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THE DEVELOPMENT AND STRUCTURE OF BASAL BODY IN THE OVULE AND SEED OF *CROTALARIA JUNCEA* L. AND *DALBERGIA LANCEOLARIA* L. (FABACEAE)

K. PRASAD and P. B. VALSAMMA
Department of Botany, College of Science, Sukhadia University,
Udaipur-313001, India.

The development and structure of basal body in the ovule and seed of *Crotalaria juncea* L. and *Dalbergia lanceolaria* L. was studied in relation to its role in ana-campylotropous and ana-amphitropous curvatures respectively. The basal body differentiated towards raphe-region was a 3-tiered organisation, contributed by subhilar tissue, outer and inner integuments respectively. The subhilar tissue constituted the solid core while the other two tiers abutted on it. The observed pre- and post-fertilization structural changes in the basal body development were not only unique but several of them characteristic of the studied species.

Keywords : *Crotalaria juncea; Dalbergia lanceolaria;* Basal body.

Introduction

Bocquet (1959) related ana-campylotropous curvature of leguminous ovule due to development of basal body in the hilar region. While other workers failed to observe this structure, Bocquets observations too, lacked its developmental characteristics. Besides, no explanation was provided for the continued curvature leading to the ana-amphitropous form of developing seed. The present study thus aims to find out the development and structural characteristics of basal body in relation to the curvature of the ovule and developing seeds of *Crotalaria juncea* L. and *Dalbergia lanceolaria* L. (Fabaceae).

Materials and Methods

The plants of *Crotalaria juncea* was raised from the seeds in University Botanical Garden The *Dalbergia lanceolaria* was available in nearby forests. The material was collected at regular intervals from bud initiation till mature-drying of seeds. Fixation of materials, tissue preparation and localization of carbohydrates and cell wall constituents were carried out following Jensen (1962).

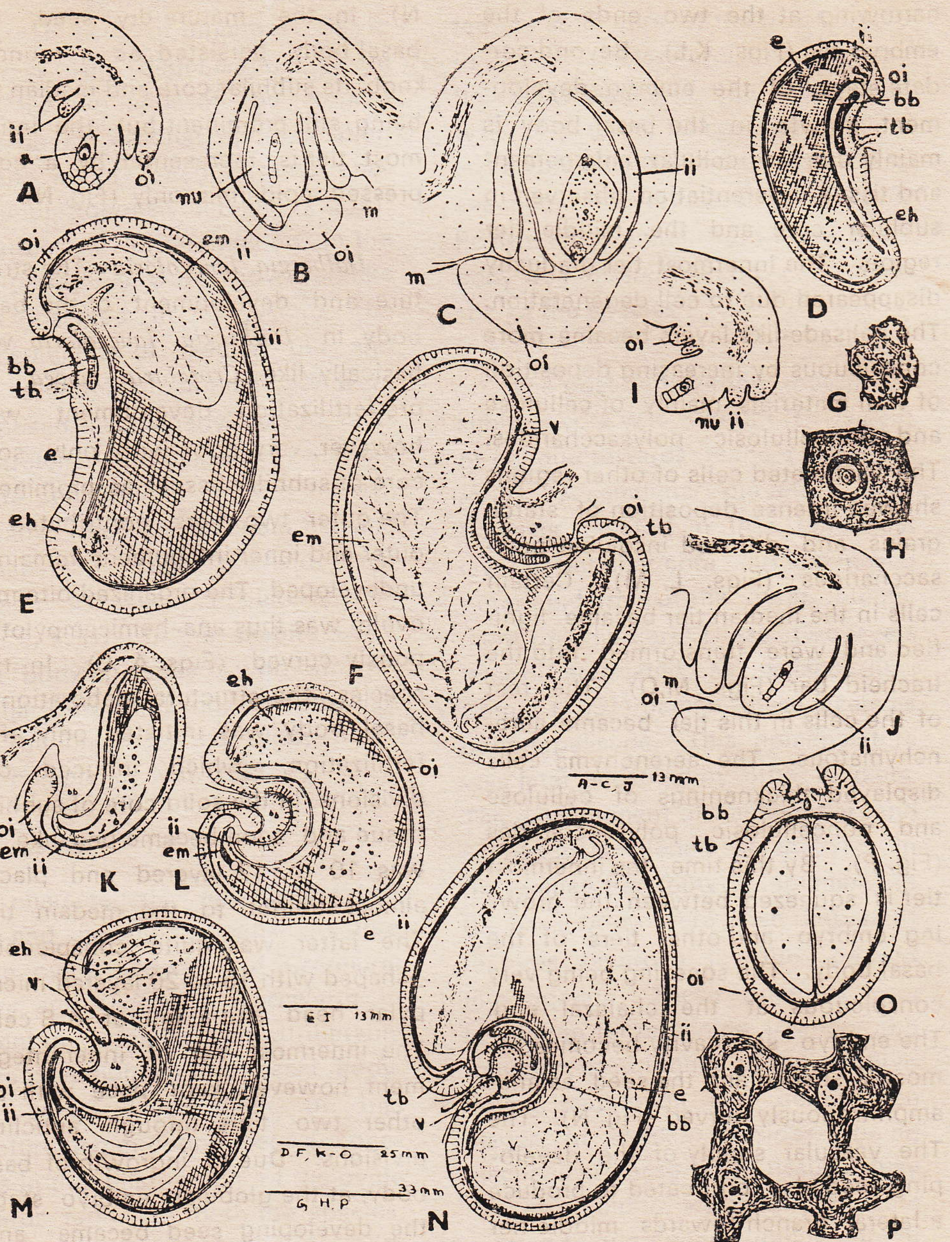
Observations

Crotalaria juncea—The primordial ovule was ana-hemitropously curved. Concomittant to megasporogenesis, ovular curvature began and is mainly due to ,-shaped funiculus and proliferation of chalazal tissue (Fig. I). During megagametogenesis cell divisions were observed in the tissues of subhilar region and the two integuments towards raphe converting the entire raphe region into a knob shaped basal body which exhibited a 3-tiered organization. The outer tier was contributed by the chalazal tissue of subhilar region and appeared like a hair pin-band, which became multilayered. It abutted on the subhilar core and attained much prominance. The inner tier developed from the inner integument and encircled the other two tiers. (Figs. I, J). Due to these structural changes, the basal body grew obliquely in the raphe of the ovule. Thus the bitegmic and crassinucellate ovule at the organized embryo sac stage appeared as ana-campylotropously curved with reniform embryo sac and thumb like obliquely placed basal body.

The ovular curvature continued in the developing seeds after fertilization and is now entirely related to the ingrowth of the basal body (Fig. K). The constitment tiers showed pronounced but differential growth. At the globular stage of the embryo, the basal body became rounded knob (Figs. K,L). It comprised of 15-20 layers in subhilar core, 20 or more layers in middle tier (outer integument) and 12-15 days layers in the inner tier (inner integument). The cellular enlargement was very conspicuous in the subhilar and inner tiers but the parenchymatous cells of the middle tier lacked prominance. The outer epidermis of the outer integuments and the innermost layer of subhilar core acquired radial enlargement and cellulosic thickenings. As a result, these juxtaposed layers became palisade-like (Fig. L). Subsequent growth in the outer and innermost tiers is rather uneven and in opposite directions. While the solid core grew towards micropyle, the tissue constitments of innermost tier enlarged towards chalaza. This

Figs. A-H *Dalbergia lanceolaria*. A—L S. ovular primordium. B, C—L.S. ovules at megaspore tetrad and embryo sac stage. D,E—M.L.S. developing seeds at cordate and dicotyledonous stages of embryo. F—M.L S. mature seed. G—palisade cells in surface view. H—tracheid bar.

Figs. I-P *Crotalaria juncea*. I—L. S. ovular primordium. J—M.L S. ovule at megaspore tetrad stage. K—M.L.S. ovule at the time of fertilization with basal body. L,M—M.L.S. developing seed at globular and dicotyledonous embryo stages. N—M L.S. mature seed. O—same in T. S. to show tracheid bar. P—surface view of aerenchyma of median of basal body.



(a-female archesporium; bb-basal body; e-endosperm; eh-endosperm haustoria em-embryo; ii-inner integument; m-micropyle; nu-nucellus; oi-outer integument; tb-tracheid bar; v-vascular supply).

behaviour caused considerable narrowing at the two ends of the embryo sac (Figs. K,L). Beyond cordate stage of the embryo development, growth in the basal body is mainly due to cellular enlargement and tissue differentiation observed in subhilar core and the middle tier region. The innermost tier gradually disappeared due to cell degeneration. The palisade-like layers became more conspicuous by increasing deposition of wall materials mainly of cellulose and noncellulosic polysaccharides. The vacuolated cells of other regions showed intense deposition of starch grains and diffused insoluble polysaccharides (Figs. L, M). Certain cells in the median tier became lignified and were transformed into the tracheid bar (Figs. M,O). The rest of the cells in this tier became aerenchymatous. The aerenchyma cells displayed thicknenings of cellulose and noncellulosic polysaccharides (Fig. P). By this time, the innermost tier is squeezed between the growing embryo and other tiers of the basal body. The sqeezing being very conspicuous at the chalazal end. The embryo sac cavity becomes almost U-shaped and the seed as ana-amphitropously curved (Fig. N). The The vascular supply of the developing seed also bifurcated to produce a lateral branch towards middle tier (outer integument) of the basal body and traversed up to a considerable extent before being finally faded in the region of tracheid bar (Figs. M, N). In the mature-dry seed, the basal body persisted as a rounded knob. Its subhilar core and median tier being still prominent but the innermost tier is represented by a compressed epidermis only (Fig. N).

Dalbergia lanceolaria—The structure and development of the basal body in *Dalbergia lanceolaria* was basically like *Crotalaria juncea*. Its pre-fertilization development was, however, very poor with only solid core of subhilar tissues as prominent. The outer two tiers, contributed by outer and inner integument, remained undeveloped. The organized bitegmic ovule was thus ana-hemicampylotropously curved (Figs. A, C). In this species, the structural elaboration of basal body was initiated only after fertilization, which induced cell divisions in the solid core of subhilar tissue and soon became peg-like. It was 10 to 12 layered and placed almost straight to the medain tier. The latter was quite conspicuous, ,-shaped with 15 to 20 layered micropylar head and a tail of 6-8 cells. The innermost tier of inner integument, however, kept pace with the other two tiers through anticlinal divisions. Due to ingrowth of basal body, at the globular embryo stage, the developing seed became ana-campylotropous (Fig. D). Hereafter, the basal body showed pronounced growth in the median position. Besides broadening the chalazal end of the embryo sac, it also forced the constituent cells of innermost tier to compress and degenerate. As a result, the two ends of the embryo sac acquired gradual approximation and the mature seed became ana-hemiamphitropously curved (Fig. E). The structural differentiation in the constituent tiers were, however, like those observed in *C. juncea.* The outer epidermis of median tier and inner epidermis of subhilar core were juxtaposed, semilunarly curved, radially stretched and palisade-like. Most of the constituents of the median tier transformed into tracheid bar and aerenchyma. The tracheid bar appeared as disc or plate-shaped (Figs. E, F, H). In the mature seed, basal body persisted with straight subhilar core and crippled median tier. The innermost tier was, however, completely lost. ((Fig. F).

Discussion

The characteristic ana-campylotropous and ana-amphitropous curvature of the ovule and seed of *Crotalaria juncea* and *Dalbergia lanceolaria* in present investigation was attributable to the development of a basal body. The actual development of this structure began during megasporogenesis in the hilar region of the ovule towards raphe. In both the species, it was 3-tiered organization with each of its tiers respectively contributed by the tissues of subhilar region, the outer and inner integuments. The subhilar tissue constituted the solid core of the basal body. In *Dalbergia lanceolaria,* pre-fertilization development of the basal body was very poor. Its constituent tiers lacked prominance and the ovule was ana-hemicampylotropously curved. Post-fertilization changes in the basal body was differential and characteristic of the species.

The post-fertilization growth of subhilar core was straight (*C. juncea*) or oblique towards raphe (*D lanceolaria*). A semilunar curvature was, however, created in the innermost layer of subhilar core and juxtaposed outer epidermis of the outer integument (middle tier). These two layers later differentiated as palisade-like. Corner (1951) named these layers as counterpalisade. This nomenclature was later accepted by other workers. The development of tracheid bar and cellulosic thickened aerenchyma in the median tier (outer integument) of the basal body were also important features recorded in the present investigation. These structures were in relation for providing aeration and transport of nutrients to the embryo during maturation and germination stages of seeds. Besides, being mechanical, these two tissues may may also help in witholding pressure exerted by ingrowing subhilar core of the basal body. Corner (1951) also observed tracheid bar and aerenchyma in the seeds of saveral leguminous species. He, however, attributed development of these tissues in relation to counter effect the pressure of drying testa, edges of the cotyledous and tip of the radicle. In *C juncea* massive median tier of outer integument was also found to be vascularized by a lateral branch of the main bundle. It usually terminated in the region of tracheid bar. The vascularization of subhilar tissue was also reported by Corner (1951). In *Dalbergia lanceolaria*, 3 tiers of basal body were a symmetrical and the inner one almost inconspiqous. The mature seed of this spices was thus ana–hemiamphitropously curved. In *C. juncea*, this tier was ,–shaped with pronounced micropylar growth. The usual ana–amphitropous curvature of seed was due to compression and loss of the innermost tier which allowed a close approximation of the two ends of the embryo sac. If used judiciously the characters of the basal body, tracheid bar, aerenchyma and vasculature may aid in the identification of the studied species.

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