DEVELOPMENT AND STRUCTURE OF SEEDS IN *CARISSA GRANDIFLORA* A.DC. (APOCYNACEAE)[1]

PEERZADA, S. H. KHAN & R. P. SINGH

National Botanical Research Institute, Rana Pratap Marg, Lucknow 226 001, India

Abstract

Development and structure of seeds in *Carissa grandiflora* A.DC. have been studied. Integumentary tapetum in the ovule is observed at the female gametophyte stage. Endosperm development is of the Nuclear type. Mature seeds are endospermic and the embryo is of the Spatulate type. Seed coat consists of thick-walled cells of the outer epidermis and compressed cells of the hypodermis. No hair is present on seed surface.

Introduction

Embryological studies in *Carissa carandas* and *C. spinarum* have been made by Rau (1940) and Maheswari Devi (1974), respectively but not much attention has been paid to the development and structure of seed. The present investigation, therefore, deals with these aspects in *Carissa grandiflora* A. DC. which has not been studied so far. *Carissa* is of economic importance and its berry is consumed in various preparations.

Material and Methods

Flowers and fruits at different stages of growth were collected locally and fixed in formalin-acetic acid-alcohol and later stored in 70 per cent ethanol. They were dehydrated through tertiary-butyl alcohol series and embedded in paraffin was in usual way. Serial microtome sections, 8-10 μm thick, were stained with safranin and fast green combination. Maceration of the seed coat was done according to Jeffrey's method (Johansen, 1940).

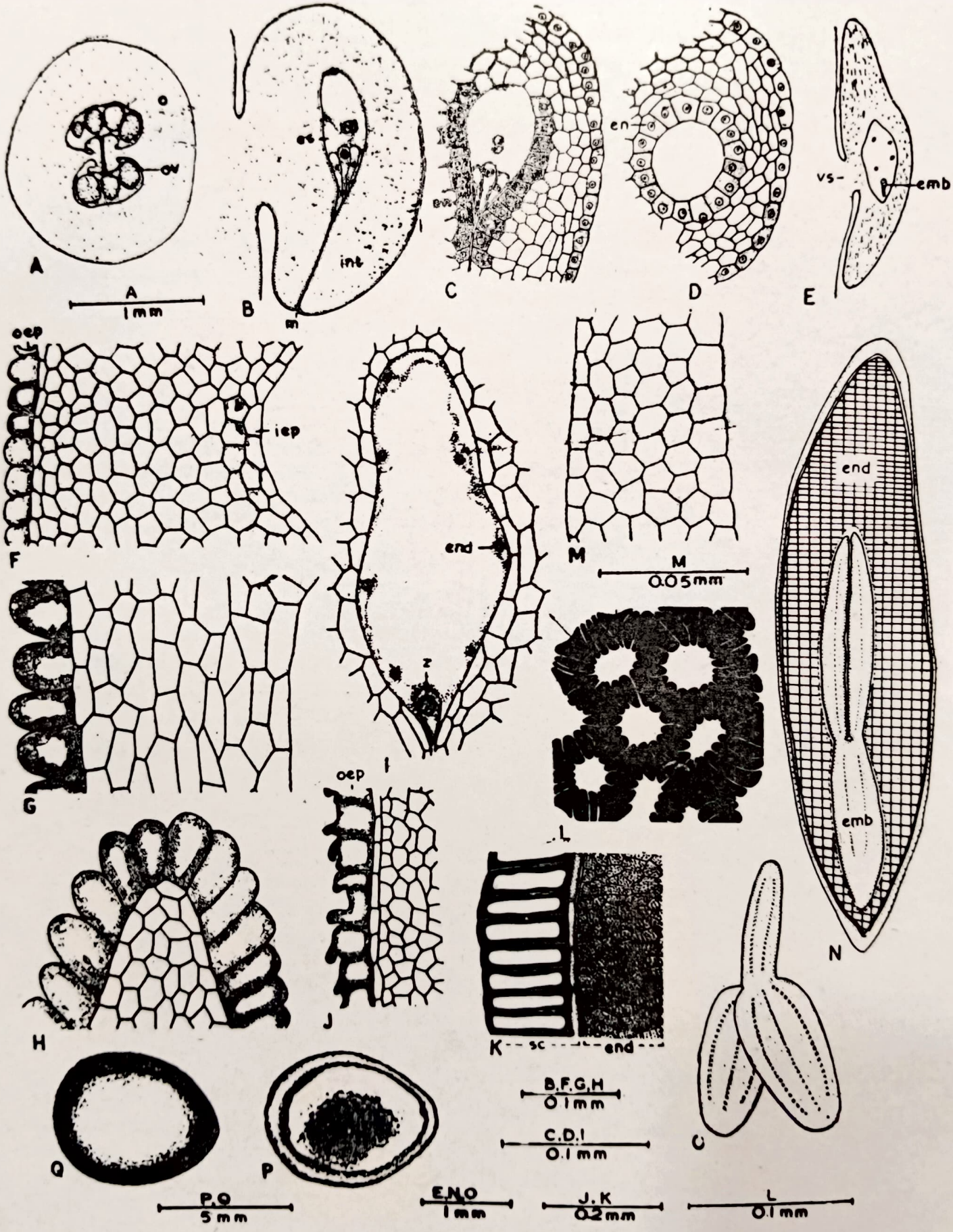
Observations

Ovary and ovule—Gynoecium is bicarpellary and ovary is superior, syncarpous and bilocular (Fig. 1 A). Each ovary chamber contains more than eight ovules attached to axile placenta. Ovules are hemianatropous, unitegmic and tenuinucellate with a long and narrow micropyle (Fig. 1 B). The integument at organised female gametophyte stage is five to six cell-layers thick on the anti-raphe side at the level of the embryo sac (Fig. 1 C), but the number is more on the raphe side. The cells of the inner epidermis elongate radially to some extent and differentiate as a distinct endothelium (Figs. 1 C, D; 2A).

The organised female gametophyte consists of an egg, two synergids, two centrally located polars and three antipodal cells (Fig. 1 C).

Endosperm and embryo—The primary endosperm nucleus divides earlier than the zygote, and development of endosperm is of the Nuclear type (Fig. 1 E, I). It finally becomes cellular and fills the embryo sac but as development of seed proceeds, gradual digestion of endosperm begins. In a mature seed the endosperm remains as a many layered

1. N. B. R. I. publication (N.S.) No. 305.


o
ow
A
A
1mm
ec
int
B
m
C
en
D
vs
emb
E
oep
iep
F
end
z
I
M
M
0.05mm
end
emb
N
G
oep
J
L
H
K
sc
end
B,F,G,H
0.1mm
C,D,I
0.1mm
O
Q
P
P,Q
5mm
E,N,O
1mm
J,K
0.2mm
L
0.1mm

Text fig. 1

structure (Figs. 1 K, N; 2 B) and its cells contain reserve food material, lipid being one of the constituents.

The mature embryo is of the Spatulate type (Fig. 10) and is differentiated into a hypocotyl-root-axis, a short shoot tip and two flat cotyledons. The hypodermal cells of the cotyledons on the ventral side do not become palisade-like (Fig. 1 M). The vascular supply is procambial and is branched in the cotyledons. Reserve food material is also present in the embryo.

Seed coat—Soon after fertilization, the integument becomes more massive owing to repeated cell divisions (Fig. 1 F) and the cells of the outer epidermis enlarge in radial direction. The cells of endothelium also get stretched in plane along the long axis of the ovule (Fig. 1 F, G, I). Concomitant with these changes, deposition of tanniniferous substance in the outer epidermal cells begins while rest of the integumentary cells do not show such deposition (Fig. 1 G, H).

The endothelial cells disorganise by the time proembryo reaches eight-celled stage. Cells of the outer epidermis enlarge further and some of them tend to form hair-like outgrowth which never develop into a typical hair as reported in other taxa of Apocynaceae (Lattoo, 1974). As development of seed proceeds, cells of the outer epidermis elongate further and the elementary outgrowth of hair-like structure become beak-shaped (Fig. 1 J).

Cells of the outer epidermis become thick-walled, whereas rest of the cells of the integument remain thin-walled and as seed development proceeds, they disorganise. The mature seed coat is formed of the thick-walled cells of the outer epidermis and a compressed hypodermal layer (Figs. 1 K; 2 B). The epidermal cells of the seed coat in cross-section show simple pit pairs and are polygonal in outline (Fig. 1 L).

Mature seed—Seeds are flat, slightly rough with roundish outline and light brown in colour (Fig. 1 Q). The seed, on an average, is 0.7 cm long and 0.4 cm broad. The micropylar side is slightly tapering and a distinct hilum is located on the concave ventral side (Fig. 1P). In a mature fruit, which is a berry, nearly five to eight fully developed endospermic seeds are found.

Discussion

The ovule in *Carissa grandiflora* is hemianatropous as in most taxa of the family Apocynaceae (Khan, 1970; Maheswari Devi, 1974; Lattoo, 1974). In *Carissa grandiflora* integumentary tapetum is well differentiated at the organised female gametophyte stage (present study), but such a feature is not reported by Rau (1940) and Maheswari Devi (1974) in *Carissa carandas* and *C. spinarum*, respectively. It will be interesting to investigate this aspect in other species of *Carissa*.

←—

Text-fig. 1 A- Q. *Carissa grandiflora*. A—T.S. ovary; B—L.S. ovule; C—D—L.S. and T.S. part of ovule respectively; E—L.S. developing seed; F,G,H—part of integument in post-fertilization stages; I—L.S. part of seed showing free nuclear endosperm and Zygote; J—L.S. part of young seed coat; K—L.S. part of seed coat and endosperm; L—T.S. epidermal cells of mature seed coat; M—L.S. part of cotylendon; N—L.S. nearly mature seed; O—Embryo; P.Q.—Mature seed as viewed from ventral and dorsal sides, respectively. (emb, embryo; en, endothelium; end. endosperm; es, embryo sac; iep, inner epidermis of integument; int, integument; m, micropyle; o, ovary; oep, outer epidermis of integument; ov, ovule; sc, seed coat; vs, vascular supply; z, zygote).

Figure A-B. *Carissa grandiflora*. A—T.S. ovule showing distinct endothelium. ×35; B—L.S. part of mature seed showing multilayered endosperm and seed coat. ×100. (en, endothelium; end, endosperm; sc, seed coat).

Endosperm development is of the Nuclear type and the free nuclear endosperm finally becomes cellular. In a mature seed the endosperm remains as a many layered structure. The mature embryo is of the Spatulate type (Martin, 1946). The cells of the outer epidermis of the integument enlarge in post-fertilization stages and some of them tend to form beak-like structure but not a typical hair as reported in some other taxa of this family (Lattoo, 1974); this is most probably because of the fruit being a berry and not a follicle.

The seed coat is formed of the thick-walled epidermal cells and a compressed layer of the hypodermis of the integument. Thick-walled epidermal cells of the seed coat appears to be a characteristic feature for the family.

Acknowledgement

We are grateful to the Director, National Botanical Research Institute, Lucknow for facilities.

References

Johansen, D. A. (1940). *Plant Microtechniuque*. McGraw Hill Book Co., New York

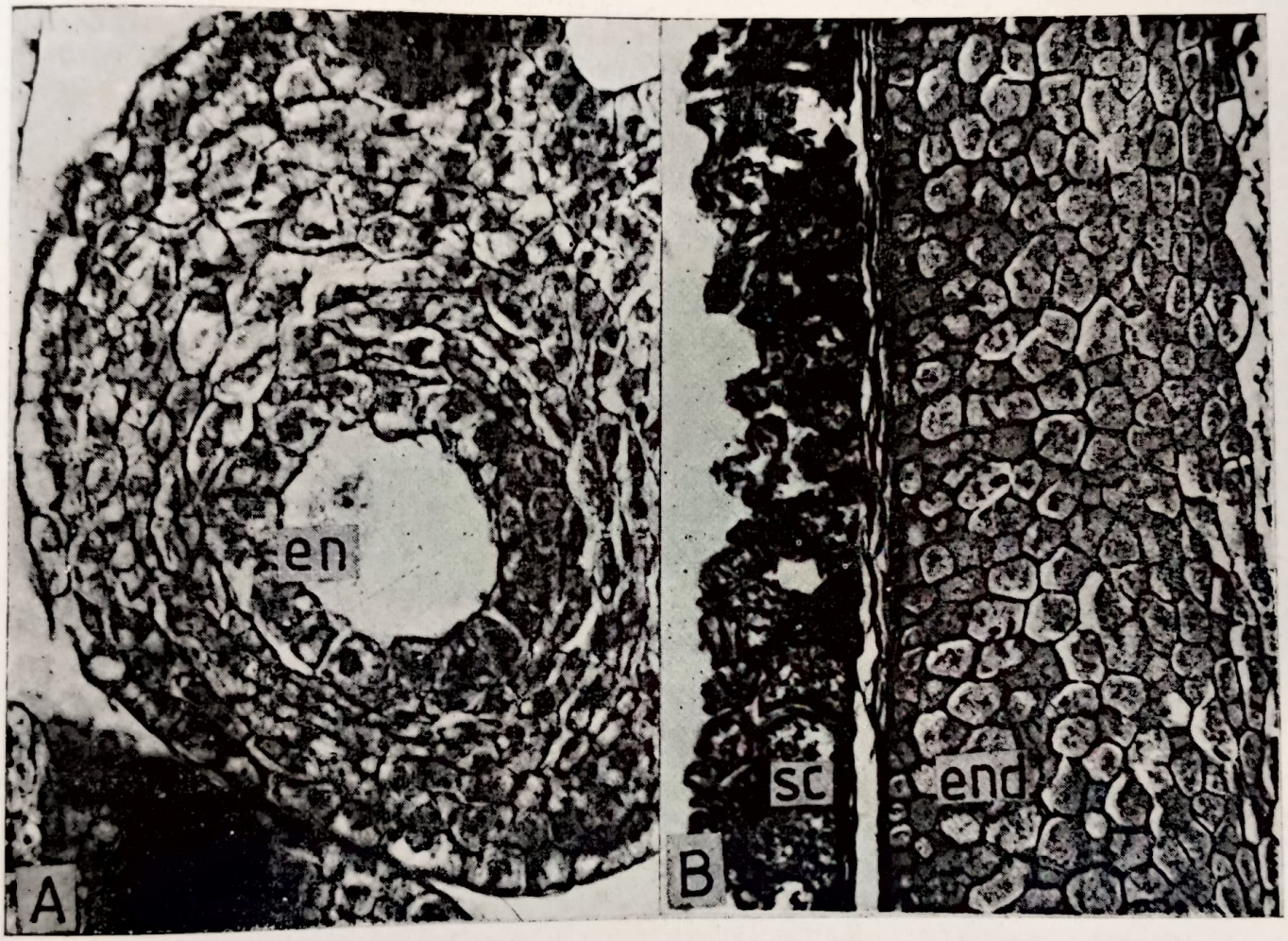
Khan, P. S. H. (1970). Structure and development of seed coat and fruit wall in *Catharanthus pusillus*. *Proc. natn. Acad. Sci. India*, **40** : 21-24.

Lattoo, C. S. (1974). Morphology and embryology of *Holarrhena antidysenterica* Wall., *Bot. Gaz.*, **135** : 173-180.

Maheswari Devi, H. (1974). Embryology of Apocynaceae-2. Arduineae (*Carissa spinarum* Linn.). *Plant Sci.*, **6** : 24-29.

Martin, A. C. (1946). Comparative internal morphology of seeds. *Am. Midl. Nat.*, **36** : 513-660.

Rau, M. A. (1940). Studies in the Apocynaceae. *J. Indian bot. Soc.*, **19** : 33-44.


en
A
sc
end
B