cell wall is thick and exhibits pale yellow colour under light microscope. This depiction of colour is very characteristic in this species and the reason for it is as yet not known. Mature sclereids possess lumina of irregular width and are free from pits[9,?] and contents.

Terminal sclereids of diverse pattern as described above is unique for this species. Their range of variation is a distinct diagnostic feature of this species. Up-to-date interesting topographic relationship with sclereids and vein-endings has been recorded in closely related and distinct taxa of angiosperms such as *Canella, Warburgia, Cinnamoma, Pleodendron* of the Canelliaceae[1], *Capparis, Niebuhria* of the Capparidaceae[2], *Salicornia* of the Chenopodiaceae[3,4], *Pseudoconnarus* of the Connaraceae[5], *Cunonia, Weinmannia* of the Cunoniaceae[6], *Hibbertia* of the Dillenieaceae[7,8], *Goupia* of the Goupiaceae[9], *Hamamelis, Exbucklandia, Eustigma, Rhodoleia, Disanthus, Liquidamber* of the Hamamelidaceae[2], *Cynometra, Cassia, Dimorphandra* of the Leguminoseae[10-12], *Aromodendron, Kmeria, Manglietia, Michelia* of the Magnoliaceae[2], *Coryphadenia, Memecylon, Mouriri* of the Melastomataceae[2], *Olinia* of the Oliniaceae[13], *Scherebera* of the Oleaceae[2], *Limomium* of the Plumbaginaceae[2], *Moutabea* of the Polygalaceae[2], *Bellendena* of the Proteaceae, *Bruguiera* of the Rhizophoraceae[2], *Scyphiphora* of the Rubiaceae[2], *Boronia* and *Boronella* of the Rutaceae[2], *Hannoa* of the Simarubaceae[2], *Enkleia, Linostoma* of the Thymelaeaceae[2], and *Vochysia* of the Vochysiaceae[14]. In all the above-mentioned 41 taxa belonging to 22 families the terminal sclereids are distinct and clearly associated with veinendings despite their typological diversity. The 'terminal' position is confirmed by ontogenetic study only in 4 taxa, namely, *Mouriri, Memecylon, Boronia,* and *Niebuhria*[2] and in the rest this positional relationship is recognised purely on a topographical basis. Its occurrence in apparently near and widely reported taxa belonging to different orders, families, genera and species can be considered as a significant morphological aspect occurring independently at various levels in a phylogenetic classification. This unusual feature of the intimate relationship of tracheary endings with the thick walled idioblasts is intriguing and the exact physiological or mechanical advantage of this association to any particular environmental stress is as yet not proved.

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1. Parmeswaran, N., *Proc. Indian Acad. Sci.*, 1961, 54 B, 306.
2. Rao, T. A. and Bhupal, O. P., *Adv. Pl. Morph.*, 1972, p. 46.
3. Fahn, A. and Arzee, I., *Amer. J. Bot.*, 1959, 46, 330.
4. De Frain., *J. Linn. Soc. Bot.*, 1912, 41, 317.
5. Dickison, W. C., *Elisha Mitchell Sci. Soc.*, 1973, 89, 121.
6. —, *Bot. J. Linn. Soc.*, 1975, 71, 275.
7. —, *J. Arnold Arbor.*, 1969, 50, 384.
8. —, *Ibid.*, 1970, 51, 89.
9. Rao, T. A. and Bhattacharya, J., *Curr. Sci.*, 1975, 44, 132.
10. —, *Ph.D. Thesis*, Mysore University, India, 1953.
11. Banerjee, M. L. and Sirkar, G., *Bull. Bot. Soc.*, Bengal, 1974, 28, 1.
12. Ragonese, A. M., *Bot. J. Linn. Soc.*, 1973, 67, 225.
13. Mujica, M. B. and Cutler, D. F., *Kew Bull.*, 1974, 29, 93.
14. Rao, T. A. and Mody, K. J., *Proc. Indian Acad. Sci.*, 1961, 53 B, 257.

REVERSAL OF NIACIN INHIBITED GROWTH BY GIBBERELLIC ACID IN GREEN GRAM (*PHASEOLUS RADIATUS* L.)

THE possibility of the regulation of plant growth by natural or synthetic antagonists of gibberellic acid (GA) remains only an interesting possibility to date. A synthetic diterpene, chlorofluorenol was reported by Ziegler *et al.*[1] as a possible GA antagonist but Krelle[2] negatived this proposition. Several unidentified natural inhibitors have been suggested as GA antagonists[3-6]. The ability of some synthetic growth retardants to inhibit GA synthesis is not to be construed as a gibberellin antagonism, even though their inhibition may be relieved by added GA[7]. The present study has been designed to know the action of niacin (*a vitamin of the B group*) on gibberellic acid in relation to growth.

Seeds of green gram (variety 525) were subjected to soaking in 50 ppm GA and 1000 ppm niacin for 24 h. in dark in petri dishes before sowing. After this interval the seeds were allowed to germinate in distilled water for about 8 days. Growth and respiratory activity was measured by the usual techniques. Nitrogen fractions were estimated according to the methods of Markham[8], and Thimann and Loos[9].

Niacin (1000 ppm) inhibited the growth by 60–80% (Fig. 1). It is to be noted in this connection that other B group vitamins are not inhibitory at this concentration but instead stimulatory, at least initially. GA (50 ppm) stimulated the growth to about 40 to 50% over the control. It is quite interesting to note that when GA (50 ppm interacted with niacin (1000 ppm), the inhibitory effect of niacin was nullified and there was about 900% stimulation of growth. This apparently indicated niacin is blocking the synthesis of endogenous GA. When GA was added exogenously, the GA synthesis must have been restored. Arditti[10] assumed that the presence of niacin may promote NAD and NADP biosynthesis which in turn may stimulate the production and utilization of a variety of compounds. In the present study it is quite possible that niacin has stimulated the gibberellin activity, resulting in 900% enhancement of growth over the control. The growth-promoting effect of niacin may, therefore, be a rather indirect one, the improved growth being only an observable index of a considerable number of biochemical—physiological—events in the seedlings. Niacin must have been activated by GA. This was corroborated by the reversal of respiratory inhibition with niacin by GA (Table I). Protein nitrogen

TABLE I

O_2 uptake (µl/seedling)

(Mean of two replications)

Treatment	Days after sowing 2 days	4 days	6 days	8 days
Control	6·0	43·0	25·5	18·0
Niacin	12·20	17·0	9·72	16·76
GA	33·0	35·0	24·0	25·0
GA + Niacin	15·0	33·0	34·0	16·0

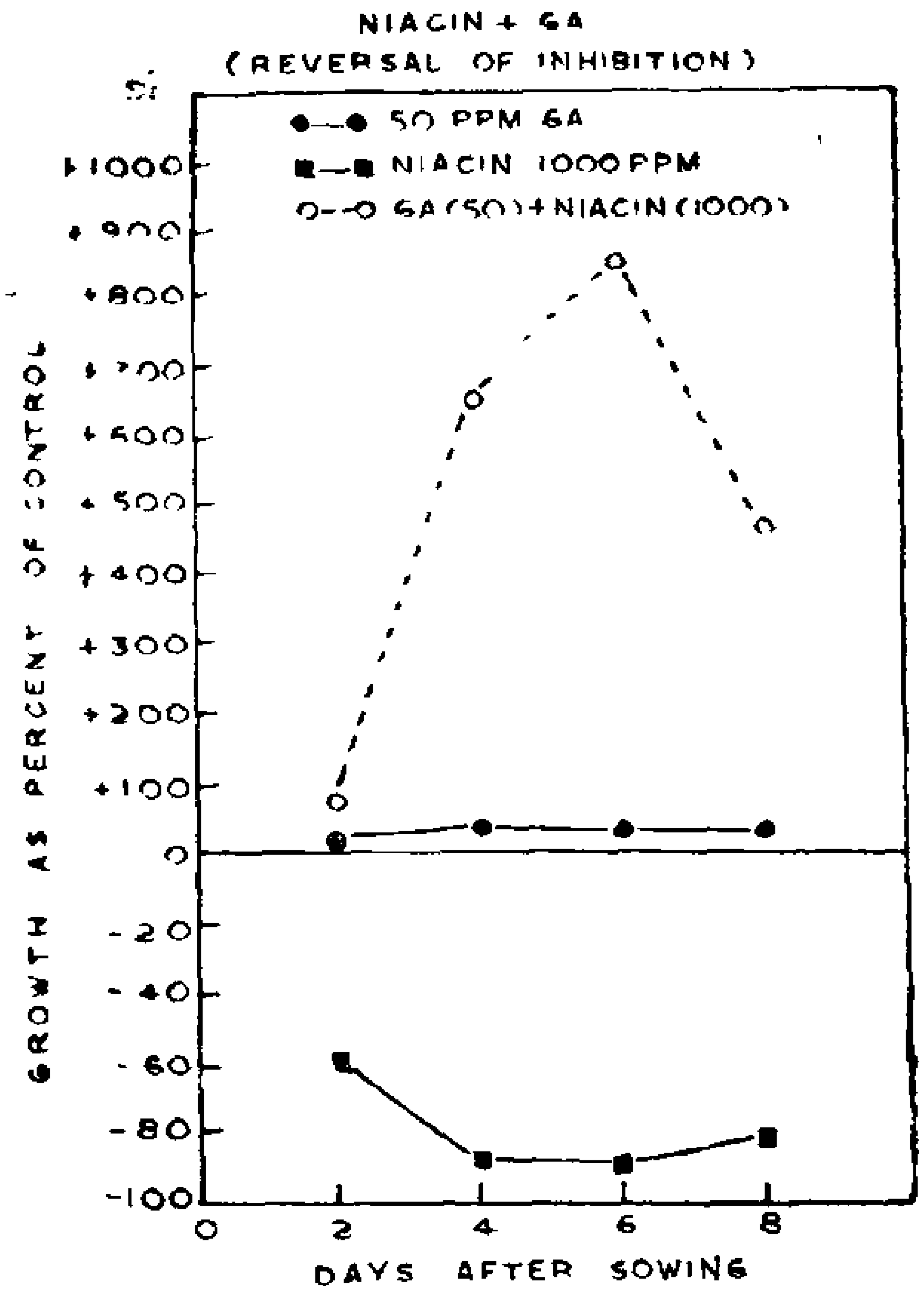

FIG. 1

content was higher in niacin treated seedlings. Combination of GA with niacin enhanced the protein nitrogen content much more than that of control, niacin and GA treatments (Table II).

TABLE II

Nitrogen fractions (mg/g dry wt) of the seedlings

(The values are the mean of three replications)

Treatment	4 Days Total Nitrogen	4 Days Protein Nitrogen	4 Days Soluble Nitrogen	6 Days Total Nitrogen	6 Days Protein Nitrogen	6 Days Soluble Nitrogen
Control	49·560 (0·792)	28·560 (0·456)	21·000 (0·336)	61·320 (0·861)	21·840 (0·307)	39·480 (0·554)
GA (50 ppm)	53·760 (0·933)	29·820 (0·518)	23·940 (0·415)	56·280 (0·768)	22·680 (0·309)	33·600 (0·459)
Niacin (1000 ppm)	44·520 (0·847)	30·240 (0·576)	13·280 (0·271)	48·720 (0·826)	25·200 (0·428)	23·520 (0·398)
GA + Niacin (50 + 1000 ppm)	46·620 (0·763)	33·600 (0·550)	13·020 (0·213)	50·400 (0·669)	29·820 (0·396)	20·580 (0·273)

The results in the parenthesis indicate mg/organ.

This apparently indicates that GA activates the effect of niacin. There are reports to show that these natural growth substances, *viz*, gibberellins, IAA and cytokinins activate vitamin activity. Digby and Skoog[11] showed cytokinin activation of thiamine biosynthesis in tobacco callus cultures. Thus, the final enhancement of growth to 900% with niacin and GA interaction appears to be synergistic although niacin is antagonistic to the synthesis of gibberellin endogenously. That the endogenous level of GA is inhibited is evident from growth inhibition by niacin and its reversal by added GA. Finally, it is concluded that niacin at higher concentrations (unlike other vitamins) can inactivate GA thus inhibiting the growth.

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N. RAJA KUMAR.

1. Ziegler and Luttage, V., *Planta*, 1966.
2. Krelle, E., *Plant Growth and Development* (Ed. A. C. Leopald, pp. 146) 1967, **70**, 193.
3. Corcoran, M. R., West, C. A. and Phinney, B. O., *Adv. Chem.*, 1961, **28**, 152.
4. Kohler, D., *Planta*, 1964, **63**, 326.
5. Michniewics, M. and Kopcewicz, J., *Rosznik i Nauk Rolu*, 1966, 90, 689.
6. Thomas, T. H., Wareing, P. F. and Robinson, P. M., *Nature*, 1965, p, 205.
7. Cathey, H. M., *Ann. Rev. Plant Physiol.*, 1964, **15**, 271.
8. Markham, R., *Biochem. J.*, 1942, **36**, 790.
9. Thimann, K. V. and Loos., G. M., *Plant Physiol.*, 1957, **32**, 274.
10. Arditti, Joseph, *Amer. Jour. Bot.*, 1967, **54**, 291.
11. Digby, J. and Skoog, F., *Plant Physiology*, 1966, **41**, 647.

LEPTURUS RADICANS (STEUD.) A. CAMUS—A NEW RECORD FOR INDIA

DURING studies on Poaceae of Karnataka State the authors came across 4 herbarium specimens of *Lepturus repens* (G. Forst.) R. Br., all belonging to a single collection of R. K. Bhide from Karka Forest, Naka, near Halyal in North Kanara District of Karnataka State dated 9th February, 1920 and the same are cited by Blatter and McCann (1935)[1]. But on a scrutiny it was found that these specimens belong to another species, *viz. L. radicans* (Steud.) A. Camus. A consultation of *BSI* herbarium and literature revealed that this species is not reported from India so far and hence the present note. The above-stated two species differ from each other in the following characters:

	L. radicans (Steud.) A. Camus	*L. repens* (G. Forst.) R. Br.
1.	Spikes 3–5 cm long	Spikes 5–15 cm long
2.	Spikelets 3–5 mm or the terminal 5–8 mm long	Spikelets 5–14 mm or the terminal upto 18 mm long
3.	Upper glume ovate-oblong or lanceolate-oblong, acute or acuminate but not drawn out into a short arista.	Upper glume lanceolate, tailed or finely acuminate
4.	Lemma 2·5–4 mm long	Lemma 4–5·5 mm long

Bor (1960)[2] gives its distribution as Madagascar, Mascarene Islands, Tanganyika Territory and Ceylon, which, with the present report, now extends to India as well. A brief description has been given by Senaratna (1956)[4] and Clayton *et al.* (1974)[3]. The former has given the illustrations as well. However, the description given by Blatter & McCann (*l.c.*)[1] under *L. repens* (G. Forst.) R. Br. belongs to that species only but his citation of the above-said Bhide's specimens now belongs to *L. radicans* (Steud.) A. Camus.

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1. Blatter, R. and McCann, C., *The Bombay Grasses*, Manager of Publications, Delhi, 1935, p. 279.
2. Bor, N. L., *The Grasses of Burma, Ceylon, India and Pakistan*, Pergamon Press, Oxford, London, New York, Paris, 1960, p. 585.
3. Clayton, W. D., Phillips, S. M. and Renvoize, S. A., *The Flora of Tropical East Africa—Gramineae* (Part 2), Whitefriars Press Ltd., London and Tonbridge, 1974, p. 389.
4. Senaratna, S. D. J. E., *The Grasses of Ceylon*, Government Press, Ceylon, 1956, p. 62.

MALE STERILITY IN SUNNHEMP (*CROTALARIA JUNCEA* L.)

MALE sterility in *Crotalaria striata* has been reported[1,2] in literature. The present note deals with the male sterility in sunnhemp.

Meiosis and the subsequent tetrad formation in the case of the sterile sunnhemp plant were found normal but the pollen was contorted and devoid of