

Report of DR. B. P. PAL, Director, Indian Agricultural Research Institute, New Delhi, on the thesis, entitled "Karyo-systematic studies in Helobiales, with some observations on Genistaceae", submitted by MR. Y. SUNDAR RAO for the degree of DOCTOR OF PHILOSOPHY of the University of Saugar, Saugar (Madhya Pradesh)

In dealing with the Helobiales, the author has presented cytological evidence, mainly with reference to the evolution of karyotype, in ~~some~~ ^{some} ~~few~~ genera belonging to the families, Butomaceae, Alismataceae, and Hydrocharitaceae. The Helobiales have been considered by many workers to constitute an evolutionary link between the monocotyledons and the dicotyledons, through the dicotyledonous order - Ranales. The author of the present thesis has ~~compared~~ endeavoured to compare, ~~the~~ though somewhat cursorily, the karyotypes of some of the Helobiales with some species of Ranunculaceae, and has suggested that the cytological evidence adduced by him favours the concept of the Ranalian origin of Helobiales in particular, and perhaps of the monocotyledons in general.

In Butomaceae, the evolution of the karyotype has been traced and aneuploidy has been shown to have progressed alongside ~~with~~ a gradual increase in the asymmetry of the karyotypes. The genus, Butomus, has been considered, on purely cytological grounds, to have had an amphidiploid origin, and it appears to be cytologically different from the other genera of the family.

In the Alismataceae, chromosome morphology has been studied in six species. Aneuploidy, and to a limited extent polyploidy, has been suggested to be determining intergeneric and interspecific relationships in the family. Aneuploidy, in both Butomaceae and Alismataceae, is believed to have arisen through chromosome fragmentation. This fragmentation hypothesis, although it has been adduced ^{also} by ^{some} other authors in respect of ~~some~~ different plant material, appears to be rather unconvincing on several grounds, especially owing

to the difficulty in imagining a de-novo-origin of the centromere.

Alisma plantago-aquatica has been shown to possess intraspecific chromosome races. The variation in the length of the SAT-thread in this species has been considered, apparently without ~~much~~ ^{much} genealogical evidence to support it, to be governed by a "gene or genes located inside the particular chromosome rather than by the genotype as a whole".

In the Hydrocharitaceae, karyological analysis of four species has been carried out. On the basis of this, the separation by Hutchinson of Vallisneria and Blyxa into different tribes has been supported. Sex chromosome mechanism, reported in Hydrilla by Sinoto, could not be confirmed in the present investigations. Polyploidy in this family has been imagined to have been caused by aquatic habit. The genus Enhalus has been shown to possess quite distinctive ~~§~~ karyotypical features.

The genus Ottelia of the Hydrocharitaceae has been dealt with extensively in a separate section. On karyological analysis, intraspecific polyplody ^{in this species} has been ~~established~~ demonstrated. Also, on cytotaxonomical grounds, the merging together of hexaploid Ottelia alismoides and Boothia, ~~to~~ as suggested by some systematists, has been supported. The geographical distribution, in India and S.E. Asia, of these intraspecific polyplod races ^(2x, 4x and 6x) has been worked out and the manner of their origin and migration has been inferred in relation to geological events.

In the last Section, on Genisteae (Leguminosae), 19 species of Crotalaria and one each of Rothia and Heylandia have been karyotypically studied; in ~~some~~ ^{some} cases, ~~however~~, mitotic chromosomes, and in some meiotic chromosomes, have been studied. In the evolution of Crotalaria,

changes in chromosome size have been inferred to have been brought about by genotypic differences; aneuploidy seems to have played only a small part in the evolution of this old genus. From observations, which however are not very extensive, on secondary association of chromosomes, it is suggested that ~~the~~ the so-called diploid species of Crotalaria are allotetraploids with $x=4$ as the basic chromosome number. ~~Mainly~~ Mainly gene mutations, rather than structural changes in chromosomes, appear to have played a major part in the evolution of Crotalaria; a few American species are perhaps allopolyploid.

The presentation of the subject matter is reasonably good, although it ^{often} tends to be verbose. Undoubtedly, the author has taken considerable pains to obtain material for study from different sources ~~for~~ within and outside this country and he has handled them well. The references to literature are extensive and up-to-date and the illustrations neat and good. The get-up of the thesis, apart from some avoidable typographical errors, is good. The discussions, although at times tending towards verbosity and redundancy, are reasonably balanced and critical.

The thesis has, of course, some shortcomings. Many of them, however, are rather inherent in the nature of the subject itself. For, unaided and unconfirmed by experimental cytogenetical work, taxonomical inferences based on purely cytological observations (like those relating to morphology of chromosomes, secondary association of chromosomes, etc.) are often inadequate if not erroneous.

Some errors are mentioned below:

(i) In the case of Tenagocharis latifolia, ~~and~~ Crotalaria incana and some other species, the increase in the number of bivalents in some P.M.Cs. has been attributed to non-disjunction during ~~prophase~~

premeiotic stages although multivalents are not observed.

(ii) The use of the term "terminal" chromosomes is erroneous except in the case of truly telocentric chromosomes. The chromosomes referred to as "terminal" ^{often} ~~often~~ appear to possess subterminal centromeres.

(iii) The bivalent configurations of $6x$ Ottelia alismoides and Boothia seem to be different from each other and do not appear to justify the merging together of these genera at least on cytological grounds. May be that these two genera ~~to~~ originated from ~~different~~ different putative ancestors. Cytology of hybrids between these two genera, if they could be produced, would perhaps indicate their true relationship.

(iv) It is difficult to see the grounds on which the different SAT-lengths in Alisma plantago-aquatica are inferred to be controlled by genes "in the particular ~~chromosome~~ chromosome". Similarly, no genetical ~~are~~ reasons have been given to show that chromosome size in Crotalaria is genotypically controlled. Again, in some Crotalaria, secondary association of chromosomes is said to be ~~influenced~~ governed by genes.

(v) Polyploidy in Hydrocharitaceae has been imagined to ~~has~~ be caused by aquatic habit, whereas it is not unlikely that ~~are~~ accidental chromosome aberrations were perpetuated through vegetative propagation.

(vi) Often, cytological data have not been ^{statistically} ~~quantitatively~~ gathered and presented.

However, ^{blemishes} these ~~errors~~ ^{and some} ~~others~~ that have not been mentioned, do not detract from the merit of the main thesis and, as mentioned earlier, many of them originate from the purely cytological, rather than cytogenetical, approach to

the subject. The evidence already gathered is quite interesting and could be decisive wherever it could in future be cytogenetically confirmed. I have no hesitation in recommending that the thesis may be approved for award of the degree for which it has been submitted.

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