act on proteins associated with differentiation of floral parts. Chemicals which can totally inhibit flower formation are few[8].

The authors thank Prof. V. S. Rama Das for his constant encouragement and valuable suggestions.

4 June 1988; Revised 1 August 1988

1. Adinarayana, B. and Gopala Rao, P., *International Conference of Plant Physiologists of the SAARC Countries, Gorakhpur*, December 20–23, 1987.
2. Clarkson, D. T. and Hanson, J. B., *Annu. Rev. Plant Physiol.*, 1980, **31**, 239.
3. Key, J. L., *Annu. Rev. Plant Physiol.*, 1969, **20**, 449.
4. Kaul, C. L. and Singh, S. P., *Indian J. Plant Physiol.*, 1967, **10**, 54.
5. Berghoef, J. and Bruinsma, J., *Z. Pflanzenphysiol.*, 1979a, **93**, 303.
6. Koning, R. E., *Am. J. Bot.*, 1984, **71**, 1.
7. Pharis, R. P. and King, R. W., *Annu. Rev. Plant Physiol.*, 1985, **36**, 517.
8. Hess, D., *Plant physiology*, Springer-Verlag, New York, 1975, p. 295.

HUMIC ACID INDUCED REVERSAL OF RETARDING EFFECT OF MORPHACTIN IN *ERUCA VESICARIA* (LINN.) CAV. SUBSP. *SATIVA* (MILL.) THELL

N. R. SINGHVI* and K. D. SHARMA
Department of Botany, Khalsa Postgraduate College, Sri Ganganagar 335 001, India.
**Present address: Central Sericultural Research and Training Institute, Mysore 570 008, India.*

HUMIC acid is a complex material formed in the soil[1]. It acts as potent auxin[2] and enhances seedling growth, chlorophyll biosynthesis[2,3], uptake of nutrients by plants[4], and has been reported to antagonize the effect of growth inhibitors[2–5]. Morphactin, a synthetic growth regulator, affects all phases of plant growth and development biochemically and morphologically[6]. The present study was undertaken to see the effect of morphactin on *Eruca vesicaria* (Linn.) Cav. subsp. *sativa* (Mill.) Thell, and the influence of humic acid *on this* effect.

Seeds of *E. vesicaria* subsp. *sativa* were germinated under continuous light from a single incandescent tubelight at 30 ± 2°C in sterilized petri dishes lined with Whatman No. 1 filter paper moistened with distilled water (control) or different concentrations of test solutions or with a mixture of equal volumes of 100 mg/l humic acid (humic acid sodium salt, Aldrich make) and morphactin solution of 5, 10 or 25 mg/l. The concentration of humic acid used (100 mg/l) was found to be the best for seedling growth and chlorophyll biosynthesis in preliminary trials using concentrations of 25, 50, 100, 200 and 300 mg/l. Three replicates of 20 seeds were used each time and the experiments were repeated five times.

Forty mg of fresh cotyledonary leaves were extracted with 80% acetone and the optical densities of the extract supernatant at 470 nm and 660 nm were determined using a photoelectric colorimeter, for carotenoids and chlorophylls respectively[7].

A concentration-dependent retardation of germination and seedling growth was caused by morphactin treatment (table 1). The usual phenomenon of root coiling disappeared after morphactin treatment. The formation of lateral roots was also inhibited but increase in density of root hairs was observed in treated seedlings. After 36 h of germination, interestingly, radicles of morphactin-treated seedlings became negatively gravitropic while in control roots remained normal. Lower concentration (5 mg/l) of morphactin showed little or no effect on gravitropic response. The levels of chlorophylls and carotenoids were very much reduced by morphactin treatment. Dry weights of seedlings also decreased in the same manner. Humic acid alone promoted linear growth of seedling, formation of carotenoids and chlorophylls and dry matter production. In combination treatments, humic acid showed antagonistic effects on morphactin and nullified the growth-retarding effect of morphactin to some extent.

It may be inferred that morphactin has a novel type of action, mainly straightening the twisting nature of the radicle. This may be due either to abolition of the polarity phenomenon[5,8,9], i.e. polar orientation of cell division, or to interference with metabolism, or to effects on transport and distribution of endogenous phytohormones[5,6]. Morphactin also increased the density of the root hairs, apparently increasing the absorbing surface of roots[5,10].

Table 1 *Effect of morphactin and humic acid alone and in combination on Eruca vesicaria subsp. sativa (72-h-old seedlings)*

Morphactin (mg l)	Humic acid (mg/l)	Germination (%)	Length (mm)		Dry weight (mg)		Optical density		Negative gravitropism (%)	Density of root hairs
			Radicle	Hypocotyl	Radicle	Hypocotyl	470 nm	660 nm		
0	0	98.0 (83.443)	31.2	21.5	8.5	53.8	0.140	0.125	0	+
0	100	98.0 (83.443)	37.4	22.7	9.1	55.6	0.188	0.141	0	+
5	0	92.0 (73.700)	23.7	14.1	7.7	44.2	0.118	0.100	8.0	+ +
5	100	96.0 (78.717)	29.5	19.4	8.3	51.5	0.135	0.120	5.0	+ +
10	0	82.0 (65.037)	14.40	11.0	6.7	38.2	0.107	0.090	20.0	+ + + +
10	100	90.0 (71.700)	24.4	16.9	7.7	46.5	0.126	0.110	17.0	+ +
25	0	68.5 (55.913)	8.8	8.6	5.0	30.3	0.082	0.072	33.0	+ + + +
25	100	83.0 (65.750)	16.3	13.60	6.5	41.4	0.110	0.090	28.0	+ + +
	F	**	**	**	**	**	**	**	**	
	CD at 5%	2.427	1.687	1.079	0.330	1.323	0.0148	0.01412	3.049	

*Angular transformed values in parentheses; **Significant at 1% level of significance, + = Very low, + + = Low, + + + = Moderate, + + + + = High.

Thanks are due to Shri H. K. Chaturvedi for statistical analysis.

4 April 1988; Revised 21 July 1988

1. Ladd, J. N., *Aust. J. Biol. Sci.*, 1964, **17**, 153.
2. Sharma, K. D. and Sen, D. N., *Z. Pflanzenphysiol.*, 1971, **65**, 81.
3. Singhvi, N. R. and Sharma, K. D., *Sci. Cult.*, 1982, **48**, 366.
4. Chaminade, R. and Boucher, I., *C. R. Acad. Agric. Fr.*, 1940, **26**, 66.
5. Sharma, K. D., *Herba Hungarica*, 1982, **21**, 97.
6. Schneider, R., *Annu. Rev. Plant Physiol.*, 1970, **21**, 499.
7. Sahu, J. K., Adhikary, S. P. and Pattnaik, H., *J. Indian Bot. Soc.*, 1979, **58**, 358.
8. Denffer, D. V., Fricke, G. and Ringe, F., *Ber. Dtsh. Bot. Ges.*, 1969, **3**, 61.
9. Zeigler, H., *Endeavour*, 1970, **29**, 112.
10. Lorenzen, H., *Naturwissenschaften*, 1968, **55**, 451.

OUTBREAK OF *SCLEROTINA* WHITE MOULD DISEASE IN INDIA

R. B. SINGH and J. M. AGRAWAT
Agricultural Research Station, (Rajasthan Agriculture University), Borkhera, Kota 324 001, India.

WHILE surveying the potato growing areas in the Kota region of Rajasthan, drooping and stem-breaking of plants were noted on farmers fields during the second week of January 1988. The disease spread so rapid that within a month the crop was fully damaged and dried. White cottony, fungal growth was visible near broken stem ends with black scleotial bodies measuring from 1 to 5 mm diameter on and inside the stem. It caused watery soft rot of the infected parts. Isolations of the fungus on potato dextrose agar slants yielded white cottony mycelium. Sclerotial bodies then formed near the periphery of the medium. The germination of sclerotia was tested as described by Bedi[1] to get apothecia formation. Each sclerotium produced 5 to 7 stipes bearing funnel-shaped, discoid apothecia of different sizes with asci and ascospores. On the basis of cultural characters and apothecial measurement it has been identified as *Sclerotinia sclerotiorum* (Lib.) de Bary. It was found pathogenic on potato.

Joshi[2] reported that *S. sclerotiorum* causes safflower wilt in India and in host range studies found it pathogenic on potato also. There is no other report of this pathogen pertaining to potato in India and thus poses a matter of great concern owing to its soil-borne nature, very wide host range and the nature of causing extensive damage during cool humid weather.

The disease is known as Sclerotinia white mould (Stalk break) and has been reported from various countries[3–8].

This work was conducted under AICRP on Potato Improvement at Kota.

5 August 1988; Revised 27 September 1988

1. Bedi, K. S., *Indian Phytopathol.*, 1956, **9**, 39.
2. Joshi, S. D., *Bot. Ser.*, 1924, **13**, 39.
3. Diaz Polanco, C., Pans De Labrador, N. and Luis Castro, J., *Clarco*, 1976, **6**, 15.
4. Edwin, A. H., *Phytopathology*, 1937, **27**, 100.
5. Franco, R. M., *Agri. Bogota*, 1938, **12**, 344.
6. Jorstad, I., *Report Ministry of Agriculture*, 1922, p. 79.
7. Pethybridge, G. H., Laffexty, H. A. and Rhynehaxt, J. G. J., Dept. of Agric. and Tech. Inst., Ireland, 1922, **22**, 20.
8. Waterston, J. M., *Rep. Bd. Agric. Bermuda*, 1938, p. 24.

FOLIAR APPLICATIONS OF UREA AND ZINC SULPHATE FOR FRUIT DROP CONTROL IN KINNOW MANDARIN

O. P. GUPTA, J. S. JAWANDA and K. R. GUPTA
SK University of Agricultural Sciences and Technology, Regional Horticulture Research Station, Udheywalla, Jammu 180 002, India.

FRUIT drop is a serious problem in citrus particularly in mandarin. It was reported[1] that in a profusely flowered orange tree, approximately 70–80% flowers and fruit-lets drop in early stages and 16–17% fruits drop during premature and pre-harvest stages. The pre-harvest fruit drop is much more alarming with serious economical significance[2]. Fruit drop has been considered to be a complex phenomenon involving the role of nitrogen and auxins[3]. Urea, zinc sulphate and its combination were therefore