

Acheulian Culture. This has been further established by statistical studies on handaxes by measuring the parameters like weight (W), length (L), breadth (B), thickness (T) and their comparison with the Early Acheulian site of Chirki-on-Pravara in Maharashtra. The statistical deductions were made by computer studies and the estimates of the mean (M), standard deviation (s.d) and coefficient of variation (c.v.) are as follows :—

Parameters	M		S.d.		C.V.	
	Chirki-Paleru		Chirki-Paleru		Chirki-Paleru	
W (in grams)	539.23	216.84	171.43	105.19	31.77	48.51
L (cm)	13.79	9.80	3.77	1.74	26.98	17.78
B (cm)	7.63	6.89	0.30	1.06	3.97	15.37
T (cm)	4.81	3.06	1.26	0.66	25.13	21.42

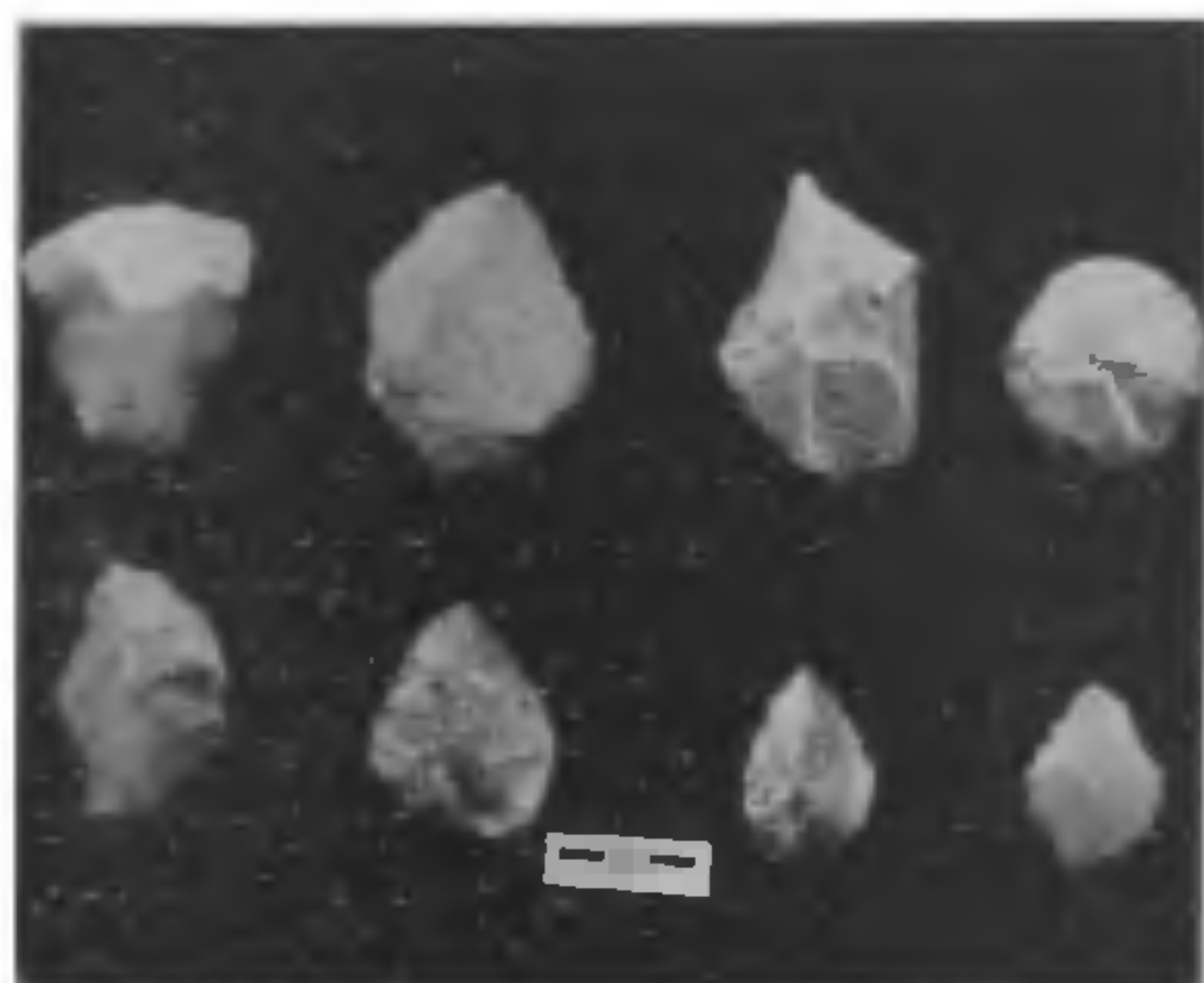


FIG. 2. Middle palaeolithic tool types.

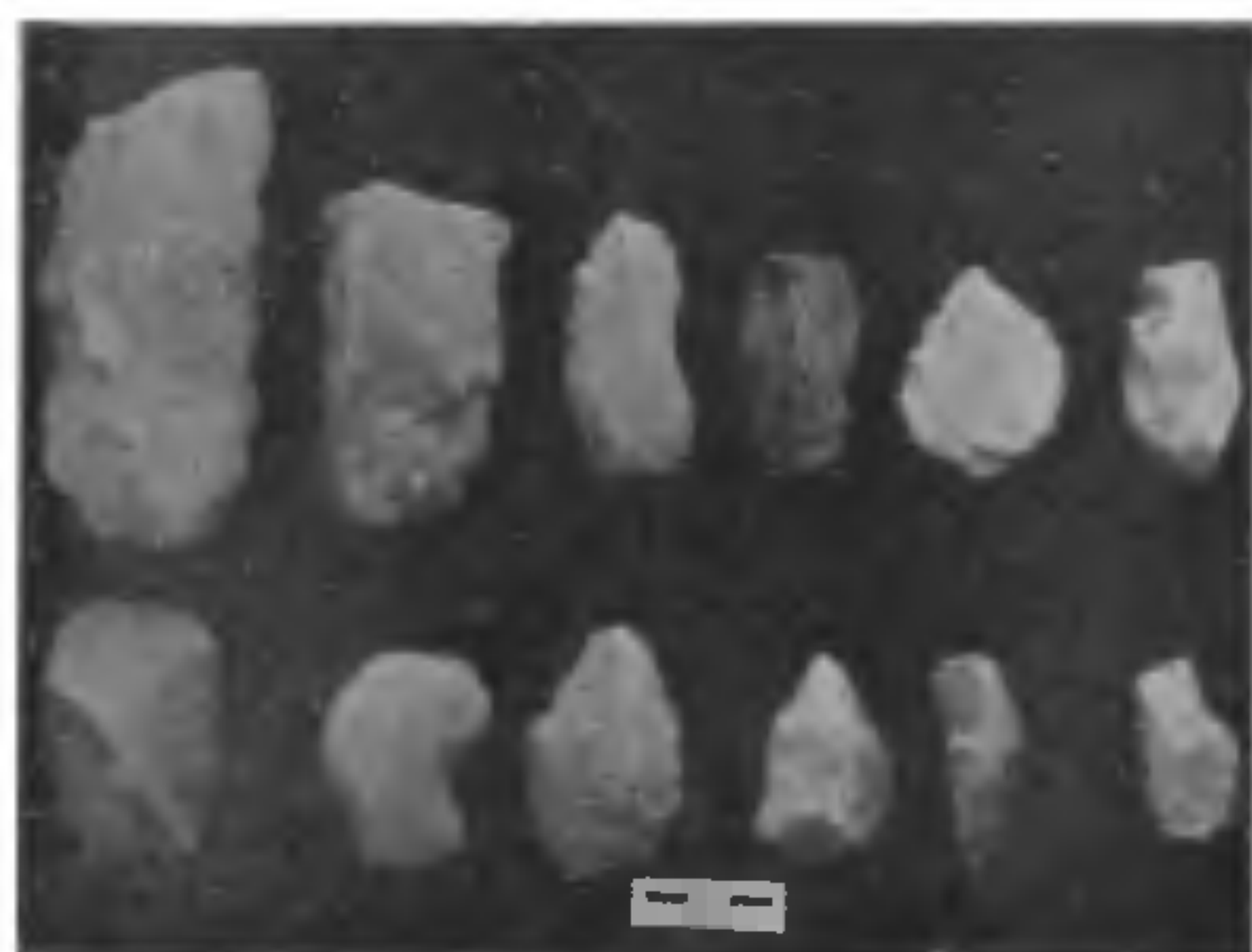


FIG. 3. Upper palaeolithic tool types.

The low mean values for all the parameters for Paleru clearly suggests the Late Acheulian trend of the Paleru industry.

The Middle Palaeolithic tool-kit comprises scrapers, points, borers, and miniature handaxes, discoids and choppers (Fig. 2). The Upper Palaeolithic collection includes typical blades, blade-flakes, burins, scrapers, points, borers, knives, etc. (Fig. 3). Backed pieces are rare in the collection. Burins are mainly on fluted cores.

The Paleru river Valley, therefore, provides a rich potential area for detailed investigations.

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1. Marathe, A. K., "Environmental background to prehistoric cultures of Hiran valley, Saurashtra, Western India", Unpublished Ph.D. thesis; Deccan College, Poona 1977.

RAPID MULTIPLICATION OF *EUCALYPTUS* BY MULTIPLE SHOOT PRODUCTION

VEGETATIVE propagation of forest trees is mainly through rooted cuttings. However, cuttings do not easily root due to inhibitory substances present¹. An alternative method is to attempt to regenerate plantlets via the tissue culture technique. The more recent application of tissue culture to propagation has enormously increased the scope and potential². Tissue culture not only provides increased rates of propagation but also can facilitate their asexual multiplication. In *Eucalyptus*, plantlets have been obtained from callus of lignotubers³, cotyledonary⁴ and hypocotyledonary⁵ segments. Plantlets obtained from embryos or seedlings (cotyledons and hypocotyledons) have the disadvantage of the genotype being different from that of the parent plant. Hence attempts are made to stimulate the axillary shoots normally inhibited by the main shoot by using tissue culture methods.

Eucalyptus citriodora seeds were germinated in petridishes at 37° C. Seeds germinated on the 3rd day. Five day old seedlings were used with or without cotyledons as inoculum. In all the cultures only the apical portion, measuring about 5 mm was left, trimming the root portion and hypocotyl region before

inoculation. Routine sterile techniques were followed in all the operations. MS basal medium⁶ was used with 2% sucrose as carbon source, ferric citrate (20 mg/l) as iron source. MS basal medium was supplemented with cytokinins such as kinetin and benzylamino purine (BAP) singly or in combination with auxins such as indole acetic acid (IAA) and naphthalene acetic acid (NAA). pH was adjusted to 5.8-6 before autoclaving. All experiments were repeated thrice. Cultures were incubated at $26 \pm 2^\circ \text{C}$ under diffused light.

All media supplemented with BAP alone (0.5, 1.0 and 2 mg/l) showed multiple shoot production within 15 days. On basal medium supplemented with lowest concentration of BAP (0.5 mg/l), ten shoots developed within 15-20 days. These on subculture to higher concentration of BAP showed an increased number. In 4 months the total number of multiple shoots from one single apical portion is as high as hundred (Figs. 1 and 2). In some cultures, multiple shoots on subculture with media supplemented with BAP and NAA showed much more vigorous and sturdy shoots. On media supplemented with kinetin (0.5, 1.0, 2.0 and 5.0 mg/l), multiple shoot production was not achieved. Only in a few tubes, 3-4 shoots developed, the growth was suppressed.

lating the development of these multiple shoots seems to depend on the growth regulating substances⁷. Application of cytokinins, to inhibited lateral buds can stimulate some outgrowth, but the effect is generally of limited practical importance. Earlier work on *in vitro* studies⁸⁻¹⁰ has shown that cytokinins have considerable effect on shoot tips in inducing multiple shoots which are usually inhibited in the normal plants. By adjusting the cytokinin concentration, the degree of branching can be controlled. In the present investigation as in other species⁸⁻¹⁰, it was possible to induce multiple shoots with varying concentrations. In explants, with apical portion on basal medium supplemented with BAP alone, no roots were formed. With the multiple shoots the whole thing has a ball like structure (Fig. 1). Unlike in *Gladiolus*, nearly 10 shoots were formed on lowest concentration of BAP (0.5 mg/l). In the present work also explants were subcultured to increasing concentrations of BAP. On a final concentration of BAP (2 mg/l) nearly 100 plantlets were produced. When roots are wanted, they are transferred to medium lacking in BAP. This technique has not been utilised successfully so far, in tree crops. Results presented above suggest a possible application for rapid multiplication of selected varieties of *Eucalyptus*.



FIG. 1. Multiple shoots in a 9 week old culture of *Eucalyptus citriodora*.

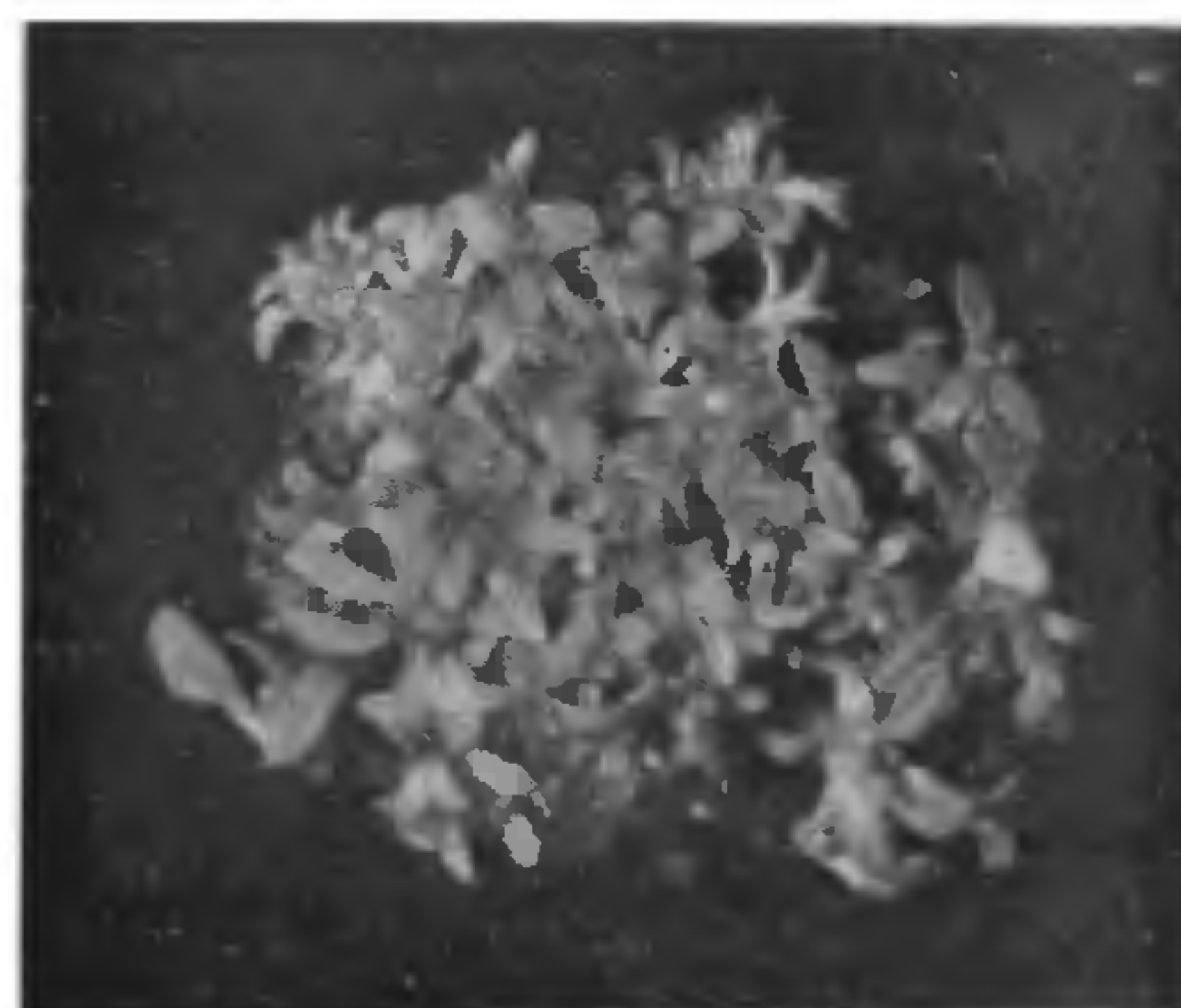


FIG. 2. Same as Fig. 1., but after 4 months in culture.

Axillary meristem is initiated in the leaf axils of most plants and each meristem is capable of developing into a shoot comparable with the main shoot. In conventional propagation, the lateral shoot development is limited. Each axillary shoot can in turn produce its own axillaries and so on; a potentially unlimited system of proliferation exists in all the plants. But in a normal plant, there is inhibition due to apical dominance. The mechanism, regu-

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1. Paton, D. H., Willings, R. R., Nicholls, W. and Pryor, L. D., *Aust. Jour. Bot.*, 1970, 18, 175.
2. Hussey, G., *Sci. Prog.*, 1978, 65, 185.
3. Aneja, S., Atal, C. K., *Curr. Sci. (India)*, 1969, 38, 69.
4. Lakshmi Sita, G., *Plant Sciences Letters*, 1979, 14(1), 63.
5. Kithara, E. H., Caldas, L. S., *Forest Sci.*, 1975, 22, 242.
6. Murashige, T., Skoog, F., *Physiol. Plant.*, 1962, 15, 437.
7. Phillips, I. D. J., *Physiology of Plant Growth and Development*, ed. M. B. Wilkins, 1969.
8. Hussey, G., *Scientia Hor.*, 1977, 6, 287.
9. Murashige, T., Serpa, H. and Jones, J. B., *Hort. Sci.*, 1974, 10, 608.
10. Boxus, P., *J. Hort. Sci.*, 1974, 49, 209.

THREE NEW HOST RECORDS FROM INDIA

WHILE making a routine survey of parasitic fungi of District Jaunpur (U.P.) during 1975-76, senior author came across severe infections of leaves of *Lycopersicon esculentum*, *Carica papaya* and *Amorphophallus campanulatus* in the localities of village, Darana (Shahganj). The specimens were collected and examined for the identity of the fungi involved in leaf-spotting. The causal organisms on *L. esculentum* and *C. papaya* were found to be *Cladosporium tennuissimum* Cooke and *Cladosporium cladosporioides* (Fresen) De Vries respectively while that on *A. campanulatus* was found to be *Phoma tropica* Schneider and Boerema.

The identity of these fungi was confirmed from the Mycologists working at Commonwealth Mycological Institute, Kew, England where the materials have been deposited at IMI No. 211536, 211406 and 210487 respectively.

It has been observed that secondary parasites like *Cladosporium* can accelerate the process of damage and cause considerable loss to the Plant produce. Both *Lycopersicon esculentum* and *Carica papaya* as well as the *Amorphophallus campanulatus* are plants of much economic value and in this remote part of Eastern U.P. where they are grown extensively, the secondary invasion of *Cladosporium* is posing a real threat to the growers.

A perusal of the literature¹⁻⁵ has revealed that there is no record on the occurrence of *Cladosporium cladosporioides* on *Carica papaya*, *Cladosporium tennuissimum* on *Lycopersicon esculentum* and of *Phoma tropica* on *Amorphophallus campanulatus* and hence these host-parasite associations are new for India.

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1. Butler, E. J. and Bisby, G. R., *Fungi of India*, (Revised by R. S. Vasudeva), I.C.A.R., New Delhi, 1954.
2. Mukerji, K. G. and Juneja, R. C., *Fungi of India*, Supplement to the list of Indian Fungi, (1962-72), Emkay Publishing, Delhi, 1975.
3. Tandon, R. N. and Chandra, S., Supplement to the list of Indian Fungi (1957-62), University of Allahabad Studies, Allahabad, 1963.
4. Vasudeva, R. S., Supplement to the fungi of India, ICAR, New Delhi (1962).

EFFECTS OF SOME SELECTED ANTIBIOTICS ON SOIL ALGAE

THE use of antibiotics to control plant diseases is an important advance in the science of plant protection. In modern agricultural practices the crop fields are sprayed with antibiotics. During this operation some of these antibiotics does fall on the soil. The potential algicidal value of antibiotics have been investigated on aquatic algae or pure algal cultures by Foter *et al.*,² Hutner and Veigh³, Kumar⁴, Lampmen and Arnow⁵, Palmer and Maloney⁶, Zehnder and Hughes⁷. They opined that algae are generally less sensitive towards antibiotics than bacteria and fungi. In the present investigation the authors made preliminary observations on the effects of four antibiotics on the soil algae of the field of Botanical garden, Institute of Science, Nagpur. The algal members present in the composite soil sample were studied by means of De's¹ modified benneck's liquid culture medium. Twenty-seven algal taxa were observed. Out of these, first eighteen belong to Cyanophyceae and the rest to Chlorophyceae (Table I). Four antibiotics, Agri-mycin-100, Aureofungin, Tetracyclin-HCl and Streptocycline were used in five different concentrations, *i.e.*, 100 ppm, 200 ppm, 300 ppm, 400 ppm and 500 ppm to study their effects on the survival of algae to evaluate their algicidal potential. Ten ml solution of the different concentrations of the four antibiotics were added to separate flasks containing 5 gms of soil sample and 190 ml of nutritive culture media. To the flasks serving as control, equal amount of sterilized water were added in place of the antibiotic solution.

The results are presented in Table II. It can be concluded that the soil algae were less sensitive towards