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EMBRYO DEVELOPMENT AND STRUCTURE OF MATURE EMBRYO, DEVELOPMENT OF SEED COAT AND FRUIT WALL OF *Aristida adscensionis* Linn.

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ABSTRACT:
The paper deals with the embryological investigation on *Aristida adscensionis* (Voucher specimen: N-1) deposited in botany department RTM Nagpur university, Nagpur. The embryo development conforms to Asterad type of Johanson (1950) or follows period I, Series A, Subseries A2 and Megarchetype II (Soueges, 1951). Development of seed coat and pericarp has been described
Keywords: *Poaceae, Pooideae, Embryogeny, Pericarp & Caryopsis.*

INTRODUCTION:

The poaceae is known for its structural diversity both in vegetative and reproductive morphology. The division of the Poaceae into two sub families viz, Pooideae and Panicoideae as proposed by Brown (1814) is maintained even today. Embryological investigations on this taxon indicate that embryological feature at subfamily level follows the uniform pattern (Narayanswami, 1955 a,b,c 1956; Koul, 1970 a,b; Raju, 1980: Bhanwar at. al., 1991; Deshpande and Makde 1994: Nikhade and makde 1997 ; Nikhade &Sanjay Kumar 2021. Poaceae having unique fruit amongst angiosperm i.e, Caryopsis it is essentially a dry monospermic indehiscent fruit with pericarp of varying thickness, free or closely adherent to the seed coat. The present work support for redefine the term "Caryopsis".

MATERIAL & METHODS :

Materials was collected from Navargaon locality & fixed in F.A.A. (70% ethanol). Customary methods of dehydration , clearing & embedding were followed (Johanson ,1940).Sections were cut at 8-12micron thick & stained with Delafield hematoxylin. Erythrosin or fast green was used as counter stain. The sections were mounted in Canada balsam. Diagrams were drawn with the help of camera lucida.

Observations:

Embryo Development: The fertilized egg is spherical and its cytoplasm shows small vacuoles around the nucleus. The first transverse division of the zygote results in the formation two superposed cells viz, the terminal ca and basal cb (Fig 4A ,B).

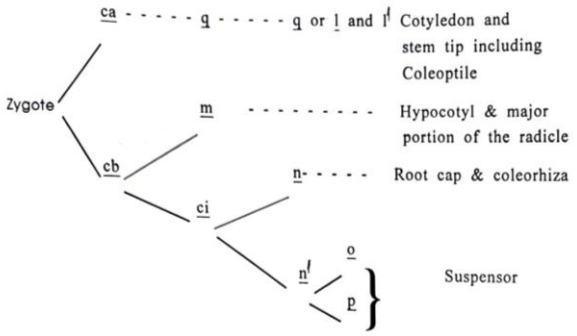
During second cell generation ca divides vertically and forms two juxtaposed cells while cb divides transversely to form two superposed cells m and ci (Fig. 4C.). Thus, at the end of 2nd cell generation, produced pro-embryonic tetrad can safely be described as T-shaped by or assigned to series A2 of Soueges (1951) system of classification. The 3rd cell generation the pre-embryo consists of 8 cells disposed of in four tiers; q, quadrant of 4 cells, m of 2 juxtaposed cells and tiers n and n .Next the cell n divides vertically and forms two juxtaposed cells. (Fig. 4D). This is soon followed by transverse partitioning of n" into o and p .

At the close of 4th cell generation the pro- embryo has 16 cells disposed of in 8 tiers (Fig 4 E, F). During subsequent development divisions in tiers 1,1 and m do not follow a regular sequence, but

occur in different planes resulting in a massive globular embryo (Fig 4. G ,H,I).

Schematic representation of Embryo development.

This is schematically shown below -



It is thus clear that embryo development in taxa investigated here broadly conforms to the Asterad type of Johansen (1950) and follows the *Poa* variation.

According to Soueges system of classification (Crete, 1963) embryogeny falls under grand period I, series A, subseries A_2 and megarchetype II.

The destinations of various tiers during the first 4 cell generation are given below -

First cell generation :

Proembryo of 2 cells disposed of in 2 tiers

ca = pco + pvt (including coleoptile)

cb = phy + icc + iec + co (including coleorhiza) + s.

Second cell generation :

ca = pco + pvt (including coleoptile)

m = phy + icc + iec

ci = co (and coleorhiza) + s.

Third cell generation :

Proembryo of 8 cells disposed of in 4 tiers

q = pco + pvt (including coleoptile)

m = phy + icc + iec

n = co + (and coleorhiza)

n' = s

Fourth cell generation :

Proembryo consisting of 16 cells disposed of in 6 tiers destinations are the same as in previous generations except that we substitute l and l' for q and o and p for n' when it divides transversely.

l = pco + cl' (upper lip of coleoptile)

l' = pvt + cl" (lower lip of coleoptile)

m = phy + icc + iec

n = co (and coleorhiza)

o, p = s

At this globular stage of embryo the tiers 1 and 1' became prominent. Generally tier 1 has few more layers as compared with 1 (Fig.4 I ,J).

The entire tire 1 gives rise to the single terminal cotyledon called as scutellum (scu) from it also organized the upper lip of the coleoptiles are derived from the inferior tier1

During further growth the development in the lip of the coleoptiles is faster than the stem tip region or shoot apex (pvt) and first leaf eventually gets practically encircled by the coleoptiles (Fig.4K,L). The hypocotyledonary region (phy) along with central cylinder of root (iec) engendered from the elements of tier m. From the central elements of this region adjoining the iec elements of m , root cap initials differentiates.

The mature embryo exhibits characteristic features of generalized grass embryo (Fig 4K). The root cap (co) and coleorhizae (cr) is formed from the outer and lateral element of n .

Development of seed coat and fruit wall

The structure and development of seed coat and fruit wall in Aristida adscensionis Linn. Investigated. The ovules are bitegmic, both the integuments generally two layered. The outer integument degenerates during post fertilization stages and does not participate in the formation of seed coat, the inner layer of inner integument alone contributes towards the development of seed coat.

At 2- nucleate, 4- nucleate or mature embryo sac stage both outer and inner integuments show 2-layers of wall formed cells (Fig.5 A,B,C) . The inner integument though persists at the earlier stages, its outer layer starts collapsing at globular embryo stage (Fig 5C, D).

It is also noticed that when outer layer of inner integument disorganizes and inner layer get filled with tannin. It is very clear from the present work that, the seed coat is constituted by inner layer of inner integument only.

Peri carp (Fruit wall)

The young ovary wall is made up of a variable number of parenchyma layers. During post fertilization development, generally there is no increase in the number as layers of ovary wall. In mature grain the fruit wall is broad and composed aof 7-layers, including the outer and inner epidermal covers. (Fig. 5 A,B). Mature pericarp in this taxa remain separate from seed coat.

DISCUSSION:

The classification of grasses during Linnean & Post-Linnean period was based upon similarities of gross morphological character. However, Van Tiegham(1987) who studied grass embryo indicated its use in the classification . R Brown was first to subdivide the family scientifically into Panicoideae & Pooideae on the basis of differences between the spikelets of the two groups .After the establishment of synthetic approach in classification ,several character which include anatomy, cytology, phytochemistry, embryology ,Palynology etc.played vital role in the grouping of grasses. The system of Takhtajan (1980),Campbell (1985), Dahlgrain (1985),Thorne (1992), find the place of such characters in the systems of classification.

The present embryological work on Aristida adscenseosis belongs to subfamily Pooideae resemble in most of the embryological features of the family worked out by earlier workers (Chandra, 1963 a,b ; Venkateshwarlu & Devi, 1964; Deshpande 1976; Raju,1980; Bhanwara1988; Ghaisas,1991; Nikhade & Makde 1997; Nikhade & Kumar 2021; embryogeny conformed to Astered type (Johansen !950) or follows Grand period I,Series A,Subseries A2, Megarchetype II (Soueges 1951).Batygina (1969 a,b; 1974) while working on *Triticum* clamied a new type of embryo development viz.,Graminad type on the basis of oblique plane during pro-embryonic development.

The fruit in grasses classified under " Caryopsis" & has been defined as seed .The testa and pericarp are further reported to be fused with each other (Anderson,!927; Julian & Aldama, 1939). Now data available on later studies on grasses do not agree with these findings (Narayanswami 1955 a,b,c; Raju,1980; Bhanwara,1988 , 1991 ; Ghaisas, 1991; Deshpande & Makde ,1994; Nikhade & Makde 1997 ; Nikhade & Sanjay Kumar 2021). Sendulsky et al.(1986) stated that "Caryopsis" essentially is a dry indehiscent fruit where pericarp is free or closely adherent to seed coat . The authors also feel that in the light of these finding there is an urgent need to redefine the term caryopsis.

Explanation of Figure: 4

A-L : *Aristida adescenosis* Linn.
(Embryo Development)

A : Zygote ; note vacuoles.

B-J : Stages in the development of embryo.

K : Mature embryo showing different parts.

L : Cellular details of plumule – radical axis in mature embryo.

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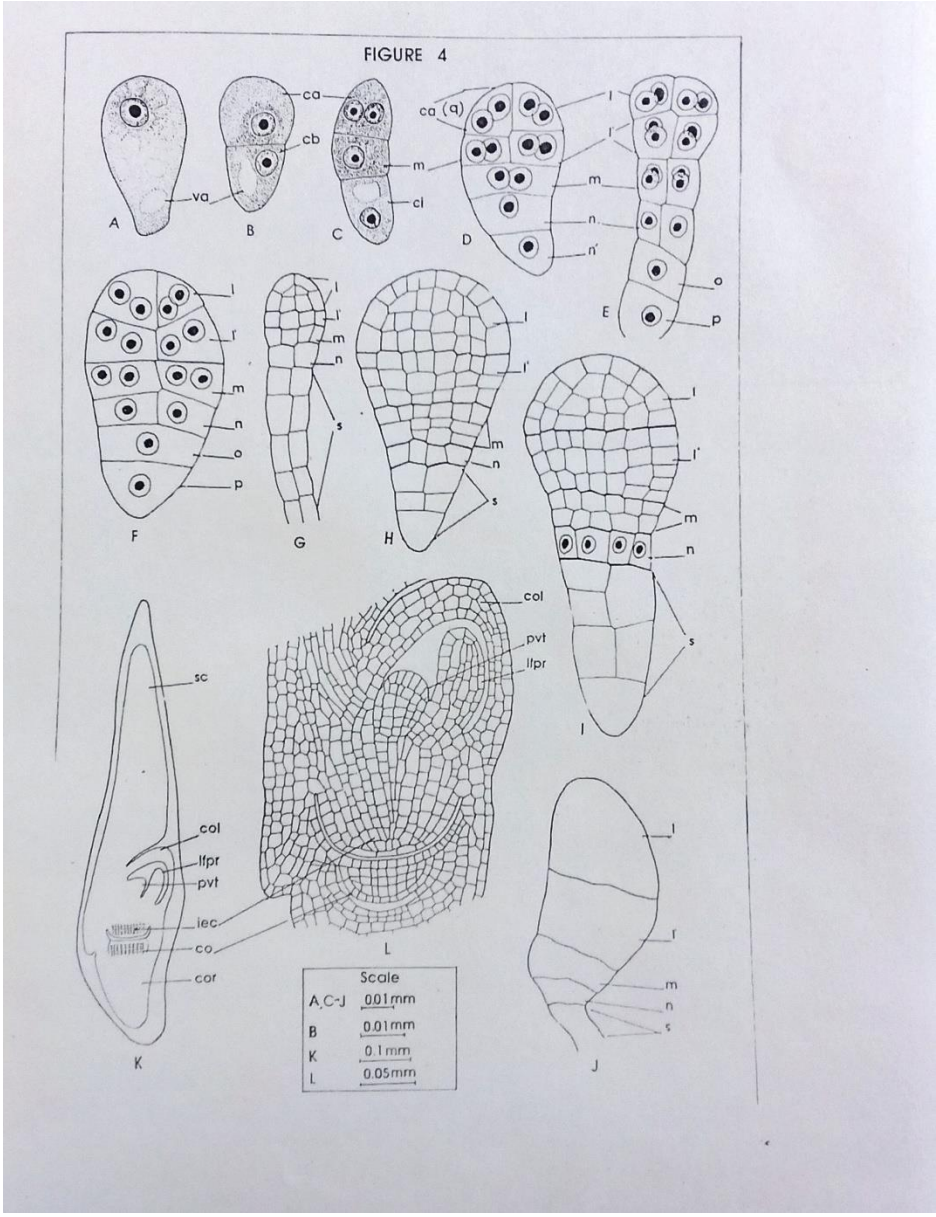
Fig 4:



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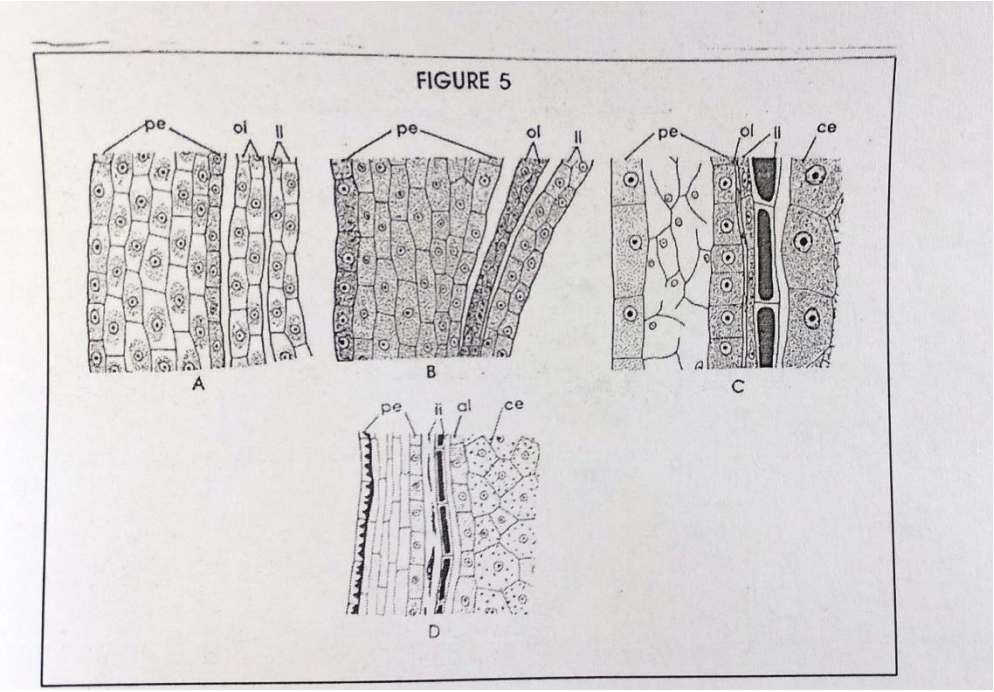

Explanation of Figure: 5
A-D : Aristida adescensionis Linn.
A : Pericarp & integuments (part)at 2-nucleate embryo.
B : Pericarp & integuments(part) at mature embryo sac stage ; note degenerating outer integument
C : Pericarp & seed coat at advanced globular embryo stage ; note obliteration of intervening wall layers of pericarp, disorganizing outer integument & outer layer of inner integument.
D : Pericarp & seed coat at (part) at mature embryo stage ; note tannin filled cells of outer epidermis of pericarp & total disorganization of outer layer of inner integument.
Abbriviation : va-vacuole, ca- cb- co-root cap; col- coleoptiles ; cor – coleorhizae
Iec- initials of the root cortex ; ifpr- leaf primordium ;pvt- stem tip s-suspensor ;sc- scutellum ;pe-pericarp ;ii- inner integument; oi-outer integument ; ce- cellular endosperm ; al- aleurone layer.