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BRIEF COMMUNICATION

Morphactin-induced malmorphogenetic effect and its transmission in *Kalanchoë*

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Abstract

Morphactin dispensed through shoot apex induced diverse malformations of plant organs in four species of *Kalanchoë*. The malmorphogenetic effect was freely transmitted to newly emerging axillary branches as well as across leaf lamina to differentiating epiphyllous buds.

Key words: apex, branches, Chlorflurenol, cup formation, epiphyllous buds.

Morphactins constitute a group of highly active chemicals that show significant morphogenetic potency (for review see Schneider 1970, 1972). One of the most dramatic effects of morphactin has been the induction of malformations. The present investigation was carried out to study the induction of morphogenetic malformations by a halogenated morphactin - Chlorflurenol (CF1) in *Kalanchoë* species where leaves along marginal serrations possess multiple meristematic centres acquired at a very early primordial stage.

Plants of *Kalanchoë daigremontiana, K. fedtschoenkoei, K. spathulata* and *K. tubiflora* were raised from epiphyllous buds under 24 h photoperiods. After attaining the age of fifty days, plants were divided into three groups and treated with water, 10 or 50 mg dm^{-3} of CF1 on alternate days for 8 weeks. 0.3 cm^3 of CF1 was dispensed to the apices by microdrop method. Twelve replicates were maintained under each treatment.

CF1 treatment induced diverse malformations in all four species. Most significant was the distortion of leaf morphology resulting in thicker, shortened and incurved leaves, partial loss of marginal serrations with a proportional reduction in the number of apparent epiphyllous bud primordia and fusion of leaves to varying degree (see Sawhney and Mahajan 1995 for detail). The fusion effects were more drastic in

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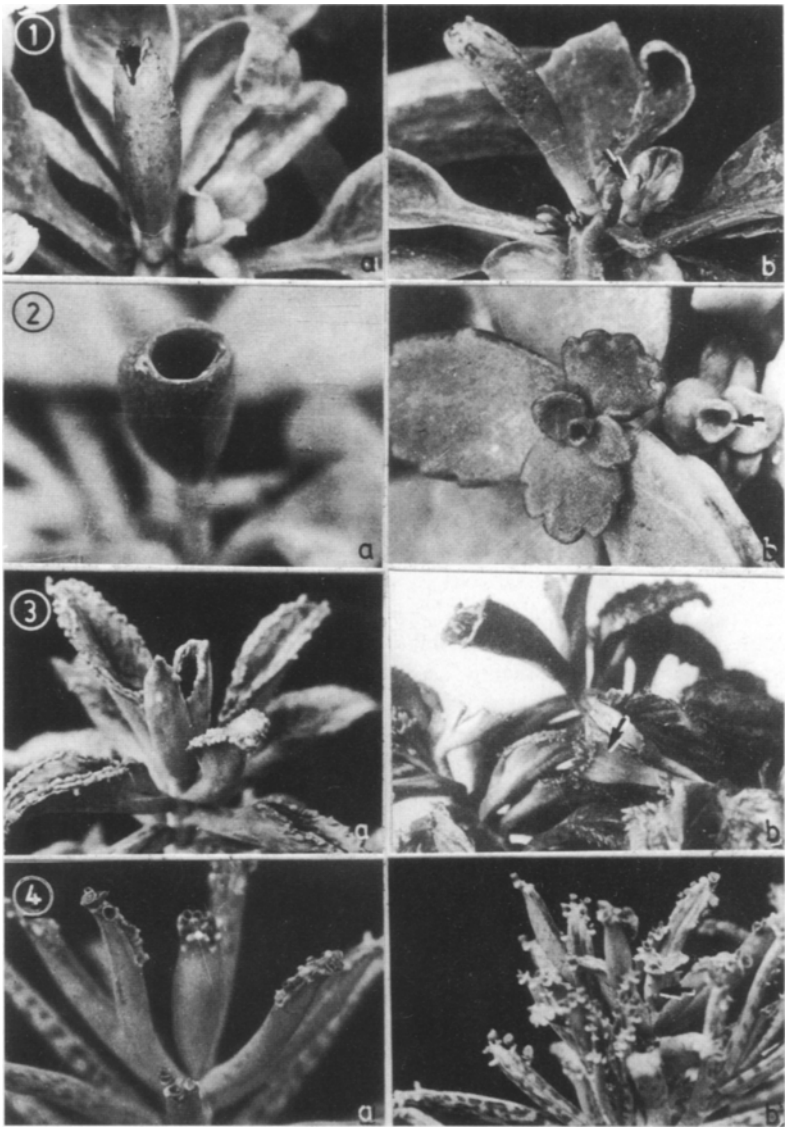
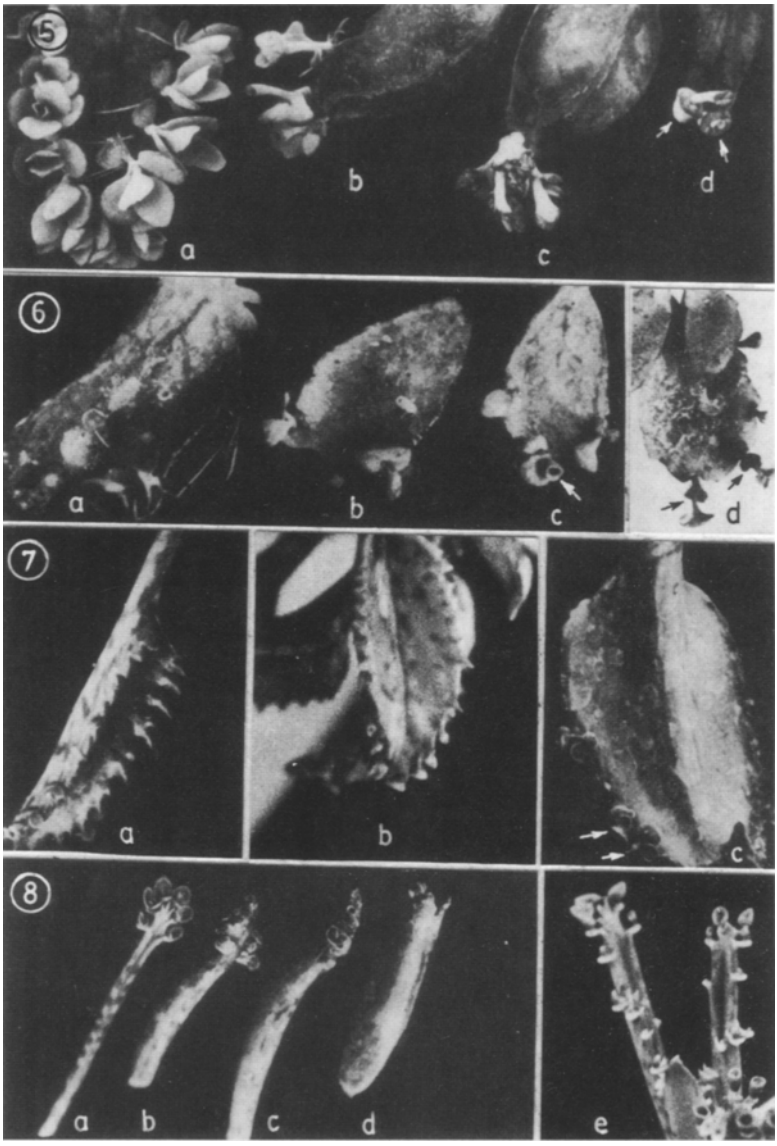


Figs. 1 - 4. Malmorphogenetic effect of morphactin (CF1, 50 mg dm^{-3}) dispensed through shoot apex in *Kalanchoë daigremontiana* (Fig. 1), *K. fedtschoenkoei* (Fig. 2), *K. spathulata* (Fig. 3) and *K. tubiflora* (Fig. 4). Cup formation was induced by fusion of uppermost pair of leaves at the shoot apex itself (*a*) as well as on the apices of emerging branches (*b*). The arrow indicates the location of cup at the branch apex.



Figs. 5 - 8. Malmorphogenetic effect of morphactin (CF1, 50 mg dm^{-3}) dispensed through shoot apex in *Kalanchoë daigremontiana* (Fig. 5), *K. fedtschoenkoei* (Fig. 6), *K. spathulata* (Fig. 7) and *K. tubiflora* (Fig. 8). Leaves with normal epiphyllous buds from water-treated plants (*a*) and with miniature cups induced by fusion of first pair of emerging leaves of epiphyllous buds from morphactin-treated plants (*b* - *e*). Some double cups were also formed by fusion of two pairs of leaves in the first three species, indicated by arrows (Figs. 5*d*, 6*c*, *d*, 7*c*).

leaves near the growing apex, so much so that the upermost pair fused completely to produce a cup like structure, in all species (Figs. 1a - 4a). The formative morphological disfigurement resulting in the production of freak plant organs is being termed malmorphogenesis. Similar malformations have been reported in some other plants (Schneider 1970, 1972, Pillai and Pillai 1980, Ahmad 1984, Sawhney *et al.* 1986).

Morphactin application to the shoot apex not only caused terminal cup formation on the main axis but also induced it on the apices of newly emerging axillary branches in all cases (Figs. 1b - 4b). It points to the transmission of morphactin-induced malmorphogenetic effects from the site of application to other growth centres.

The number of new leaves differentiated on main axis in both water- and CF1-treated plants was significantly less in *K. daigremontiana* and *K. fedtschoenkoei* as compared to *K. spathulata* and *K. tubiflora* (Table 1). This pointed to the much faster rate of growth in the latter species. The extent of transmission of malmorphogenetic effects from the shoot apex (site of CF1 application) to the apices of axillary branches had a reciprocal relationship among species with contrasting growth rates. Thus, the fast growing species had a higher percentage of plants bearing cup on the shoot tip but lower percentage of branches bearing cups, whereas the reverse was true for slow growing species (Table 1).

Table 1. Effect of CF1 dispensed through shoot apex on leaf differentiation (number of new leaves differentiated prior to cup formation) and induction of cup like malformations at the shoot apex as well as at the apices of newly emerging branches

Species	CF1 [mg dm^{-3}]	New leaves	Cup, apex [%]	Cup, branches [%]
K.daigremontiana	0	4.00 ± 0.25	0	0
	10	3.30 ± 0.38	60	100
	50	3.60 ± 0.67	60	100
K. fedtschoenkoei	0	4.20 ± 0.17	0	0
	10	4.20 ± 0.13	60	100
	50	4.30 ± 0.19	60	100
K. spathulata	0	14.71 ± 0.75	0	0
	10	10.80 ± 0.96	100	13
	50	9.57 ± 0.71	100	15
K. tubiflora	0	13.00 ± 0.50	0	0
	10	11.50 ± 0.56	100	9
	50	12.10 ± 0.58	100	17

The number of epiphyllous buds differentiated on leaves of CF1-treated plants was much less in comparison to the corresponding water-treated ones in all *Kalanchoë* species (Figs. 5 - 8). On the other hand, in *Begonia rex* CF1 induced an increase in the number of regeneration loci for adventitious buds on leaf discs (Schott and Schraudolf 1967).

The morphactin-induced effects could be transmitted across leaf lamina to bring about miniature cup formation by fusion of the emerging leaf pair of the differentiating epiphyllous buds (Figs. 5 - 8). In *K. daigremontiana* (Fig. 5d), *K. fedtschoenkoei* (Fig. 6c,d) and *K. spathulata* (Fig. 7c) there was double cup formation *i.e.* a second cup arising out of the centre of the first cup.

The appearance of malformed structure on newly emerging axillary branches as well as on developing epiphyllous buds clearly demonstrate not only free transmission of malmorphogenetic effect of morphactin but also its exclusive expression in the new growth centres being differentiated in the plant body both in time and space.

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