

ON THE RELATION BETWEEN TRIGONOCARPUS AND GINKGO.—

Miss Affourtit and Miss La Rivière, in their paper entitled 'On the Ribbing of Seeds of *Ginkgo*' (Ann. Bot., October, 1915), writing of the comparison of *Ginkgo* with *Trigonocarpus*, state (p. 594) that 'Since in *Ginkgo*, however, no valves occur—the stony coat lacking fissures at the plane of the ribs—and as vascular bundles are absent from the sarcotesta, those seeds cannot, as it seems to us, be compared with the seeds here described'. With regard to the first objection, it has been pointed out by the writer (Ann. Bot., January, 1914) that the Trigonocarpaceae show almost every transition with regard to the occurrence of commissural ribs. In *Polylophospermum* both the major and secondary ribs were commissured. In the genus *Trigonocarpus* itself the fissured character had entirely disappeared from the secondary ribs and was not uniformly exhibited by the major ones. Moreover, in the closely related *Stephanospermum* both ribs and commissures have entirely disappeared. The absence of fissures in the major ribs of *Ginkgo* is therefore merely a further stage in the evolutionary tendency exhibited by the genus *Trigonocarpus*, and it is significant that, as pointed out by Carothers (Bot. Gaz., 1907, p. 126), the integument of *Ginkgo* readily splits in the plane of the ribs.

The absence of sarcotestal bundles in *Ginkgo* can no more be taken as precluding affinity between the two groups than the presence of vascular strands in the integuments of some angiospermous ovules invalidates their comparison with ovules in which an integumental vascular system is lacking.

In view of the absence of sarcotestal bundles, the non-development of tertiary ribs calls for no explanation.

It is probable that the two vascular bundles (three in three-angled seeds) of the *Ginkgo* ovule correspond to the nucellar supply of *Trigonocarpus*.

This is indicated by the facts that they pass up close to the plane of fusion between nucellus and integument, and that, though serving as the vascular supply for both structures, the bundles end at the level at which the nucellus becomes free.

That the number and position of the strands should correspond to that of the ribs of the integument is not surprising, seeing that the angling of the nucellus shows a like correspondence as to number and position. Moreover, in *Trigonocarpus shorensis* it was found that the number of bundles in the nucellar system was a multiple of three, corresponding with the trimerous character of the integument.

In the taxonomically more important features of general organization the ovules of Ginkgoales, Cycadales, and Trigonocarpaceae exhibit a uniformity of construction difficult to explain except on the basis of affinity. The morphological and anatomical characters of these groups, whilst emphasizing the closer relation between the Trigonocarps and Cycads, lend further support to the hypothesis of the affinity of all three. On such a view, the large proportion of *Ginkgo* ovules with three ribs recorded by Affourtit and La Rivière has an added significance.

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