CYTOLOGY OF *GNETUM ULA* BRONGN

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(With Plate 18 and Four Text-figures)

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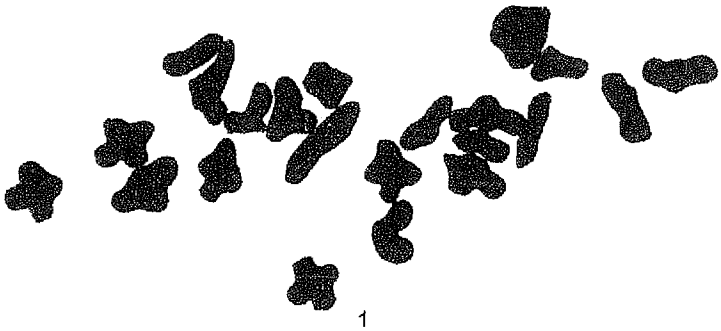
Of the three genera of the Gnetales, *Ephedra* and *Welwitschia* have been adequately cytologically investigated, but not so the genus *Gnetum*, and consequently the bearing of this important aspect on the interrelationship of these genera is not yet fully elucidated. While most of the authors have maintained that these three genera are phylogenetically related though distantly, Eames (1952) recently concluded that *Ephedra* has no relationship whatsoever with the other two members. It was for this reason that *Gnetum ula*, the only species available to the writers, was investigated cytologically.

Coulter (1908) working on the morphology of *G. gnemon* incidentally reported n and $2n$ numbers to be 12 and 24 from microsporogenesis, but without illustrations. Pearson (1912) stated the number of bivalents to be about 12 in the sporocytes of *G. africanum*, but was uncertain. Recently Fagerlind (1941) stated $n=22$ with a certain reserve in *G. gnemon*, as he could get only a single metaphase plate in the spore mother cells of this species. Eleven of these chromosomes were reported to be larger and situated peripherally and eleven smaller in the centre. He concluded the base number to be probably 22, and it could not be 11 as there were two groups of eleven chromosomes with distinctive difference in size.

G. ula is a liana growing profusely in the tropical forests of southern India and is also reported from Java (Pearson, 1929). The male cone material for the present study was collected from Castlerock (Bombay State) on the border of India and Goa in early January between 9 a.m. and 2 p.m., fixed in acetic alcohol and squashed for mother cells in acetocarmine.

Numerous preparations of sporocytes from several plants revealed 22 bivalents unmistakably (Pl. 18, figs. 1, 2; Text-figs. 1–3). Of these 22 chromosomes there is no differentiation into eleven bigger and eleven smaller as reported by Fagerlind for *G. gnemon*. There is a slight intergradional variation in size. The configurations at diakinesis are in the form of X, L, Y, O and the figure 8, showing thereby that the chiasma number is one or two but does not exceed three (Text-fig. 3). Meiosis is normal with no laggards and no irregular associations. As a rule tetrad formation is normal.

Occasional mother cells much larger than the normal were noticed in which there were apparently double the number of bivalents, though these could not be counted precisely. A few larger, presumably diploid, grains, as inferred from their relative size, were also encountered. Some of these gave an indication of having been formed through irregular cytokinesis (Text-fig. 4), much in the same fashion as diploid grains reported previously by Mehra (1946) in the genus *Ephedra*.



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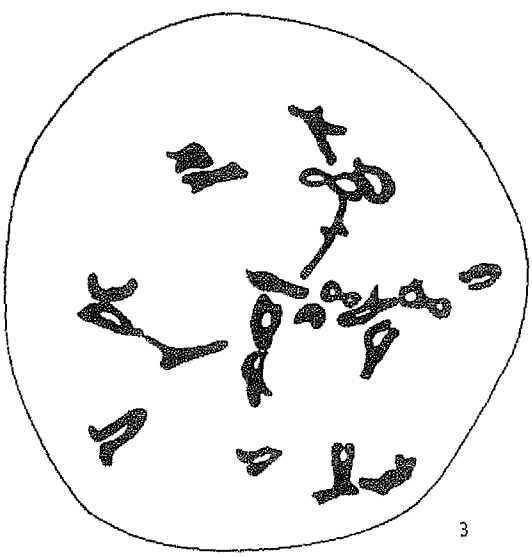
Text-figs. 1, 2. Twenty-two bivalents in two mother cells (explanatory diagrams to Figs. 1, 2).



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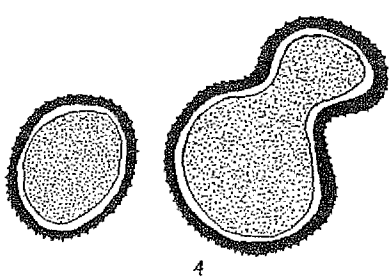
Text-fig. 3. Diakinesis, ×1000.



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Text-fig. 4. A normal and a probable diploid spore, ×1500.

DISCUSSION

The most authentic records of chromosome number in the genus *Ephedra* are by Geitler (*vide* Tischler, 1931), Florin (1932), Mehra (1934, 1946), Hunziker (1953) and Krapovickas (1954), all of whom reported the base number for the genus as 7. In some species tetraploidy was noticed. Mehra concluded the basic karyotype for the genus to be fixed

and composed of two chromosomes with subterminal centromeres and five with median or submedian centromeres.

In *Welwitschia mirabilis*, the monotypic species, Florin (1932) reported $2n=42$ from root tips which was later confirmed by Fernandes (*vide* Tischler, 1938). Karyotypic analysis was not attempted. Thus numerically this genus falls in line with the base number 7 and incidentally advances a cytological argument in favour of the relationship between the two genera arrived at on other grounds (Mehra, 1950).

On the other hand *Gnetum* shows a divergent chromosome number. The two species hitherto investigated with any measure of certainty are *G. gnemon* and *G. ula* with $n=22$ belonging to two different morphologic sections, and they may well indicate the same position for the genus as a whole. Since *Gnetum* and *Welwitschia* are supposed to be more closely related to each other than either to *Ephedra*, the verdict of cytology on the inter-relationships of the three genera is not conclusive.

SUMMARY

Eleven bivalents were observed in the meiosis of microsporocytes of *Gnetum ula*.

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EXPLANATION OF PLATE 18

Figs. 1, 2. Twenty-two bivalents in acetocarmine squash of two mother cells of *Gnetum ula* Brong., ×986 and ×1186 respectively.