STUDY OF THE MATURE NATIVE STRUCTURE OF EMBRYO IN SOME MEMBERS OF THE FAMILY ACANTHACEAE

N.M. Labhane[1*] and N.M. Dongarwar[2]
[1]Department of Botany, Bhavan's College, Andheri- Mumbai, MS, India
[2]Department of Botany, RTM Nagpur University Campus, Nagpur, MS, India
nitin.labhane@bhavans.ac.in

ABSTRACT

Acanthaceae family comprises taxon, which are considered as with very diverse. This necessitates the exploration of various fields for solving the taxonomic problems. The embryology has been the backbone for solving various taxonomic intricacies. The structure of embryo in considered as a very important taxonomic tool for the identification and delineation of the species. The classical studies on embryology focused on the internal structures to depict the various stages in the development of male and female reproductive structures along with development of the embryo and the seed. The native or the in-vivo structure of embryo is increasingly been found to be very important in the knowing the affinities and delimitation of the taxa. The structure of mature embryo just before dormancy enables to establish the relationship between the embryo and endosperm. Thus, native structure of embryo in Blepharis repens (Vahl) Roth., Haplanthodesverticillata (Roxb.) Majumdar, Justicia procumbens Linnaeus and Rungia repens (Linnaeus) Nees. Belonging to family acanthaceae was found be interesting.

Keywords: *Native embryo, Ruminate embryos, in-vivo, species, Acanthaceae*

Introduction

The family Acanthaceae, which is one of the important members of sympetalae group is comprising of diverse taxon, where not a single morphological character can be considered to be significant to delimit it from its allies. Thus, the family Acanthaceae consists of very closely related taxa, whose placement is uncertain (Bremekamp, 1953). Embryological characters have acquired greater significance in plant taxonomy, especially when the external morphological characters are unconvincing and ambiguous as a result of convergence (Kapil & Bhatnagar, 1980).

The seed is an important stage in the higher plant life cycle with respect to the survival as a species (Bewley & Black, 1994). The development of seed includesthe embryo and endosperm development, along with seed maturation (Bentsink&Koornneef, 2008). Embryogenesis, which is a post fertilization product, starts with the formation of a single-cell zygote and ends in the mature cotyledonary stage when all embryo structures have been formed (Mayer et.al., 1991). At the end of the embryo growth phase, cell division in the embryo is arrested and seed undergoes dormancy (Raz et.al., 2001). Hereafter, the seed, containing a fully mature embryo, undergoes maturation during which food reserves accumulate and dormancy and desiccation tolerance develops (Goldberg et.al., 1994). Seed germination process leads to the emergence of the plumule and radicle along with the cotyledons, however very less is known about the mechanism to overcome seed dormancy (Bewley, 1997). The study of morphology of developing embryo at the stage of maturity can give a conclusive idea regarding the viability of seeds. The traditional way of reviewing embryology is by doing laborious microtome studies but the biggest weakness is that, it is highly impossible to understand the embryo morphology in its native form at maturity (Labhane & Dongarwar, 2020).

Materials and Methods

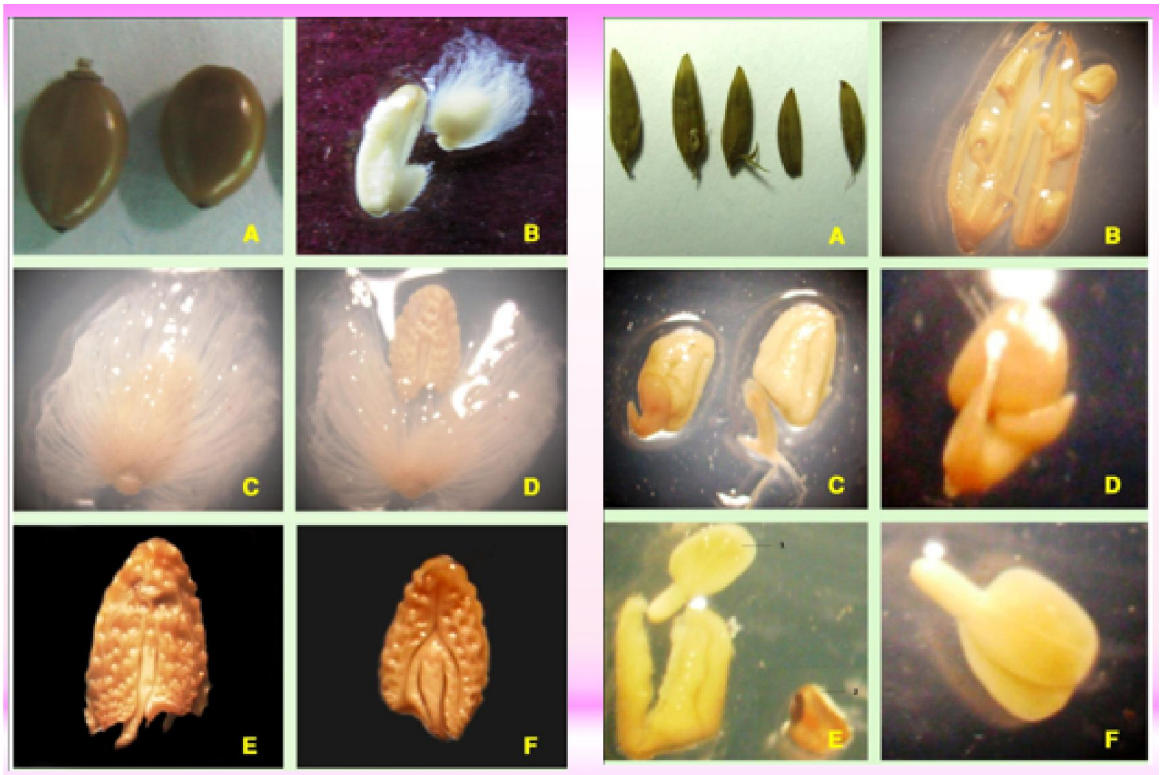
The plants selected for the investigation are *Haplanthodesverticillata*(Roxb.) Majumdar, *Blepharis repens* (Vahl) Roth.,*Rungia repens* (Linnaeus) Neesand *Justicia procumbens* Linnaeus. All the plants selected were collected mostly from Nagpur region with only exception that *Haplanthodesverticillata*(Roxb.) Majumdar was collected from Sanjay Gandhi National Park, Borivali, Mumbai.The taxa under investigation were preserved in the form of herbarium specimen and deposited in the Department of Botany, Rashtrasant Tukadoji Maharaj Nagpur University, Nagpur with the accession numbers NML/201- *Blephahris*

repens, NML/202- *Haplanthodes verticillata*, NML/203- *Justicia procumbens* and NML/204- *Rungia repens.*The plants were identified with the help of standard flora by Ugemuge (1986) and Singh et.al. (2001). Thirty young and mature fruits of each taxon were hand dissected under dissecting microscope to study the embryo structure in native form.

Observations

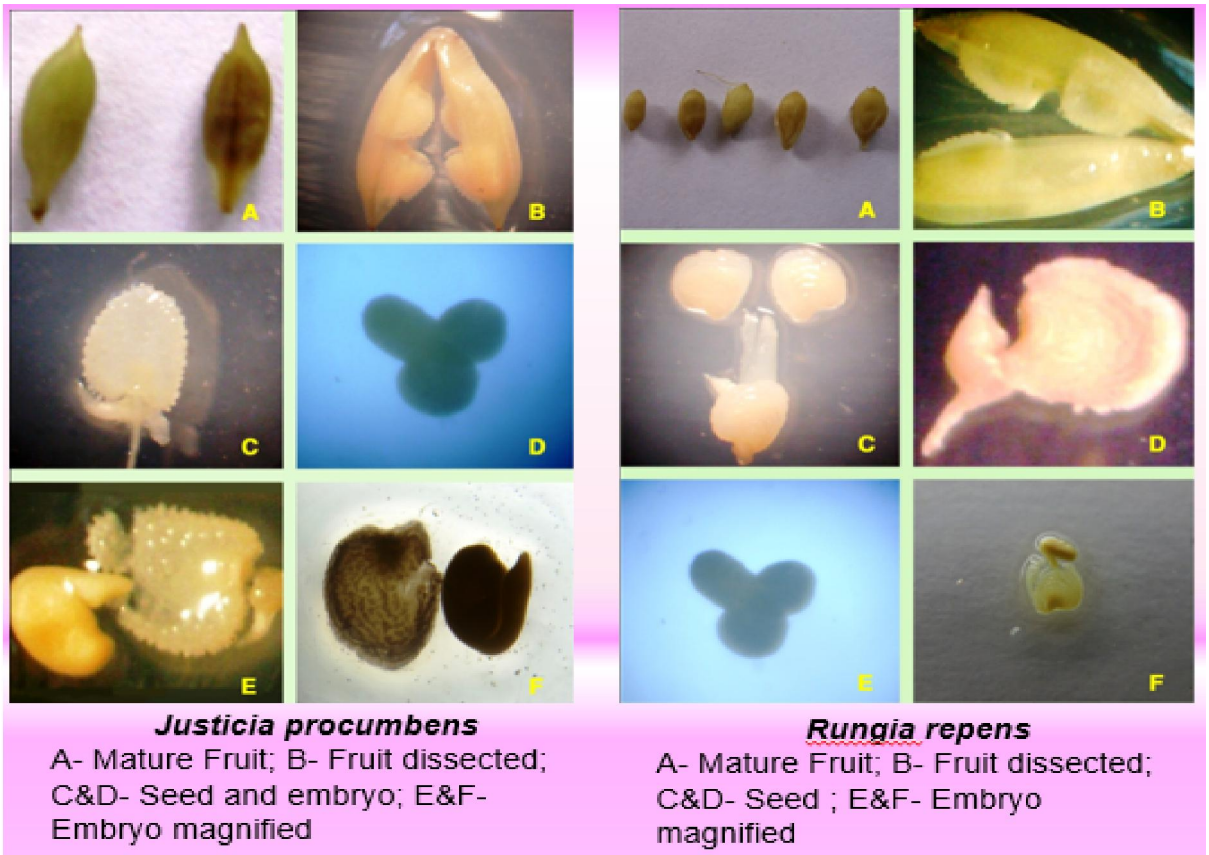
Table No-1 Showing the Some characters related to development of Seed (N=30; Fruits were collected from various location and the embryo morphology in native form is studied)

Characters	*B. repens*	*H. verticillata*	*J. procumbens*	*R. repens*
Number of ovules in ovary	2	8	4	4
Number of seeds at young stage	2	6	4	4
Endosperm- *Present/ Absent*	Absent	Present	Present	Present
Mature embryo- *straight/ curved*	Straight	Straight	Curved	Curved
Ornamentation on embryo- *Present/Absent*	Present	Absent	Absent	Absent
Tubercles on seed- *Present/Absent*	Absent	Present	Present	Present
Seed dispersal- *Splitting/ degeneration*	Degeneration	Splitting	Splitting	Splitting



Blepharis repens
A- Mature Fruit; B- Fruit dissected; C&D- Seed and embryo; E&F- Embryo magnified

Haplanthodes verticillata
A- Mature Fruit; B- Fruit dissected; C&D- Seed ; E- Healthy and aborted embryo; F- Embryo magnified



Photoplate-1 Showing the Structure of Fruit, seed and Embryo in native form

The mature fruits were dissected to see the structure of the seed. The young and mature seeds were dissected so that the structure of native embryos is evident. The structure of the embryos is studied to ascertain the structures of embryo at maturity. Table-1, clearly shows various characters taken into consideration, however the structure of embryo is very diagnostic to ascertain the taxonomic position of the plants under investigation.

The photoplate-1 clearly shows the various stages in the development of the fruit, seed and embryo. However, the structure of embryo at maturity is very diagnostic. The embryo structure and its orientation display a visible differentiation between the four taxa under investigation. The structure of embryo of *B. repens* and *H. verticillata* are upright, whereas the embryos of *J. procumbens* and *R. repens* are inverted.

Result and Discussion

The taxa studied shows in this paper shows the difference in the number of ovules present in the young and mature stage of fruit development. Thus, the variability in the production of viable seeds has been described by several authors (Karkkainen et.al., 1999; Wani et.al., 2010; Fu et.al., 2008; Labhane & Dongarwar, 2012). The plant embryological studies have always tried to explore the use of various development stages for solving taxonomic problems in various taxa (Maheshwari, 1950; Bhojwani& Bhatnagar, 1999). With the development in the field of molecular biology, attempts have been made to establish the genetic basic of embryology (Raghavan, 1997, 2003; Scott et.al., 2004).

Diploid embryo (2n) and the triploid endosperm (3n) are encircled by the maternally derived integument layers that transforms into the seed coat, and effective seed formation entails the synchronous development of all three of these genetically distinct tissues (Garcia et.al., 2005; Berger et.al., 2006; Ingouff et.al., 2006).The structure of embryo at maturity have been found to be very characteristic in case of *B. repens*. Labhane & Dongarwar (2014) reported the presence of ruminate structure in the native embryo of *B.*

repens. The development and the structure of the ruminate embryo is seen as very distinct in family Acanthaceae, hence it can be considered as a very important character for the taxonomic identification.

The study of embryo in its native form in the taxa such as *B. repens, T. stans* etc, highlights the importance of mature embryo in taxonomic studies (Labhane & Dongarwar, 2014). The photplate-1, shows the presence of ruminate upright embryo in B. repens, while *H. verticillata* shows non-ruminate upright embryo. Thus, these two taxa belonging to family Acanthaceae, can be very well differentiate based on embryo morphology. The structure of embryo at maturity in *J. procumbens* and *R. repens* shows inverted embryo with no rumination. Even the structure and developmental stages have been reported to be same, using reproductive and embryological characters along with biochemical character, Isozyme (Labhane & Dongarwar, 2011, 2012, 2014, 2020).

The use of embryological characters to ascertain the taxonomic position of the both the taxa *J. procumbens* and *R. repens* most probably have evolved together reproductively or they might have just segregated very recently. Labhane & Dongarwar (2011) had suggested the inclusion of the taxon *Rungia* into *Justicia* based on various embryological characters. The above study also suggests the co-evolution of *J. procumbens* and *R. repens*based on the study of freshly dissected embryo in its native form from the seeds.

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