

A Review :

Superposed multiple megagametophytes – trisporic development in *Cyamopsis psoraloides* DC. – A record for the angiosperms : Further evidence of a criticism of Maheshwari (1950), Johri (1963) and Rembert (1967a - Ph.D. Thesis, 67b, 69, 71)

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Cyamopsis psoraloides DC., is a member of the Papilionaceae showed at one instance a linear tetrad of megaspores, where the chalazal three megaspores found functional, while the micropylar one lost its potentiality, leaving behind its remnant. Thus resulting into the superposed multiple megagametophytes. The upper megagametophyte is developed up to the four-nucleate stage. The middle megagametophyte developed six nuclei, arranged in two groups, four at the micropylar end and two at the chalazal end. The chalazal megagametophyte developed three antipodal cells. Thus resulted in the trisporic in origin.

Key words : Embryology of the Angiosperms

Battaglia (1955) considers the concept of the spore and emphasizes that the term should be limited to a cell produced by regular or irregular meiosis, originating in the sporophyte and giving rise to a gametophyte. Battaglia (1951) discusses the importance of the position of the megaspore nuclei in determining the final form of the megagametophyte. He states that “natural modification” in megasporogenesis determine the morphology of the gametophyte. This is an important point, and its implications should be realized. Megasporogenesis culminates with the production of megaspores.

Coulter (1908) was the first to make a clear distinction between divisions which formed megaspores, and divisions that produced nuclei of megagametophytes. This, as it turned out, was a very important distinction, and separates the meiotic divisions leading to megasporogenesis from the mitotic divisions leading to megagametogenesis.

A generalized or hypothetical (ancestral) pattern may be postulated as consisting of four megaspores in linear arrangement. Any one of these megaspores has equal potential for maturing into a megagametophyte. Depending on the number of megaspore nuclei taking part in the development, the megagametophytes of angiosperms has been classified into three main types: monosporic, bisporic and tetrasporic (Maheshwari, 1950; Johri, 1963). In the first only one of the four megaspores, in the second two megaspore nuclei, and in the third all

the four megaspore nuclei take part in the development of the megagametophyte.

Rembert (1969) stated that “In no case is more than one megaspore known to function in this family-Papilionaceae”. However, findings of Jonsson (1879-80) and Guignard (1881) make it very clear that Rembert’s (1967a – Ph.D. Thesis, 67b, 69, 71) knowledge in the field is inadequate. Bisporic development in *Laburnum anagyroides* (Rembert, 1966), in *Wisteria sinensis* (Rembert, 1967b) as well as in *Pueraria lobata* (Rembert, 1969) was also noted by Rembert (1966, 67b, 69) under such condition his this statement is contradicting. Present work as well as the past extensive work of the author (1973a, c, 74b, 75a, c, d, g, h, i, j, k, n, 97, 2000, 06) made it very clear that the statement of Rembert (1969) is misleading.

Trisporic development of the megagametophyte is recorded for the first time by Salgare (1973a, c, 74b, 75a, c, d, g, h, i, j, k, n, 97, 2000, 06) which has no place in the present classification of the megagametophytes of Angiosperms (Maheshwari, 1950; Johri, 1963) which had escaped from the eyes of the embryologists. This is a weakness of the classification of the megagametophytes of Angiosperms and needs its revision. Trisporic development has no place in the megaspore tetrad patterns formulated by Rembert (1967a - Ph.D. Thesis, 67b, 69, 71). This proves that his (1967a - Ph.D. Thesis, 67b, 69, 71) system is imperfect and needs its revision.

Cyamopsis psoralioides DC., is a member of the Papilionaceae. At one instance a linear tetrad of megaspores showed further development, where the chalazal three megaspores were found to be potential and developed further, however, the micropylar one lost its potentiality and degenerated, leaving behind its remnant, resulting into the superposed multiple megagametophytes. The upper megagametophyte is developed up to the four-nucleate stage. These four nuclei are situated more or less in the same plane. The middle megagametophyte developed six nuclei, which are arranged in two groups, four at the micropylar end, while the two at the chalazal end. The lowest or the chalazal megagametophyte developed three antipodal cells. These three antipodal cells are arranged side by side, one of them being smaller in size. Since the well developed three antipodals are formed by the chalazal megagametophyte, it is every possibility that the middle megagametophyte may contribute to the secondary nucleus and the next to it, the uppermost megagametophyte may contribute to the formation of the egg apparatus. It should be pointed out that the non-simultaneous formation of the antipodals and the egg apparatus is observed by the author in *Sesbania aculeata* (1973a, c), *Alysicarpus vaginalis* (1975m), *Canavalia ensiformis* (1975b), *C. gladiata* (1975d), *S. aegyptiaca* (1975g, h), *Cyamopsis psoralioides* (1975n) and *Dolichos lablab* (Salgare unpublished). If this be so, then there is no doubt at all that this superposed multiple megagametophyte at its maturity is going to act as a single megagametophyte, with the egg apparatus formed by the upper megagametophyte, the secondary nucleus produced by the middle megagametophyte and the antipodals by the lower megagametophyte. In such case the septa will be dissolved, resulting into a single megagametophyte, with its trisporic in origin.

If all the upper megagametophyte is going to form the egg apparatus, in such an egg apparatus either one of the synergids would be bi-nucleated or an egg would be bi-nucleated. Bi-nucleate synergids were observed by the author in *Sesbania aculeata* (1973a, c), *Canavalia ensiformis* (1975b), *Dumasia villosa* (1975i, j) and *S. aegyptiaca* (1974b, 75g). A bi-nucleate egg was noted by the author in *S. aculeata* (1973a), *C. ensiformis* (1975h), *D. villosa* (1975i, j) and *S. aegyptiaca* (1975g, h). The formation of the secondary nucleus by more than two nuclei was observed by the author in *S. aculeata* (1973a), *C. ensiformis* (1975b, c), *D. villosa* (1975i, j) and *S. aegyptiaca* (1974b, 75g, h). In such a case the middle megagametophyte which contains six nuclei (more than two nuclei), could be expected to develop into the secondary nucleus, which would be the product of six

nuclei. The formation of secondary nucleus by more than two nuclei was noted by the author in *S. aculeata* (1973a, c), *C. ensiformis* (1975b, c) and *S. aegyptiaca* (1974b, 75g, h). In such case the septa will be dissolved and the superposed multiple megagametophytes would act as a single unit, which would be trisporic in origin.

In addition to the above contributions of Salgare (1973a, c, 74b, 75a, c, d, g, h, i, j, k, n, 97, 2000, 06) to embryology, the following findings in the embryology of Papilionaceous legumes may be added which are the first and the only reports in the field.

Superposed multiple megagametophytes (1973b, 74a, 75a, e, f, n, 97, 2006)

Superposed superimposed multiple megagametophytes (1974b, 97, 2000, 06)

Juxtaposed superposed multiple megagametophytes (1973b, 75a, e, n, 97, 2006)

It should be noted that the superposed multiple megagametophytes, superposed superimposed multiple megagametophytes and juxtaposed superposed multiple megagametophytes will result into the trisporic development.

Trisporic development (Salgare, 1973b, 74a, b, 75a, e, f, n, 97, 2000, 06) has no place in the megaspore tetrad pattern formulated by Rembert (1967a - Ph.D. Thesis, 67b, 69, 71) for the Leguminales and forms a type by itself. This proves that Rembert's (1967a - Ph.D. Thesis, 67b, 69, 71) system of megaspore tetrad pattern is imperfect and needs its revision. Present investigation as well as the past extensive work of Salgare (1973b, 74a, b, 75a, e, f, n, 97, 2000, 06) made it very clear that the trisporic development does occur in the Angiosperms and it was the failure of the past workers to trace out it. Hence it needs to revive the system of classification of the megagametophytes of the Angiosperms formulated by Maheshwari (1950) and Johri (1963).

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