

Effect of Morphactin on the Linear Extension of *Ricinus Communis* Linn.

MARY VARKEY¹, R. K. NIGAM², and D. E. REUBEN

In a study on the effect of morphactin on castor, it was found that soaking seeds prior to germination in low concentrations of morphactin (1 and 5ppm) promoted stem growth, while soaking in higher concentrations (10, 20, 40 and 60 ppm) tended to inhibit stem growth. Application of the chemical at 60, 120 or 240 ppm at later stages *viz.*, cotyledon to one leaf, five to seven leaf and 10-12 leaf stages resulted in stunted growth and epinasty of the main axis.

Morphactins (chlorflurenols) are known as a novel group of growth regulators (Ziegler, 1970; Bopp, 1972; Schneider, 1972). They inhibit the growth of root and shoot in seedlings of *Avena sativa*, *Lactuca sativa* and *Ricinus communis* (Khan, 1967; Reuben *et al.*, 1978). The present work was undertaken to study the effects of morphactin on the linear extension in *Ricinus communis* when given at four different stages of development.

MATERIAL AND METHODS

For treatment at stage A (prior to germination), seeds were treated in 1, 5, 10, 20, 40 and 60 ppm of morphactin (EMD 7301W) as per the method of Reuben *et al.*, (1979). The treated seeds were sown in pots (25 cm diameter) filled with garden soil, along with the seeds to be treated at stage B (cotyledon to one leaf), stage C (five to seven leaf) and stage D (10-12 leaf). Concentrations above 60ppm at stage A inhibited the growth of the seedlings (Reuben *et al.*, 1978). For treatment at stage 'B', 'C' and 'D' the plants were sprayed with 60, 120

and 240ppm solutions, when they had attained an age of 30, 60 and 90 days respectively. For all treatments Triton AE (0.05%) was used as the wetting agent.

Observations were taken on height and number of nodes in the main axis at 30 days interval from the day of treatment till 180 days after sowing.

RESULTS AND DISCUSSION

Treatments with 20, 40 and 60ppm at stage A damaged the shoot apex in 33.3, 55.5 and 77.7% of the plants, respectively, within 15 days from sowing. Plants treated with 20 and 40ppm showed recovery in another 15 days. A greater delay in recovery was observed with 60ppm.

With an increase in concentration at stage B, C and D the upper part of the stem showed epinasty within 30 days of treatment (Fig 1A). With 240ppm at stage B, 66.6% of the plants succumbed within the next 30 days due to a high degree of epinasty. The remaining plants

1, 2 and 3 Department of Botany Christ Church College Kenpur 208 001, U. P.

recovered from epinasty between 60 and 90 days from treatment.

Treatments at stage A increased the height of the plant (Fig. 2; Table). With 1 and 5 ppm the increase in height and node number was more than in control throughout the period of study (Fig. 2, 3). Treatments of 40 and 60 ppm at stage A inhibited node formation (Fig. 3). With 1 and 5 ppm there was a significant increase in the total height. Only 1 ppm showed significant increase in the total number of nodes as compared to control. With 1 and 5 ppm given at stage A the length of the upper five internodes was not significantly increased. However, the rest of the treatments at this stage caused a reduction in height. Treatments at stage B, C and D markedly inhibited linear expansion (Fig. 2), and node formation (Fig. 3) compared to control (Fig. 1B).

Morphactin at low concentrations markedly promoted stem growth by enhancing internodal elongations in *Luffa acutangula* and *Pisum sativum* (Kohler, 1968; Krishnamoorthy, 1971) as observed in the present study. Tognoni and his co-workers (1967) and Krishnamoorthy (1971) opined that the physiological activity of low concentrations of morphactin resembled to that of gibberellins. Paliwal *et al.* (1975) noted damaged apex in two week old *Brassica* and *Trigonilla* plants treated with morphactin. This could be due to the reduction of endogenous auxin in the meristematic tissue which are the primary sites of interference of morphactin (Haccius, 1969).

Reduction in growth with treatments at the older stages is not only due to an inhibited elongation of the newly formed internodes but also due to a gradual reduction in the number of these internodes. This was substantiated by the work of Schneider (1965) in *Galium aparine*. A reduction/stimulation in the length of the upper five internodes indicates that the test compound mainly affected the newly formed regions.

Lack of auxin transport from one side to the other may have resulted in greater growth on one side as compared to the other in the region showing epinasty (Bopp, 1972). Epinasty may also be due to the inhibition of tension wood formation with morphactin on the upper side of the bent shoot, as noted by Phelps *et al.* (1976) in *Aesculus hippocastanum*.

REFERENCES

- BOPP, M. 1972. On the physiological action of morphactins. Proc. 2nd NATO/Ege, Univ. Proc. Adv. Study Inst., Izmir, 1971. 333-48, Verlag Chemie, Weinheim.
- HACCIUS, B. 1969. Anomalien der Pflanzenbichen Embryogenese nach Einwirkung von 2, 4-D, TIBA und Morphaktinen, ein Vergleich. *Ber. dt. Bot. Ges.* 3: 89-102.
- KHAN, A. A. 1967. Physiology of morphactins. Effect on gravi- and photo-response. *Physiologia Pl.* 20: 306-13.
- KOHLER, D. 1968. Die Wirkung des Morphaktins 2-chlor-9-fluorenol-9-carbonsaure auf des Längenwachstum von Erben im Licht und im Dunkeln. *Planta* 79: 50-57.
- KRISHNAMOORTHY, H. N. 1971. Effect of morphactin on growth and sex expression of *Luffa acutangula*. *Z. pflphysiol.* 65: 88-91.

- PALIWAL, N. B. BARMA and G. S. PALIWAL. 1975. A comparative study of the effect of morphactin and Niagara on the leaf epidermis, *Biologia Pl.* 17: 189-97.
- PHELPS, J. E., E. A. MCGINNES Jr., J. PIENIAZEK, M. SANIEWSKI and M. SMOLINSKI. 1976. A scanning electron microscope study of the structure of normal tension wood and morphactin IT 3456 induced wood in *Aesculus hippocastanum*. *Bul. Acad. Pol. Sci, Ser. Sci. Biol.* 23: 495-97.
- REUBEN, D. E., R. K. NIGAM. and MARY VARKEY. 1979. Influence of morphactin on the emergence of inflorescence in *Ricinus communis* Linn. *J. Indian Bot. Soc.* 58: 381-85.
- REUBEN, D. E., MARY VARKEY and R. K. NIGAM. 1978. Studies on the effects of morphactin and irradiation (gamma rays) on the seedlings of *Ricinus communis* (Linn.). *Phytomorphology* 28: 450-54.
- SCHNEIDER, G. 1965. Zur Wirkung von Morphactinen und Gibberellinsäure auf die sprossentwicklung von Blütenpflanzen. *Ber. dt. Bot. Ges.* 78: 143-44.
- SCHNEIDER, G. 1972. Morphactins and plant growth regulation. H. Kaldewey and Y. Vardar (Eds.). *Hormonal Regulation in Plant Growth and Development. Proc. Adv. Study Inst., Izmir. 1971, PP 317-331.* Verlag Chemie, Weinheim.
- TOGNONI, F., HERTOIGH, A. A. and WITWER, S.H. 1967. The independent action of morphactin and gibberellic acid on higher plants, *Pl Cell Physiol.* 8: 231-39.
- ZEIGLER, H. 1970. Morphactins. *Endeavour* 29: 112-16.

TABLE Effect of morphactin on castor 'D'.

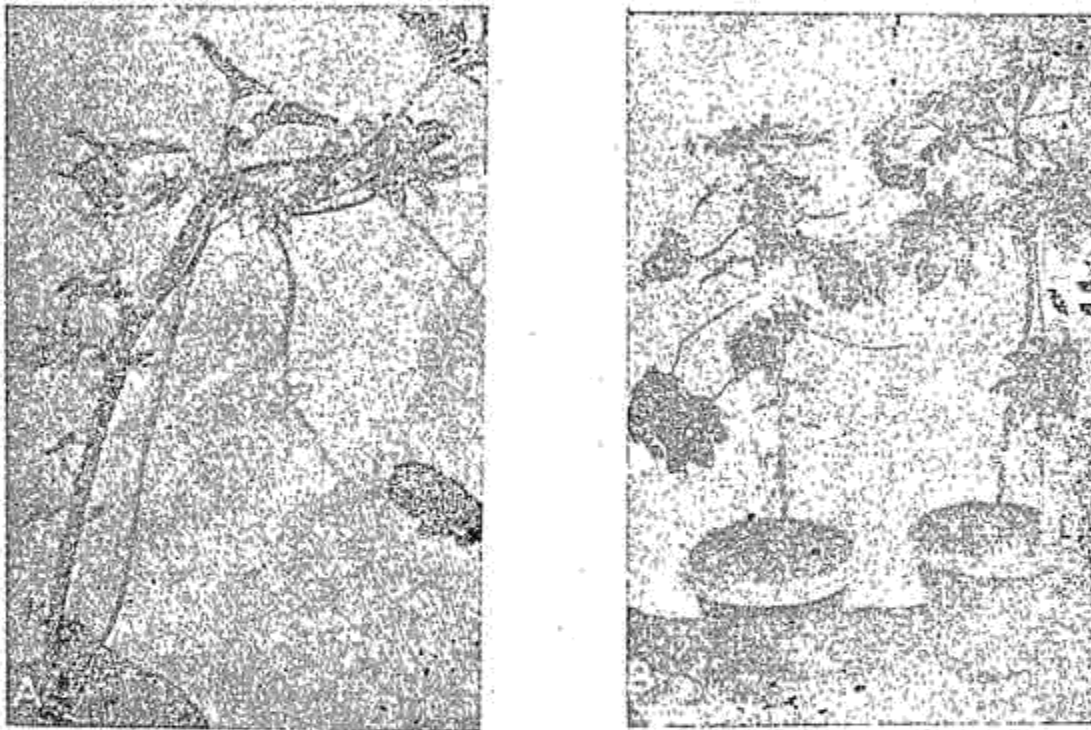
Stage	Treatment		Observations		
	Concentration (ppm)		Height (cm)	Number of nodes	Length of upper five internodes (on 180th day)
A	Control		40.3	20.0	14.1
	1		56.3**	22.0*	16.9
	5		47.7**	21.0	16.2
	10		43.2	19.8	11.9
	20		42.3	18.5	10.8
	40		41.8	18.5	10.5*
	60		41.8	18.0*	10.0*
	B	Control		39.2	20.2
60			32.8**	17.5**	14.0
120			23.9**	17.4**	11.8
240			21.3**	15.5**	9.0*
C	Control		52.6	19.4	14.3
	60		34.4**	18.2	7.2**
	120		33.2**	18.0	4.9**
	240		30.7**	17.2*	3.7**
D	Control		32.3	18.0	14.0
	60		29.8**	16.0*	5.1**
	120		26.3**	15.3*	4.5**
	240		25.8**	15.4*	2.6**
C. D. at 5% level			3.5	1.9	3.5
C. D. at 1% level			4.7	2.6	4.7

Data collected from nine replicates.

+ Data from three replicates as the remaining plants were damaged.

* Significantly different from its control at 5% level.

** Significantly different from its control at 1% level.



Effect of morphactin on epinasty and total height of *Ricinus Communis*

- A. Plant treated with 120 ppm at stage C showing epinasty 80 days after treatment
- B. Reduced total height of plant (180 days after treatment) with 120 ppm at stage D (left) as compared to control (right).

Fig 3

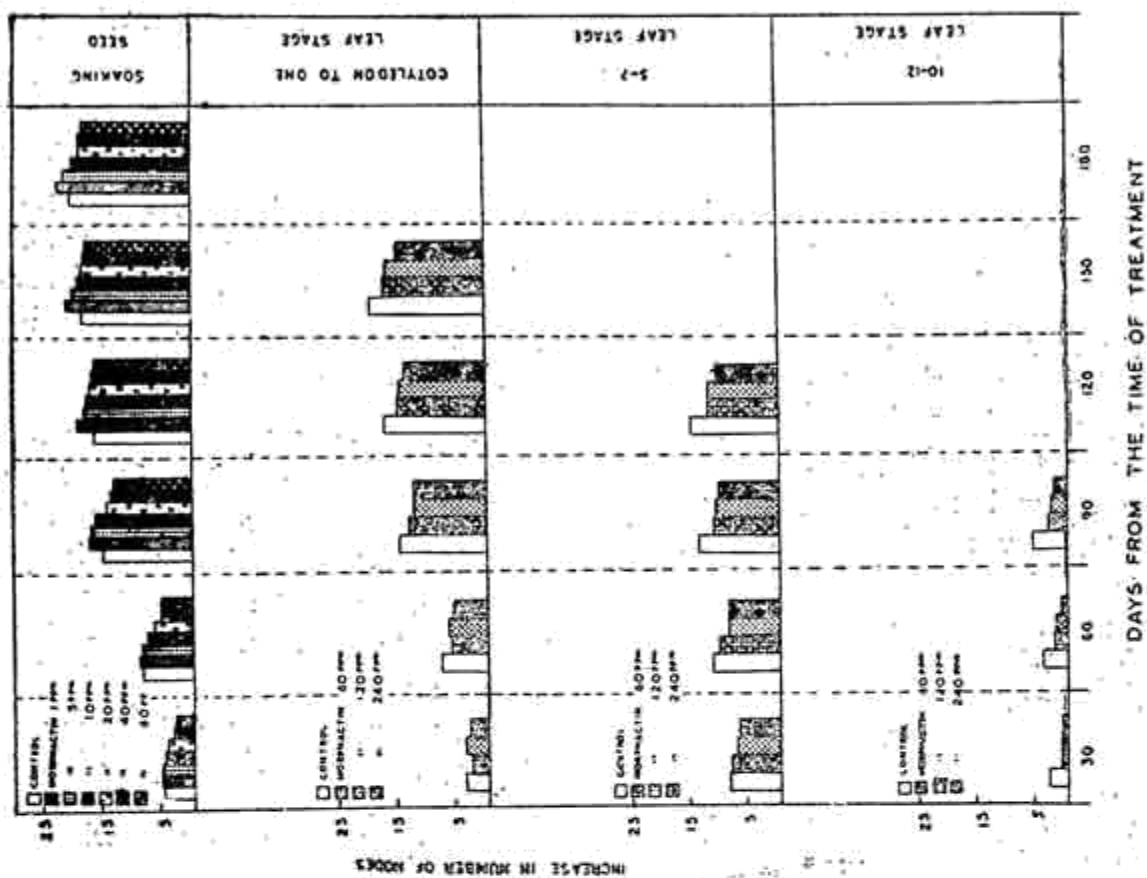
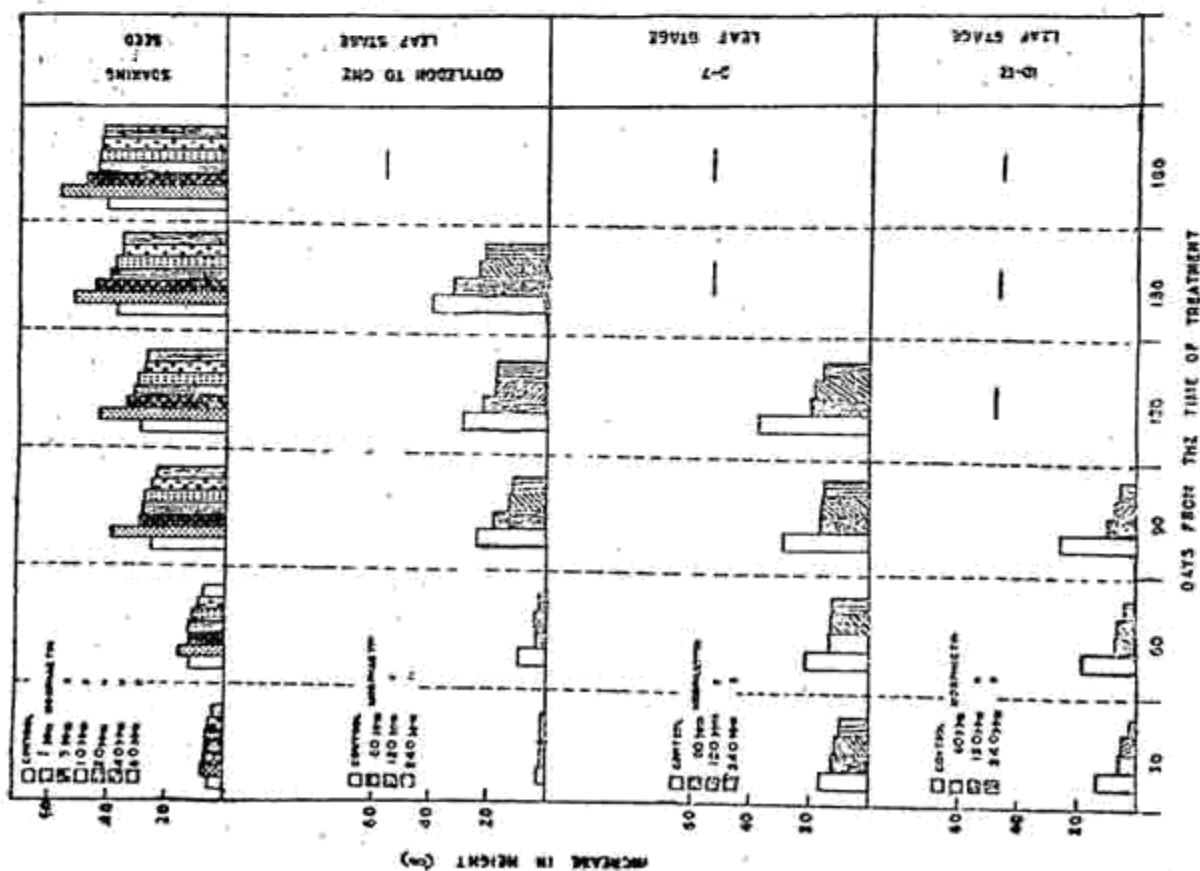


Fig 2



Effect of morphactin on the increase in the number of nodes in *Ricinus communis*

Effect of morphactin on the increase in height of *Ricinus communis*