figures obtained graphically and by Fisher's statistical treatment.

It is evident from Table I that the graphically obtained mean value is appreciably close to that estimated statistically. It is expected that this approach in the analysis of the palæomagnetic data may provide a better understanding of the dispersion of directions, the significance of their concentration, and the pattern of their preferred orientation. Further work on these lines is in progress and will be reported in due course.

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VERSATILE REPRODUCTION IN *LANTANA CAMARA*

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L. CAMARA Linn., a native of Tropical America, is a very hardy shrub which can grow in poor soil and requires very little care. It has spread to many parts of the old world including India, where it now grows throughout the Deccan Peninsula extending northwards up to sub-mountain regions of the Himalayas. Some varieties are no doubt noxious weeds but others are beautiful ornamentals which bloom nearly the whole year round. The flowers are of various shades of red, orange, yellow and white, giving a striking contrast against its dark green foliage. There is a wide variety of types, differing in the nature of leaves, prickles, bracts, flower colour, etc., which are very difficult to classify because of the extensive reticulation of taxonomic characters. This led Yates[1] of Kew to remark that in Lantanas a "bewildering number of meaningless names" have been used to designate the different types. For such a morpho-taxonomic situation, the nature of breeding system generally offers a valuable key to an understanding of the underlying cytogenetic mechanisms. The present experiments were started with a view to breed Lantanas for ornamental purposes.

Progenies from open pollinated seeds of five cultivars were raised and scored for their morphological and cytological characters. The results, along with those of Raghavan and Arora[2] are summarized with their implications in Table I and Fig. 1.

The ploidy level of the various cultivars of *L. camara* in NBG ranges from 2 X to 5 X. Meiosis is regular in both diploid cultivars, one of which ('Nivea') is male sterile. The other variety, 'Drap D'Or' has very low seed fertility, and the only plant raised from it was triploid. A character analysis of this 3 X revealed it to be a likely hybrid with 4 X 'Mutabilis'. This implies sexual reproduction. Only one, out of the five plants from male-sterile 'Nivea' (2 X), was perfectly matroclinus. Three other plants, although diploid, are hybrids with related diploid cultivars. The remaining one plant is triploid ; its characters indicate it to be a hybrid with 4 X 'Mutabilis'. The results obtained by Raghavan and Arora[2] on this particular cultivar suggest the occurrence of obligate apomixis. In other words, all types of reproduction from sexual to obligate apomixis occur in the diploids.

The 4 X 'Mutabilis has also a regular meiosis with reasonably good pollen fertility. The progeny raised both by us and Raghavan and Arora[2] is matroclinus. In addition, we have observed that no seed is produced from emasculated and bagged flowers, implying thereby that reproduction is either sexual or by obligate apomixis accompanied by pseudogamy. Further work in this direction is in progress.

The reproduction in triploid ('Red Cap' and 'Mutabilis') and pentaploid ('Purple Prince') cultivars appears to be the result of facultative apomixis. These varieties have a highly irregular meiosis and it is unlikely that their normal sexual progeny could be balanced. The progeny obtained is very likely the result of agamospermy or semi-sexuality. All matroclinus 3 X and 5 X individuals must be the result of the former process, while the individuals with higher chromosome numbers are the result of semi-sexuality, *i.e.*, their unreduced eggs get fertilized by pollen from related cultivars. For instance, 4 X and 5 X plants, obtained in the progeny of 3 X 'Red Cap', can arise by the union of its unreduced triploid eggs with X pollen from 2 X cultivars, and 2 X pollen from 4 X cultivars respectively. Similarly, the 6 X plants from 5 X 'Purple Prince' appear to be the result of 5 X unreduced eggs and X pollen from a related diploid cultivar. These conclusions are not only supported by the morphological characters of the progeny plants, but also by the lack of hexaploid cultivar of *L. camara* in our collection. The

Although final proof of the presence of apomixis has to be obtained by a critical embryological study including the nature of female meiosis, yet it is clear from the foregoing results of the progeny tests that the various wild and cultivated varieties in *L. camara* reproduce both sexually and/or apomictically (Table I and Fig. 1). In view of this, the non-conformity

TABLE I

NAME	2n	PMC MEIOSIS	POLLEN FERTILITY	OPEN POLLINATED PROGENY			PRESUMED ORIGIN		MODE OF REPRODUCTION
L. CAMARA X=11			%	TOTAL	MATROCLINUS	ABERRANT	NATURE	%	
'DRAP D'OR'	22	REGULAR	30.4	1	-	1 (3x)	SEXUAL	100	SEXUAL
'NIVEA'	22	"	NIL	5	1	3 (2x) 1 (3x)	SEXUAL AGAMOSPERMY	80 20	FACULTATIVE APOMIXIS
	22*	"	NIL	6	6	-	AGAMOSPERMY	100	OBLIGATE APOMIXIS
'RED CAP'	33	IRREGULAR	15.6	10	3	6 (4x) 1 (5x)	AGAMOSPERMY SEMISEXUAL	30 70	FACULTATIVE APOMIXIS
'MUTABILIS'	33*	-	47	14	14	-	AGAMOSPERMY	100	OBLIGATE APOMIXIS
	44	REGULAR	90.8	6	6	-	?	-	SEXUAL OR PSEUDOGAMOUS
	44*	-	65-90	28	28†	-	?	-	OBLIGATE APOMIXIS
'PURPLE PRINCE'	55	IRREGULAR	69	3	1	2 (6x)	AGAMOSPERMY SEMISEXUAL	33.3 66.7	FACULTATIVE APOMIXIS
L. WIGHTIANA X=12	72*	-	NIL	32	32†	-	AGAMOSPERMY	?	OBLIGATE APOMIXIS

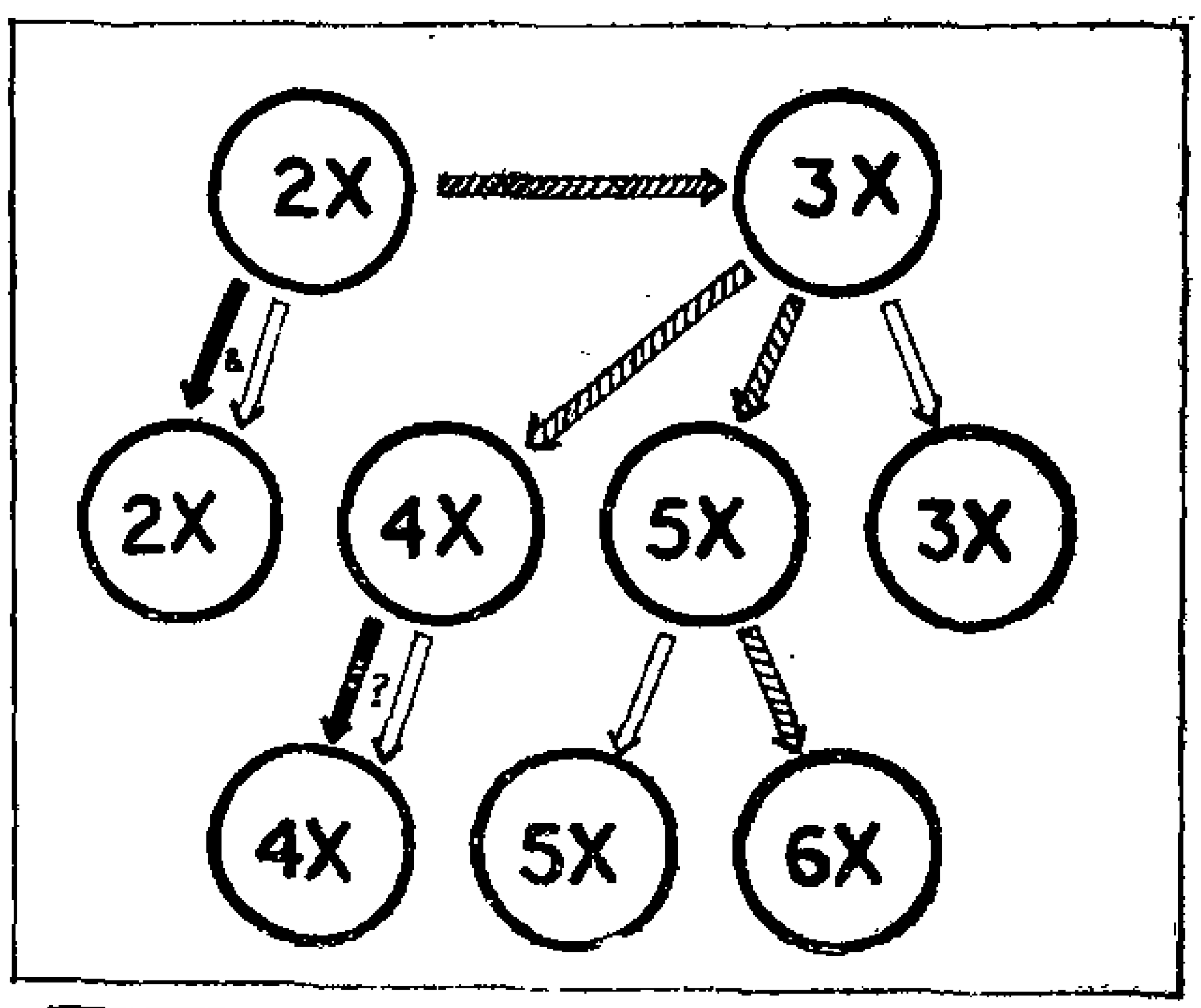
* FROM RAGHAVAN AND ARORA, 1960.

† ONLY 8 AND 12 PLANTS RESPECTIVELY, SCORED CYTOLOGICALLY, HAD PARENTAL NUMBER.

observations of Raghavan and Arora[2] indicate the occurrence of obligate apomixis in 3 X 'Mutabilis'.

As stated above, hexaploid types of *L. camara* were not available to us, but the data of male sterile 6 X *L. wightiana* (X = 12) obtained by Raghavan and Arora[2] is significant. They found all the 32 plants matroclinus; out of these, 8 were actually scored for chromosome number which was the same as the mother plant. They suspected the occurrence of apomixis.

A comparison between our results and those of Raghavan and Arora[2] reveals that at Allahabad 2 X 'Nivea' and 3 X 'Mutabilis' tend to be obligate apomicts, while under Lucknow conditions both 2 X 'Nivea' and 3 X 'Red Cap' are only facultative apomicts. Furthermore, seed fertility appears to be higher at Allahabad than at Lucknow.



SEXUAL APOMICTIC

SEMISEXUAL (UNREDUCED ♀)

FIG. 1.

between the extent of irregular meiosis and fruit set observed by Natarajan and Ahuja[3] in the species becomes perfectly understandable.

In this taxon there is a combination of traits like efficient vegetative reproduction, cross pollination within various colour forms due to butterfly specificity,[4] high incidence and level of various types of polyploidy, seed dispersal by birds, and, superimposed on these, is in reproductive versatility. Because of the last characteristic, there is a complicated mixture of sexual, semi-sexual and totally apomictic biotypes at various levels and types of polyploidy (Fig. 1). These become the starting points of newer biotypes. Consequently, there is an intricate reticulation of taxonomic differences and it is difficult to recognize discrete taxa morphologically. Furthermore, such a pattern creates a formidable taxonomic problem with its bewildering array of wild and cultivated variants that are generally given an equally bewildering array of names. *L. camara* is, therefore, an *agamospecies* and its problems akin to taxonomic enigmas like *Rubus* with its well-known cases of facultative apomixis.

The above traits in particular the excellent supportive factors like vegetative reproduction and seed dispersal by birds have been responsible for its weedy character and very wide distribution in India and abroad. Lastly, apart from its evolutionary implications, such a genetic system demands that the programme for breeding ornamental Lantanas needs to be reoriented on a different pattern. Considerable genetic variability can be created by a judicious use of sexual and facultative apomictic biotypes.

We would like to enlarge our germ plasm collection of ornamental and wild Lantanas, and any gift of viable seed samples and/or cuttings from India and abroad would be most welcome.

Our thanks are due to Dr. L. B. Singh, Director, for facilities.

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VARANASI MEETINGS ON THE INTERNATIONAL BIOLOGICAL PROGRAMME

RECENTLY a number of ecologists of India met twice in Botany Department of Banaras Hindu University at Varanasi, to discuss the International Biological Programme. Firstly there was a three-week School on Plant Ecology held from October 20 to November 9, 1966, under the direction of Prof. R. Misra. It was joined by about 30 ecologists—all being teachers from different Universities. They practised suitable and standard methods for measuring primary production in forest, grassland and freshwater. A few papers dealing with the flow of energy and mineral cycling within the ecosystems were also discussed. An ecology workbook of about 300 pages was prepared. It was agreed that some teaching of ecology be oriented towards the IBP at both the undergraduate and graduate levels.

The second meeting was a one-week symposium organised by the International Society for Tropical Ecology, from January 16–21, 1967. Twentry-three overseas members from 11 countries and about 125 Indian members discussed thirty-six papers out of a total of 97 received earlier for the purpose. Dr. F. R. Fosberg, Special Adviser for Tropical Biology, Smithsonian Institution, Washington, was the President of the symposium.

Besides discussion of papers the members considered at some length implementation of the IBP in the tropical countries. Dr. Hugo Boyko emphasized the urgency of the problem. Dr. F. R. Fosberg presented his observations on the economics of the ecosystems of the Pacific Islands. Dr. D. Mueller-Dombois presented a paper on the joint project of the Smithsonian Institution and the University of Hawaii regarding the selection and conservation of sites for research throughout the tropical belt. Prof. R. Misra explained the position and potentialities of the IBP in India. Some of the special problems which India may investigate are: Production responses to exploitation of biota, nutrient turnover in Deciduous forest and grassland, saprophytic and secondary production, nodulation in legumes in relation to the rhizosphere, root production and soil ecosystem, parameters of production measurement, etc. Dr. J. A. Bullock discussed the problems of IBP in the lowland rain forests of Malaysia. Dr. H. Boyko summarized the debate with emphasis on the organisation of training and research in the IBP and resources ecology at suitable centres.