Effect of Algal Growth Hormones on the Germination of Paddy Seeds

by

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(with 2 figs.)

INTRODUCTION

HOWARD as early as 1924 emphasized that rice can be grown in India for long periods in the same fields without the addition of manure. The rice fields are water logged for several months during the year and there is a rich growth of algae. Several workers, FRITSCH (1907), HOLSINGER (1935), DE (1939), SINGH (1939, 1959), WATANABE (1951, '56 & '60), ALLEN (1956), PRASAD (1949), DE & SULAIMAN (1950), DE & MANDAL (1956), GUPTA (1957), FOGG (1960) and others have studied the algal flora of the paddy fields in India and abroad. Some of them have worked extensively on the capacity of Myxophyceae to fix atmospheric nitrogen and the beneficial effect on the rice crop and higher yield, it is suggested, is due to the nitrogen fixed by the algae in the fields.

GUPTA (unpublished) while working on the algae of paddy fields observed that *Fischerella mucicola, Scytonema hofmanni* and *Nostoc* sp. accelerate the germination of the seeds. It seems very likely that the beneficial effect of the algae on the rice crop may not be restricted to their capacity to fix atmospheric nitrogen alone, especially in fields where nitrogen fixing algae may not be present in appreciable quantity. In view of the above, investigations have recently been undertaken to study in detail the effect in all aspects of some of the common algae growing in the rice fields at Kanpur. The following is an account of the observations made on the effect of growth hormones of some *Phormidium* spp. on the germination of seeds. *Phormidium* sp. have been selected as they are not known to fix atmospheric nitrogen.

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Material and methods

Three species of *Phormidium*, namely *P. foveolarum*, *P. corium* and *P. autumnale* were selected for this purpose. These were grown from the soil cultures of samples collected from the rice fields but of these only *P. foveolarum* was common in nature. The growth hormones were extracted with water and ether, the latter was also diluted with water. The seeds were soaked in 1, 2 and 10% solutions of the extracts for 24 and 48 hours and were then sown with others as control. The experiments were carried out in triplicate, each pot containing 15 seeds.

Observations

P. foveolarum

It was observed in all cases that seeds treated with 1, 2 and 10% solutions of water extract of the alga germinated earlier than the control seeds e.g., on the 9th day of sowing, there were on an average 4 to 7 seedlings in pots with seeds treated for 24 hours and 5 to 7 in pots with seeds treated for 48 hours. On the contrary, there was only 1 seedling each in the control pots. On the next day the number of seedlings was on an average 8, 7 to 9 and 2 to 3 respectively. The ratio of germination of the treated and control seeds on successive days is shown in Table I and figs. 1 and 2.

There is little difference in the percentage germination of the control seeds and seeds soaked for 24 hours in the extracts although the latter germinated earlier. In the seeds soaked for 48 hours in the extracts there is, however, a slight reduction in the percentage as compared with the control seeds.

The seeds soaked in the water extract germinated earlier than the seeds soaked in the ether extract e.g., on the 8th day of sowing one out of the 15 seeds treated with 1% water extract germinated while none out of the 15 treated with 1% ether extract. On the successive days seeds soaked in 1% water and ether extracts germinated in the ratio of 7 : 1, 8 : 3, 12 : 6, 12 : 8, 13 : 8, 13 : 10 and 15 : 10 respectively. Seeds soaked in 2% and 10% water extract also germinated earlier than the seeds soaked in the ether extracts. Seeds soaked for 48 hours in the water and ether extracts behaved similarly. The ratio of the germination of seeds is shown in Table I.

It was further observed that of the seedlings only those from seeds treated with 1% water extract and soaked for 24 hours showed better growth than the control plants.

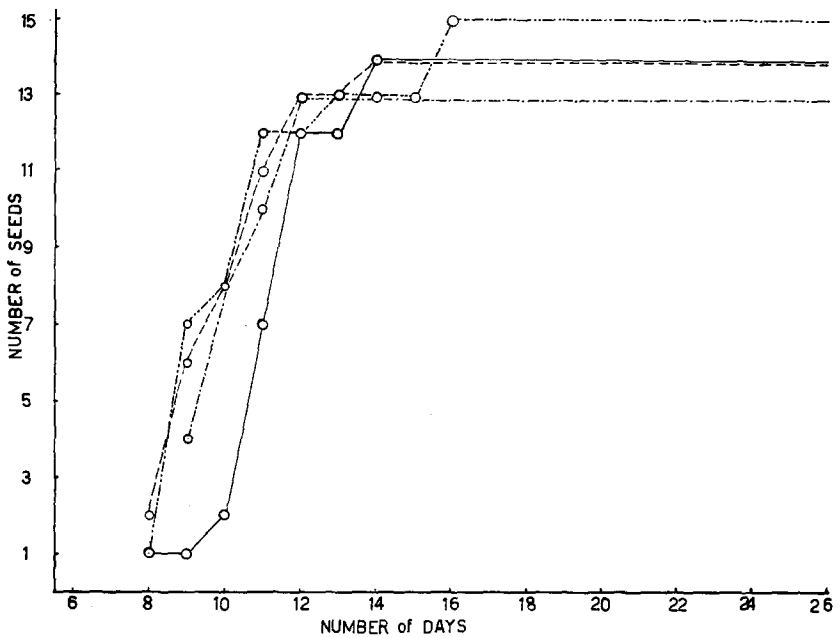

Fig. 1. The germination of control and seeds soaked in water extract of P. foveolarum for 24 hrs.

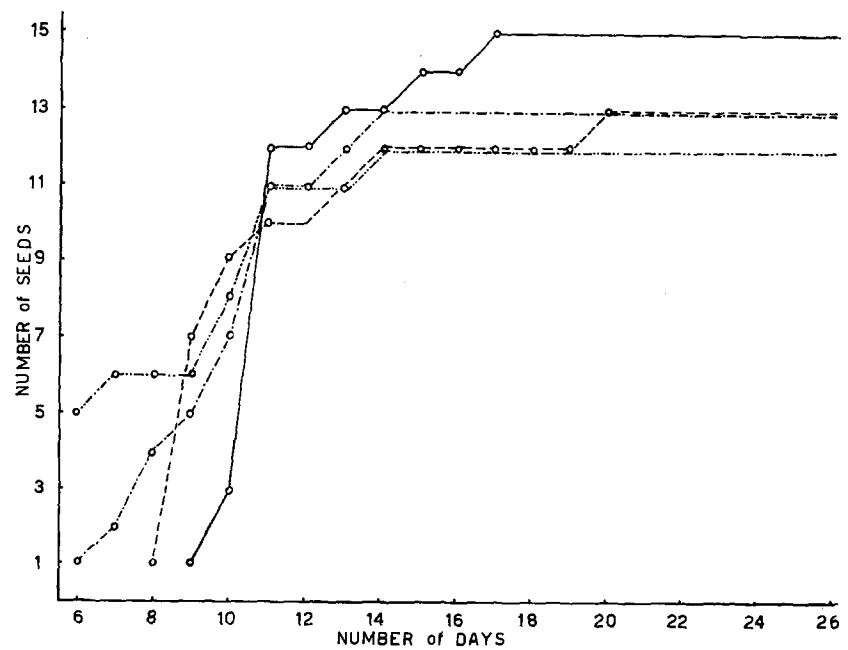

Fig. 2. The germination of control and seeds soaked in water extract of P. fovealarum for 48 hrs.

TABLE I.

The number of control and treated seeds germinated on 6th and subsequent days of sowing. Fifteen seeds were sown in each pot

Days	6th				7th				8th				9th				10th			
Dry seeds	x				x				x				x				2			
Duration of soaking seeds in hours	24′		48′		24′		48′		24′		48′		24′		48′		24′		48′	
Seeds soaked in water	x		x		x		x		1		x		1		1		2		3	
	W	E	W	E	W	E	W	E	W	E	W	E	W	E	W	E	W	E	W	E
Seeds soaked in 1% extract	x	x	5	x	x	x	6	2	1	x	6	2	7	1	6	4	8	3	8	5
Seeds soaked in 2% extract	x	x	1	x	x	x	2	x	x	x	4	1	4	2	5	3	8	6	7	3
Seeds soaked in 10% extract	x	x	x	x	x	x	x	x	2	x	1	1	6	x	7	5	8	3	9	8

Days	11th				12th				13th				14th				15th			
Dry seeds	3				12				12				14				14			
Duration of soaking seeds in hours	24′		48′		24′		48′		24′		48′		24′		48′		24′		48′	
Seeds soaked in water	7		12		12		12		12		13		14		13		14		14	
	W	E	W	E	W	E	W	E	W	E	W	E	W	E	W	E	W	E	W	E
Seeds soaked in 1% extract	12	6	11	8	12	8	11	8	13	8	11	8	13	10	12	9	13	10	12	9
Seeds soaked in 2% extract	10	7	11	4	13	11	11	6	13	11	12	6	13	12	13	7	13	12	13	8
Seeds soaked in 10% extract	11	7	10	9	13	10	10	9	13	11	11	9	14	11	12	11	14	12	12	11

Days	16th				17th				18th				19th				20th			
Dry seeds	14				14				14				14				14			
Duration of soaking seeds in hours	24′		48′		24′		48′		24′		48′		24′		48′		24′		48′	
Seeds soaked in water	14		14		14		15		14		15		14		15		14		15	
	W	E	W	E	W	E	W	E	W	E	W	E	W	E	W	E	W	E	W	E
Seeds soaked in 1% extract	15	10	12	9	15	10	12	10	15	11	12	12	15	11	12	13	15	11	12	13
Seeds soaked in 2% extract	13	14	13	8	13	14	13	9	13	14	13	9	13	14	13	10	13	14	13	11
Seeds soaked in 10% extract	14	12	12	11	14	12	12	12	14	12	12	12	14	14	12	12	14	14	13	12

Days	21st				22nd				23rd				24th				25th				26th			
Dry seeds	14				14				14				14				14				14			
Duration of soaking seeds in hours	24′		48′		24′		48′		24′		48′		24′		48′		24′		48′		24′		48′	
Seeds soaked in water	14		15		14		15		14		15		14		15		14		15		14		15	
	W	E	W	E	W	E	W	E	W	E	W	E	W	E	W	E	W	E	W	E	W	E	W	E
Seeds soaked in 1% extract	15	12	12	13	15	12	12	13	15	12	12	13	15	12	12	13	15	12	12	13	15	13	12	13
Seeds soaked in 2% extract	13	14	13	9	13	14	13	9	13	14	13	10	13	14	13	11	13	14	13	11	13	14	13	11
Seeds soaked in 10% extract	14	14	12	12	14	14	12	12	14	14	13	12	14	14	13	13	14	14	13	13	14	15	13	13

Abbreviations — W — P. foveolarum hormones extracted with water
E — P. foveolarum hormones extracted with ether

P. corium and P. autumnale

In *P. autumnale* the seeds invariably germinated later while in *P. corium* some of them germinated earlier than the control but in both cases the percentage germination was lower and the growth was also inhibited as compared with the control plants. It may be mentioned here that the above species were found to be rare in nature.

Conclusions

The effect of growth hormones obtained from three species of *Phormidium* (*P. foveolarum*, *P. corium* and *P. autumnale*) has been studied on the germination of the paddy seeds. The growth hormones of *P. foveolarum* which is common in the paddy fields in nature accelerates germination and promotes the growth of the seedlings. The beneficial effect however is restricted to low concentration of the hormone and soaking for a short duration only. Prolonged soaking in water extract and soaking in ether extract exercises an injurious effect shown by reduction in percentage germination of seeds. Hormones from *P. corium* and *P. autumnale* on the other hand retard germination and growth of seedlings.

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