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Short Communication

Effect of algalization on seed germination of vegetable crops

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Soaking seeds of cucumber and pumpkin with an extract of *Westiellopsis prolifica*, an N_2-fixing cyanobacterium, promoted germination and their subsequent growth and development. An extract of *Lyngbya* sp., a non-N_2-fixing cyanobacterium, had no significant effect.

Key words: Algalization, cyanobacterium, seed germination, seedling growth, Westiellopsis prolifica.

Algalization can enhance crop yields (Rodgers *et al.* 1979; Singh 1988; Pachpande 1990). Many cyanobacteria can fix nitrogen to ammonia which is then used for amino acid and protein synthesis. We report here that pre-soaking of seeds of pumpkin and cucumber with a cyanobacterial extract can enhance their growth and germination.

Materials and Methods

Cyanobacteria

Westiellopsis prolifica, a nitrogen-fixing cyanobacterium, was maintained on the N_2-free medium of Allen & Arnon (1955), and a non-nitrogen-fixing filamentous cyanobacterium, *Lyngbya* sp., was maintained in Chu-10 medium (see Padhi *et al.* 1986). They were cultivated separately in magnetically stirred, aerated culture flasks. The cultures were harvested and the cells washed with distilled water. Cell extracts were made by grinding the alga in double-distilled water with a glass mortar and pestle. An algal suspension containing 1.0 g fresh algal material in 100 ml of distilled water is referred to as a 1% extract. Different concentrations of algal extracts were made accordingly.

Germination of Seeds

Air-dried seeds of pumpkin and cucumber were soaked in different concentrations of algal extracts for 24 h. The seeds, without any soaking treatment, served as control. Germination was by spreading 20 seeds on filter papers placed in glass petri-dishes containing 5.0 ml of a cell extract. Dishes containing seeds with 5.0 ml of distilled water served as a further control. The experiments were conducted in triplicate. The petri-dishes were placed near the laboratory window at ambient temperature. Only distilled water was periodically added to check any evaporation that occurred from the petri-dishes. A seed showing onset of radicle formation after 10 days was considered to have germinated.

Five healthy seedlings from treated and untreated samples were then grown in pots in triplicate for 40 days. No fertilizer was applied, but treated seeds were sprayed with 200 ml of algal extract (or water for untreated seeds) every fourth day equally on both leaf and soil.

Results

Soaking of seeds with 5% extracts of *W. prolifica* gave higher germination than with *Lyngbya* extracts (Tables 1 and 2). For untreated seeds, germination began after 5 days, whereas germination of treated seeds, treated with either algal extract, began earlier. Spraying with extracts of *W. prolifica* (but not of *Lyngbya* sp.) onto the emerged seedling during their subsequent cultivation led to significant increase in growth and development of both crops (Table 2). Nitrogen contents of both roots and shoots were significantly increased by *W. prolifica* extracts.

Discussion

The algal extracts of *Westiellopsis prolifica*, analysed as by Fogg & Pattanaik (1966), showed that ammonium- and amide-nitrogen accounted for most of the total extracellular combined nitrogen. Among the amides, aspargine and glutamine were detected. The stimulation of germination of both cucumber and pumpkin seeds by extracts of *Westiellopsis prolifica*, but not by extracts of *Lyngbya* which does not fix N_2, would suggest that the supply of nitrogenous nutrients to the seeds is important. It is not yet

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Table 1. Germination (%) of seeds treated with cyanobacterial extracts*.

Seeds	Control (untreated)	*W. prolifica* extract at			*Lyngbya* sp. extract at		
	%	1%	2%	5%	1%	2%	5%
Pumpkin	64 ± 2	80 ± 1	88 ± 2	97 ± 3	64 ± 2	71 ± 2	80 ± 1
Cucumber	53 ± 2	50 ± 2	60 ± 1	90 ± 3	43 ± 2	60 ± 2	70 ± 1

* Mean values for germination % after 10 days.

Table 2. Foliar spraying effect of *Westiellopsis prolifica* and *Lyngbya* sp. on growth of seedlings of pumpkin and cucumber after 40 days growth.

Treatment	Seedlings	Height of plant (cm)	Fresh weight of whole plant (g)	N in roots (% dry wt)	N in shoot + leaves (% dry wt)
Control (water only)	P	80 ± 0.12	31 ± 0.15	1.3	4.75
	C	65 ± 0.33	25 ± 0.33	1.32	3.85
W. prolifica extracts					
1%	P	110 ± 0.14	78.2 ± 0.21	3.25	5.75
	C	80 ± 0.16	50.6 ± 0.32	2.55	4.82
2%	P	125.5 ± 0.15	78.5 ± 0.18	3.50	6.25
	C	85 ± 0.12	52.5 ± 0.32	2.58	5.20
5%	P	150 ± 0.12	80.3 ± 0.15	3.58	6.85
	C	90 ± 0.15	55.8 ± 0.44	2.85	5.25
Lyngbya extracts					
1%	P	81 ± 0.12	38.5 ± 0.15	2.25	4.83
	C	71 ± 0.21	37.5 ± 0.30	1.71	3.62
2%	P	82 ± 0.13	40.1 ± 0.13	2.12	4.72
	C	71.5 ± 0.22	37.8 ± 0.32	1.85	3.81
5%	P	95 ± 0.15	40.5 ± 0.18	2.38	4.75
	C	71.2 ± 0.19	40.5 ± 0.31	1.88	3.85

P = Pumpkin (*Cucurbita pepo*).
C = Cucumber (*Cucumis sativus*).

confirmed which may be the key compound involved in this stimulation, but further work is in progress to address this question.

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