

A Criticism of George, George and Herr's (1979) paper entitled, 'Comparative study of Ovule and Megagametophyte development in field-grown and greenhouse-grown plants of *Glycine max* and *Phaseolus aureus* (Papilionaceae)

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The ovule of *Phaseolus aureus* is bitegmic, crassinucellate and campylotropous. Though the outer integument is initiated later it grows faster and by itself alone forms the micropyle (Salgare, 1970,73d,75f,76e,j,k,t,78a,80a,86a,97a,b,2000a). However, George, George and Herr (1979) have stated that both the integuments are initiated simultaneously. This is an error due to their inability to get the earlier stages of integument development. The earliest stage which they have described (their Fig.14) is in fact, a more advanced stage and by 'no means the earliest. Hence a degree of confusion and misinterpretation has inadvertently been produced. The inner integument consists of two layers throughout its development and the outer integument which is bi-layered in the beginning becomes thicker. In one case it was observed that both the integuments were of the two layers. Normally outer integument reaches at the top of the nucellus at the megaspore mother cell stage. But in some cases it has been observed that even at the dyad and tetrad stage both the integuments are creeping at the base of the nucellus. Such a variability in the nature and behavior of the integuments in the same species of the Papilionaceae seems to be the first report. However, George, George and Herr (1979) were unaware of it. In addition to linear tetrads, T-shaped ones and an oblique T-shaped tetrad of megaspores are noted by Salgare (1970,73d,75f,76e,j,k,t,78a,80a,86a,97a,b,2000a) in *Phaseolus aureus*. George, George and Herr (1979) failed to note T-shaped and an oblique T-shaped tetrads which proved their superficial and misleading observations. Further they stated that the chalazal dyad cell divides unequally such that D (chalazal functional megaspore) is much larger than the a, b or c megaspore (their Figs. 19, 41, 42). Once again, from their Figures 19, 41, 42 it appears that they have mistaken a later stage for an earlier one, where the functional megaspore is considerably increased in size which accounts for their error of interpretation. So far there is no report of an unequal division of dyad amongst the Papilionaceae. Further an abnormal case was observed by Salgare (1970,73d,75f,76e,t,78a,86a), where the megagametophyte was having an extra nucleus – 9-nucleate. George, George and Herr (1979) failed to take notice of such anomalies. With such a superficial observations they are comparing the development of ovule and megagametophyte in field-grown with the greenhouse-grown plants.

Key words : Sweet sorghum, Vermicompost, Biofertilizers, Micronutrients

A consideration of phylogeny in relation to taxonomy within families of flowering plants using embryological data is today becoming an important tool supplementing other taxonomic information. Gametophyte reduction is customarily viewed by plant morphologists as maximized in angiosperms. When concerned with reduction in angiosperm sporophytes, we are immediately cognizant of that reduction in relation to systematics, *i.e.* indeterminate leaf-bearing branch contrasted with determinate, reduced branch – the flower. The very fact of gametophyte reduction intensifies the significance of that reduction to the extent that it becomes inversely proportional to the complexity of the developing structure (gametophyte).

The ovule of *Phaseolus aureus* is bitegmic, crassinucellate and campylotropous. Though the outer

integument is initiated later it grows faster and by itself alone forms the micropyle (Salgare, 1970, 73d, 75f, 76e,j,t, 78a, 80a,86a) and Salgare and Dnyansagar (1971). Such a condition was also noted by Salgare in *Phaseolus aconitifolius* (1974a,75q,76p,97c), in *Alysicarpus vaginalis* (1975d,76d), in *Dumasia villosa* (1975z), in *Sesbania aculeata* (1975ab,76a,s) in *Sesbania aegyptiaca* (1976c,r) and in *Cyamopsis psoraloides* (1975as). However, George *et al.* (1979) have stated that both the integuments are initiated simultaneously. This is an error due to their inability to get the earlier stages of integument development. The earliest stage which they have described (their Fig.14) is in fact, a more advanced stage and by no means the earliest. Hence a degree of confusion and misinterpretation has inadvertently been produced. The inner integument consists of two layers throughout its development and the outer integument

which is bi-layered in the beginning becomes thicker. In one case it was observed that both the integuments were of the two layers. Normally outer integument reaches at the top of the nucellus at the megaspore mother cell stage. But in some cases it has been observed that even at the dyad and tetrad stage both the integuments are creeping at the base of the nucellus. Such a variability in the nature and behaviour of the integuments in the same species of Papilionaceae seems to be the first report. However, George, George and Herr (1979) were unaware of it.

In addition to linear tetrads, T-shaped ones and an oblique T-shaped tetrad of megaspores are noted by Salgare (1970,73d,75f,76e,80a,b,86a,97a,b,2000a) in *Phaseolus aureus*. George, George and Herr (1979) failed to note T-shaped and an oblique T-shaped tetrads which proved their superficial and misleading observations. It should be pointed out that Rembert (1966,67a,b,69,71) was the first to formulate a system of megaspore tetrad patterns for Papilionaceae. However, Salgare (1980a,b,97a-c,2000) proved that the system of megaspore tetrad patterns formulated by Rembert for Papilionaceae is imperfect and misleading. Rembert has not made any provision for the trisporic and tetrasporic megagametophytes. Not only that but so many monosporic and bisporic forms are also left out by Rembert. Rembert also misplaced some of the patterns of the previous workers. Neither was he through about the existing literature. This tempted Salgare (1980a,b,97a-c,2000) to formulate a system of megaspore tetrad patterns for Papilionaceae. Salgare's system contains 28 patterns against 10 patterns of Rembert. To accommodate the existing forms Salgare has reserved 13 patterns for the monosporic types against 7 patterns of Rembert and 10 patterns for the bisporic forms against 3 patterns of Rembert. Salgare kept 3 patterns for the trisporic development and 2 for tetrasporic megagametophytes.

Further George, George and Herr (1979) stated that the chalazal dyad cell divides unequally such that D (chalazal functional megaspore) is much larger than the a, b or c megaspore (their Figs. 19, 41, 42). Once again, from their Figures 19, 41, 42 it appears that they have mistaken a later stage for an earlier one, where the functional megaspore is considerably increased in size which accounts for their error of interpretation. So far there is no report of an unequal division of dyad amongst the Papilionaceae.

Further an abnormal case was observed by Salgare (1970, 73d,75f,76e,t,86a) in *Phaseolus aureus*, where the megagametophyte was having an extra nucleus – 9-nucleate. George, George and Herr (1979) failed to take notice of such anomalies. Nine-nucleate

megagametophyte was also reported by Roy (1933) in *Dolichos lablab*. However, it was the failure of Roy (1933) to decide the fate of an additional nucleus. It was Salgare (1975am) who proved that an additional nucleus in the anomalous megagametophyte of *Dolichos lablab* contributed to the formation of secondary nucleus – resulting triploid secondary nucleus in the Polygonum type of megagametophyte. Except Salgare (1975am) so far nobody has reported triploid secondary nucleus in the Polygonum type of megagametophyte. Salgare recorded formation of secondary nucleus by more than two nuclei in the Polygonum type of megagametophytes of *Sesbania aculeata* (1973c,e), *Sesbania aegyptiaca* (1974d,75s,t), *Canavalia ensiformis* (1975g-i), *Cyamopsis psoralioides* (1975a).

Extensive work of Salgare (1973e,74a,75q,ac-ag,76e-k,m,p,t,77a,b,78a,80a,b,81,97a-c,2000a-d) on the embryology of *Phaseolus aconitifolius* proved the observations of Bhasin (1971) and Deshpande and Bhasin (1974) on the embryology of *Phaseolus aconitifolius* are superficial and misleading. The embryological work of Alysicarpus of Sareen and Wadhwa (1981) is also challenged by Salgare (1975b,d,o,aj,ao-ar,76d-f,h,j-l,n,t,78a,b,80a,86b,97a,b,c,2000a). While monosporic development in megagametogenesis is the rule in Papilionaceae, bisporic development has occurred in *Lathyrus odoratus* (Jonsson, 1879-1880), in *Lupinus luteus* and *Lupinus polyphyllus* (Guignard, 1881), in *Laburnum anagyroides* (Rembert, 1966), in *Wisteria sinensis* (Rembert, 1967a) as well as in *Puereria lobata* (Rembert, 1969b), in *Canavalia ensiformis* (Salgare, 1975g-j, 76g, 77a,80a,b,,97a,b,2000a), in *Canavalia gladiata* (Salgare,1975l,76g,77a,80a,97a,b,2000a), in *Cyamopsis psoralioides* (Salgare, 1973b, 75l,as, 76g,q,t, 77a, 78a, 80a, 97a,b, 2000a), in *Dumasia villosa* (Salgare, 1975z,aa, 76g, 77a, 80a, 97a,b,2000a), in *Phaseolus aconitifolius* (Salgare, 1973a,c, 75q,ad, 76m,t, 77a,b, 80a,b, 97a-c,2000a), in *Sesbania aculeata* (Salgare, 1975c,e,ab, 76a,i, 77b, 78a, 80a, 97a,b,2000a), in *Sesbania aegyptiaca* (Salgare, 1975r,s, 76b,c,h,i, 77b,80a, 97a,b, 2000a). It should be pointed out that all previous reports of bisporic development in Leguminosae have been challenged by Maheshwari (1955). Extensive work of Salgare make it very clear that the bisporic development in Leguminosae is a well established fact which invalid the challenge of Maheshwari (1955).

Salgare's (1970,73a-e,74a-d,75a-as,76a-t, 77a,b, 78a,b, 80a-c,81,86a,b,97a-c,2000a-d) outstanding contribution in the field of embryology of Papilionaceae is as : (1) Tendency towards bi-layered tapetum, (2) Binucleate microspore mother cells, (3) Giant pollen grains,

(4) Twin megagametophytes, (5) Juxtaposed twin megagametophytes, (6) Superposed twin megagametophytes, (7) Superimposed twin megagametophytes, (8) Superposed multiple megagametophytes, (9) Superposed multiple megagametophytes, (10) Superimposed superposed multiple megagametophytes, (11) Juxtaposed superposed multiple megagametophytes, (12) Non-simultaneous formation of antipodals and egg apparatus, (13) Occurrence of additional nuclei in antipodals, (14) Reduction in the number of antipodal cells, (15) Failure of the development of antipodals, (16) Megagametophytes with increased number of antipodals, (17) Failure of cell formation amongst antipodal nuclei, (18) Separation of antipodals from the main body of megagametophyte, (19) Megagametophytes with revised polarity, (20) Egg with an additional nuclei, (21) Avortion of cell formation by egg nucleus, (22) Megagametophyte with suppression of egg, (23) Synergids with additional nuclei, (24) Occasional omission of synergid nuclei from cell formation, (25) Suppression of synergids, (26) Formation of secondary nucleus by more than two nuclei in Polygonum type of megagametophyte, (27) Megagametophyte without development of polar or secondary nucleus, (28) Eight new Megaspore Tetrad Patterns in Papilionaceae, (29) New Megagametophyte type – Trisporic Development, (30) Occasional occurrence of a single fertilization, (31) Prior division of zygotic nucleus instead of primary endosperm nucleus, (32) More than one type of embryo development in the same species, (33) Six different Megarchtypes in the same species and (34) New Megarchtypes. These are the first and only reports indicating that all the previous reports on the embryology of Papilionaceae are superficial and misleading.

It should be pointed out that with such a superficial observations, George, George and Herr (1979) are comparing the development of ovule and megagametophyte in field-grown with the greenhouse-grown plants.

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