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STUDIES ON THE INTERNAL STRUCTURE OF LEMON LEAVES AS INFLUENCED BY PLANT GROWTH REGULATORS

Introduction

THE concept of use of different plant growth regulators to obtain higher percentage of fruitset and yield is not a new one. But the success depends on the nature of growth regulators, its appropriate doses and many other environmental factors along with the plant characteristics like—species, variety, etc. The present paper envisages a report on anatomical studies of lemon leaves as influenced by plant growth regulators.

Materials and Methods

Experimental materials for the anatomical studies of lemon [*C. limon* (L.) Burm.] leaves were collected randomly from the twigs marked for studying the effect of growth regulators on set and retention. Microscopic studies were made on the internal structure of the leaves of various treatments. The treatments were:

(1) GA — 5, 10, 20 and 40 ppm
(2) NAA —25, 50, 100 and 200 ppm
(3) 2,4-D — 5, 10, 20 and 40 ppm

Leaf samples of 1 sq.cm were taken from the central part of the 3rd and 4th leaves, about 0·5 cm away from the main vein. Free hand sections were made after clearing (with solutions of $CaCl_2$ and K_2CO_3) and washing. The thickness of the leaf lamina, palisade and spongy parenchyma were measured separately. Measurements were made with ocular micrometer and for each treatment average was made from 20 measurements.

Results

Leaf thickness was greatly influenced by the application of NAA (100 and 25 ppm), GA (40, 10 and 5 ppm) and 2,4-D at 20 ppm which as revealed by the separate measurements of palisade and spongy parenchyma, is mainly due to the higher development of spongy tissues (Table I). Different growth regulators influenced the elongation of palisade parenchyma tissue in leaves at different concentrations (Ga—5 ppm, NAA—50 ppm and 2,4-D 20 ppm). These differences are understandable, as the cell divisions cease when the leaf is still very small. The application of different growth regulators affect mainly the enlargement of cells, rather than their division.

Discussion

Microscopic studies of tissues of the leaves treated with various growth regulators revealed that almost all the treatments caused an increase in the thickness of leaf. This fact indicates that the growth regulators under study are effective in stimulating the increase of cell size of even in the semi-mature leaves of citrus. The measurements of both palisade and spongy parenchymatous tissues indicate that while in some of the treatments the palisade parenchymatous tissue had developed more, in some other cases, more marked development took place in the spongy parenchyma. It is already known that the light absorption potentiality of leaves and photosynthetic activity are partially correlated with the internal tissue development of the leaves; thicker leaves with better developed and compact palisade tissue usually absorb more radial energy in comparison to thinner leaves with loose tissue systems[1-3]. In addition to this, as chloroplasts are located in the leaf parenchyma cells, and as the parenchymatous cells also act as the storage cells for photosynthates at the initial stage, the degree of development of the leaf tissues indirectly effect their photosynthetic behaviour and potentiality.

TABLE I

Effect of different growth regulators on the internal structure of leaves

Treatments	Concentrations in ppm	Thickness in μ		
		Leaf lamina	Palisade parenchyma	Spongy parenchyma
Control		206·17	67·77	121·23
GA	5	228·79	75·81	131·65
	10	226·16	61·07	145·90
	20	206·01	57·17	133·27
	40	238·84	64·74	153·41
2,4-D	5	207·68	57·67	127·65
	10	216·97	57·67	137·86
	20	224·31	73·11	132·35
	40	214·05	55·83	137·59
NAA	25	230·68	60·84	148·93
	50	216·75	74·73	125·65
	100	244·99	65·44	156·00
	200	210·92	64·53	127·92
SEm ±		1·75	0·91	2·07
C.D. at 5%		4·96	2·58	5·82

The growth regulators, used for obtaining higher percentage of fruitset and yield, may also influence the photosynthetic activity of the leaves indirectly, by influencing the degree of development of leaf tissues.

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SEEDLING HANDEDNESS IN *PHASEOLUS VULGARIS* L.

ALL aspects of seedling characters in flowering plants were not explored, although some of them were used for taxonomic[1] and genetic studies[2]. However, Compton[3] studied seedling handedness in a number of cereals. Later this phenomenon was observed by Ono and Suemoto[4] in *Triticum*, Bahadur and Udayachandra[5] in *Sorghum* and Bahadur, Rao and Rao[6] in *Bambusa arundinacea*. Recently, Rao and Bahadur[7] reported seedling handedness in *Cajanus cajan*, a dicot for the first time. In this communication we report observations on the seedling handedness in *Phaseolus vulgaris* L. (Papilionaceae).

In Table I, cultivars of *P. vulgaris* studied are listed. Seeds were sown in small earthen flats and their germination characters were carefully observed as their first pair of leaves emerged and the seedlings have been classified as Left, Right and two types of Neutrals, according to the procedure followed by Rao and Bahadur[7]. The frequencies of four types of seedlings in each of the 7 cultivars have been worked out in the sample (Table I).

A total of 696 seedlings were examined out of which 339 (49·3%) were left-handed, 349 (50·7%) were right-handed and the rest neutrals (both types included). The data on neutral seedlings have not been given in Table I, since their number is negligible. The students t test was applied and the t value was found to be 0·51 and it is less than the tabulated value (2·18) at 5% level of significance and hence we conclude that there are no significant differences in the frequency of L and R forms of seedlings in *P. vulgaris* cvs. The L/R ratio was also found to be unity although a slight excess of R seedlings was observed. A similar excess of R seedlings was also observed in *Cajanus cajan*[7], *Bambusa arundinacea*[6] and in number of species of *Phaseolus* and *Vigna* (unpublished). However, Bahadur and Udayachandra observed a higher incidence of L seedlings in *Sorghum vulgare*[5].

The seedling handedness observed in *P. vulgaris* is a clear case of bioisomerism and both L and R seedlings represent stereoisomeric forms and hence mirror images, like the one described in the cyathial bracts of *Euphorobia milli*[8]. The L and R biological objects have been variously designated in the literature as isomers or Bio-isomers[9], Enantiomorphs[10] and Bio-enantiomorphs[11]. But the causal factor for the existence

TABLE I

The distribution of Left and Right-handed seedlings in Phaseolus vulgaris *cultivars*

Sl. No.	Cultivar	Twist of the first pair of leaves: Left	Right	L + R	LH/RH	LH%	Source of the seed material
1.	Bangalore Local	43	62	105	0·6935	41·00	Deccan Seed Stores, Hyderabad
2.	K-41	46	45	91	1·022	50·45	do.
3.	French Yellow	40	35	75	1·143	53·07	do.
4.	Premier	78	74	152	1·051	51·32	do.
5.	Hyderabad Local	43	48	91	0·897	47·25	do.
6.	PLB-14-1	36	38	74	0·92	48·64	NBPCR Regional Station, Simla.
7.	PLBK-1	53	47	100	1·128	53·00	do.
	TOTAL ..	339	349	688	0·986	49·27	