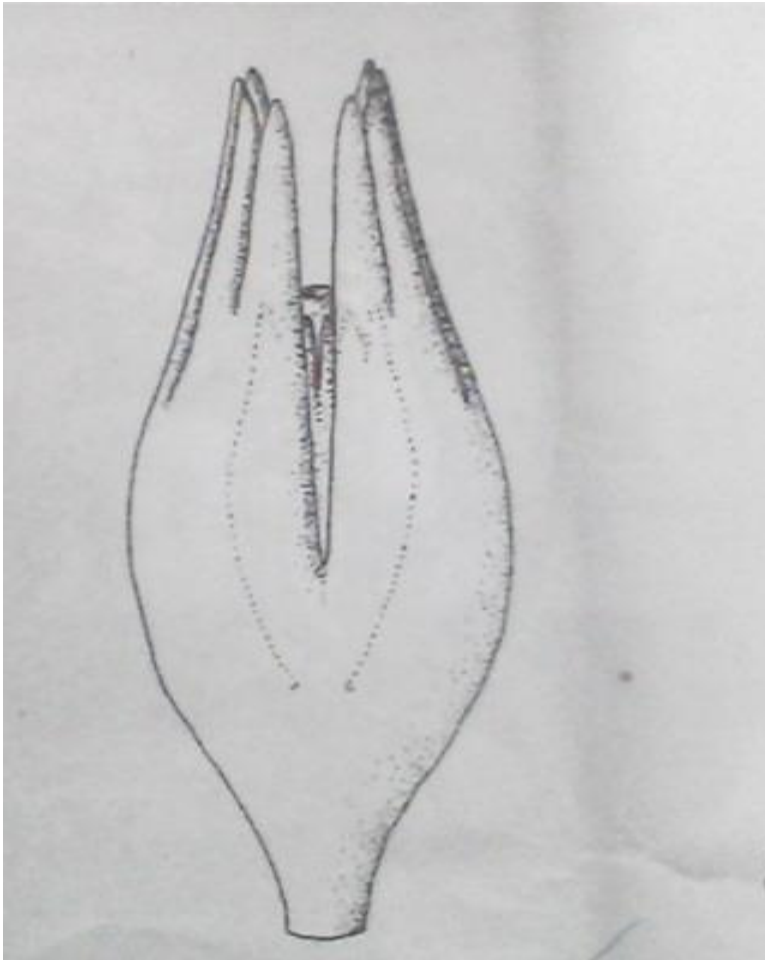
- ❖ It consists of two cupules borne terminally and a dichotomizing branch system. Each cupule is 1.5 cm long and contains two short pedicels, each bearing a small seed. A total of two seeds per cupule. The seeds are flask-shaped and 4.2 mm long. Thus, nothing is known about the pollen. Clones a tetrahedral tetrad of Archaeosperma.

Hydrasperma tenuis



Hydrasperma tenuis

Ruxtonia minuta



*Ruxtonia
minuta*

- ❖ *Ruxtonia* was proposed for small bilaterally symmetrical ovulate cupules up to 5mm long from the mississippion of Australia .
- ❖ Difference in the integument morphology and the large number of seed on an individual bedding plane suggest that in some of the early seed plant.

Spermolithus devonicus



- ❖ One exception to the radial symmetry of early seeds, may be *Spermolithus devonicus* a compressed seed from the famennian of southern Ireland the seed appears to be platyspermic (bilaterally symmetrical) with the integument fused all the way to the apex unlike the free integumentary lobes of other devonian seed nothing

Runcaria heinzelinii



- ❖ About 20 million years ago *Runcaria* small and radially symmetrical is an integumented megasporangium surrounded by a cupule. The megasporangium bears an unopen distal extension protruding above the multilobed integument it is suspected that the extension was involved in anemophilous pollination

Runcaria heinzelinii

Pullaritheca longii



Pullaritheca longii

- ❖ Proposed for ovulate cupule from the mississippion ovulate cupules from the upper devonian