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Karyotypically Distinct Morphotypes in Taro (*Co'ocasia esculenta* (L) Schott)

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Taro (*Colocasia esculenta* (L) Schott) is an important tuber crop cultivated throughout the tropical and subtropical regions of the world for the edible tubers which in many countries used as staple food. Innumerable morphologically distinct varieties of taro are cultivated around the world, particularly in India. Taro has been considered to be a single polymorphic species complex, *Colocasia esculenta*, with several botanical and cultivated varieties (Purseglove 1972), and they occur in two ploidy levels, diploid with 2n=28 and triploid with 2n=42 chromosomes. Detailed karyomorphological information on the cultivated varieties of taro is very fragmentary and scattered (Kuruvilla and Singh 1980, Coats *et al.* 1988, Sreekumari and Mathew 1989, 1990). The present authors have made detailed karyomorphological studies in quite a large number of diploid and triploid varieties. A critical assessment of the karyotypes of various diploid morphotypes has revealed the existence of noticeable karyotype distinction between two of the morphotypes, and the present paper concerns the data of this and its possible taxonomic bearing.

Materials and methods

The two morphotypes studied were indigenous collections which differed one from the other in seveal morphological features which was striking in characters like pigmentation of leaf sheath and petiole as well as size and form of leaf blade and cormel. Type I had leaf sheath and petiole deep purple and characterised by strikingly narrow leaves with undulated margin with roundish cormel, and type II was an entirely green plant with broad leaf blade and entire leaf margin, with cylindrical cormel.

Somatic chromosomes of five accessions each of the two morphotypes were studied from their root tips fixed in 3: 1 Carony's fluid after pre-treatment with 0.002 M 8-Hydroxyquinoline at 4°C for 2 hr, and stained in acetocarmine. Karyomorphology was studied based on measurements from ten well spread metaphase plates of comparable stage in each of the accessions, and karyotypes analysed following the system proposed by Levan *et al.* (1964) and TF % calculated after Huziwara (1962).

Observations

Both the morphotypes were diploids with 2n=28 chromosomes ranging in length from 3.60–1.66 μm in type I, and 3.00–1.33 μm in type II (Figs. 1–4). Their karyomorphological features are summarised in Table 1.

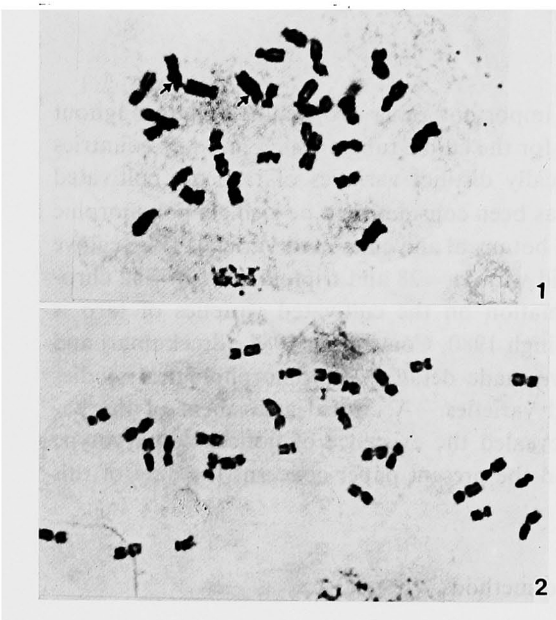
Discussion

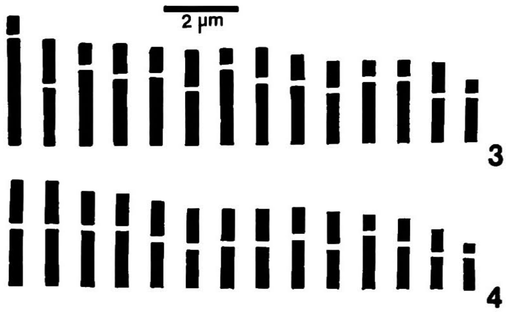
The data revealed noticeable difference between the karyotypes of the two morphotypes, type I showing higher ACL and TCL, viz. 2.61 and 73.20 μm respectively as against 2.32 and

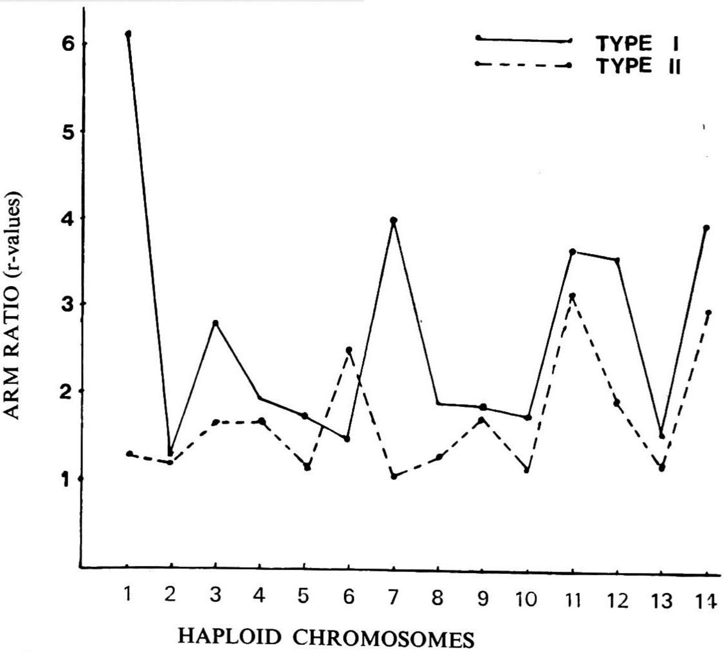
Table 1. Karyomorphological details of two morphotypes of taro

Morphotypes	2n	ACL	TCL	TF%	Chromosome types (Number)		
					m	sm	st
Type I	28	2.61	73.20	29.84	6	12	10
Type II	28	2.32	64.98	38.48	18	6	4

ACL–Average chromosome length, TCL–Total chromosome length, TF%–Total form precentage.







Figs. 1–5. Somatic chromosomes, Idiograms and arm ratio of two morphotypes of taro. 1, Somatic chromosomes of morphotype I (×1,250). Chromosome No. 1 is nearly acrocentric (arrow marked). 2, Somatic chromosomes of morphotype II (×1,250). 3, Idiogram of morphotype I. 4, Idiogram of morphotype II. 5, Arm ratio of haploid chromosomes of the two morphotypes.

64.98 μm in type II. The karyotype of type I consisted of 3 pairs of m-type, 6 sm- and 5 of st-type chromosomes, as against 9 pairs of m, 3 sm, and 2 of st-types in type II (Table 1). Difference in centromeric locations was evident in several pairs of chomosomes (Fig. 5) such as chromosome Nos. 1, 3, 6, 7, 12 and 14, of which the situation in chromosome No. 1 was very obvious, which in type I was nearly acrocentic with an r-value of 6.23 (See arrow-marked chromosomes in Fig. 1) as against its counterpart in type II being metacentric with very low r-value (1.27). The difference in the centromeric positions of chromosomes is correspondingly reflected in their TF% which was significantly lower in type I viz. 29.84 as against 38.48 in the other.

The magnitude of difference between the karyotypes of the two morphotypes is striking, and it appears to be more than what can be accounted for by mere structural changes of chromosomes of one type leading to the other in the recent evolutionary span and hence the authors are inclined to consider these two morphotypes to be karyotypically distinct. This possibility apperars to be strengthened by our observation of a few diploid morphotypes whose karyotypes are found to comprise one haploid set of the present type I and the other type II (unpublished). These should be natural diploid hybrids involving the above two morphotypes.

Purseglove (1972) has recognized two distinct taxonomic types in taro population such as esculenta type and antiquorum type based on certain characters including the length of the sterile appendage on the inflorescence, and he observed that the esculenta type is diploid and antiquorum, triploid. Our observation also show that all the triploid varieties which have larger spadix posses longer appendage and diploid with smaller spadix and shorter appendage. The longer appendages in the triploids could be the result of *gigas* effect of polyploidy, and hence the division into two separate taxonomic types based on this feature can be taken only with some reservation. It may be noted that the present two morphotypes which are different one from the other with respect to certain obvious plant morphological characters such as type I with purple leaf sheath and petiole and narrow leaves with undulated margin and roundish cormel and type II entirely green plant with broad leaf and entire margin with cylindrical cormels differ in gross karyomorphology as well. In view of consistent association between karyotype distinction and plant morphological difference at the diploid level, taxonomic separation of the two morphotypes may be worth consideration.

Summary

Detailed karyomorphology of two morphologically distinct varieties of diploid taro (*Colocasia esculenta*) was studied. The karyotypes of the two morphotypes were found to be different in gross karyomorphology. The magnitude of difference between the karyotypes of these two morphotypes was striking and it appears to be more than what can be accounted for by mere structural changes of chromosomes of one type leading to the other. A taxonomic separation of the two morphotypes may be worth consideration.

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