

Table 1 Consumption (C), Growth (P) (J/g prawn) and growth efficiency (K_1 ; %) of control and eyestalk ablated (unilateral) prawn *Macrobrachium nobilii*, for four successive months.

	C	P	K_1
Control	28140 \pm 1020	3000 \pm 205	10.5 \pm 1
Eyestalk-ablated	31620 \pm 1540*	4830 \pm 364*	15.5 \pm 1*

Each value represents the average (\pm S.D.) performance of about 10 animals

* $P < 0.0005$ statistically significant

*M. lanchesteri*⁸, which underwent uni- or bilateral eyestalk ablation, showed no marked variation in the food consumption, while *Palinurus homarus*⁹ (marine form), after bilateral eyestalk ablation, increased the food intake (50 to 97 % more than the control). In the unilaterally destalked *M. nobilii*, growth efficiency showed an increase of 32 % over the control, which in *M. lanchesteri*⁸ was only 17 %.

Our studies on *M. nobilii* bring to light the fact that eyestalk ablated prawn consumes more food than their non-ablated counterparts. This is the first communication, which attributes the faster growth of eyestalk ablated prawns to increased food consumption. Unilateral eyestalk ablation has induced hyperphagia in these prawns. The appetite of these eyestalkless crustaceans may be stimulated by the growth excitatory hormone in *M. nobilii*. Eyestalk extirpation releases the prawn from that regulation thereby increasing the titre of growth excitatory hormone in blood and hence the animal is induced to take more food and grow larger with an enhanced growth efficiency.

It is also worth mentioning that though food intake is 1.1 times higher in the ablated group, growth efficiency is 1.5 times higher and the extra feed-cost due to increased food consumption is compensated or rather profited by the enhanced growth efficiency. Hence eyestalk ablation prevails as a recommendable technique to prawn farming.

Financial assistance from ICAR, New Delhi is gratefully acknowledged.

27 May 1985; Revised 26 August 1985

1. Conte, F. S., In: *Drugs and food from the sea—Myth or reality*, (ed.) P. N. Kaul and Sinderman. Academic Press, New York, 1978.

2. Muthu, M. S. and Laxminarayana, A., *Proc. Symp. Coastal Aquaculture*, 1982, 1, 16.
3. Abramowitz, R. K. and Abramowitz, A. A., *Biol. Bull.*, 1940, 78, 179.
4. Passano, L. M., In: *The physiology of Crustacea*, I, (ed.) T. H. Waterman, Academic Press, New York, p. 473.
5. Mauviot, J. C. and Castell, J. D., *J. Fish. Res. Bd. Can.*, 1976, 33, 1922.
6. Pandian, T. J. and Balasundaram, C., *Int. J. Invertebr. Reprod.*, 1982, 5, 21.
7. Katre, S. and Reddy, S. R., *Aquaculture*, 1977, 11, 247.
8. Ponnuchamy, R., Reddy, S. R. and Shakuntala, K., *Hydrobiologia.*, 1980, 77, 77.
9. Vijayakumaran, M. and Radhakrishnan, E. V., *Indian J. Fish.*, 1984, 31, 148.

EFFECT OF *BACILLUS SUBTILIS* ON THE GROWTH OF VASCULAR WILT FUNGI

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BIOLOGICAL control of plant pathogens, free from hazards, is a difficult but important necessity. Among the various bacterial antagonists tried *Bacillus subtilis* and some species of *Pseudomonas* have been reported to control several plant diseases including plant wilts¹⁻⁸. They are used for soil treatment, seed treatment or as aerial spray. To bring wilt diseases under adequate control, application of biocontrol and development of new techniques are necessary⁹. We have earlier reported the inhibitory effect of two isolates of *B. subtilis* on fungal wilt pathogens viz *Verticillium albo-atrum*, *V. dahliae*, *Fusarium udum* (two isolates), *F. oxysporum* f. sp. *lycopersici*, *F. oxysporum* f. sp. *vasinfectum*, and *Ophiostoma ulmi* (= *Ceratocystis ulmi*)¹⁰. However, a bacterial wilt pathogen *Pseudomonas solanacearum*, was unaffected by *B. subtilis*. The present work investigates the effect of concentrated cell-free culture filtrate of *B. subtilis* on the growth of some vascular wilt fungi.

Fungal wilt pathogens are the same as used earlier and *B. subtilis* is the same as AF₁, the potential antagonist¹⁰.

Table 1 Effect of concentrated cell-free culture filtrate of *B. subtilis* on the radial growth of vascular wilt fungi

Organism	Control	5%			10%			20%			40%		
		2*	5	10	2	5	10	2	5	10	2	5	10
<i>Verticillium albo-atrum</i>	43.2	42.6	22.6	11.9	40.2	10.6	NG**	36.0	NG	NG	30.2	NG	NG
<i>V. dahliae</i>	51.6	49.6	16.2	8.3	47.8	NG	NG	42.3	NG	NG	36.2	NG	NG
<i>Fusarium udum</i> isolate 1	58.4	55.7	32.4	18.6	53.2	26.4	NG	50.4	12.6	NG	45.4	NG	NG
<i>F. udum</i> isolate 2	56.2	53.4	36.2	20.4	49.7	28.8	NG	45.6	18.2	NG	39.2	NG	NG
<i>F. oxysporum</i> f. sp. <i>lycopersici</i>	51.8	48.4	24.2	19.7	45.5	18.6	NG	42.8	11.8	NG	37.6	7.0	NG
<i>F. oxysporum</i> f. sp. <i>vasinfectum</i>	53.2	51.3	28.4	12.2	48.6	11.4	NG	44.5	8.3	NG	40.6	NG	NG

* Values in this row indicate the concentration folds; ** NG = No growth

B. subtilis was grown in 1 lit flasks containing 500 ml of potato dextrose broth and incubated on a reciprocating shaker (80 rev/min) at $28 \pm 2^\circ\text{C}$ for 72 hr. Cultures were centrifuged at 15000 rpm for 15 min. The supernatant was concentrated to 2-, 5-, and 10-fold by reducing the volume in a rotary vacuum flash evaporator and passed through millipore filters (0.45 μm). The pH was adjusted to a desirable value (original pH was 5.5, 5.2 and 4.8 for 2-, 5- and 10-fold concentrated extracts, respectively). Each extract was diluted to indicate 5%, 10%, 20% and 40% in PDA. Plates without added extracts served as control. Petriplates were inoculated with actively growing test fungal cultures (5 mm plug) and incubated at appropriate temperatures of growth. The fungal growth was measured in terms of colony diameter after 7 days of inoculation. Each experiment was run in duplicate.

It was observed (table 1) that the 10-fold concentrated extract inhibited the growth of all the test fungi at $> 10\%$ concentration. With the exception of *F. oxysporum* f. sp. *lycopersici* no test fungus could grow in 5-fold concentrated extract at 40% concentration. There was some level of inhibition in all the cases, which increased with increase in percent concentration as well as the original concentration of the extract.

It is evident that the organism (*B. subtilis*, AF₁) produced some extracellular antibiotics, diffusible in solid agar which could inhibit the growth of test fungal wilt pathogens. Since the initial inoculum of wilt fungi appears from the debris of diseased plants and from the residual inoculum which remains viable in the soil for long periods, stable amendment of wilt sick soils with *B. subtilis* may provide a biological control for fungal wilt diseases. This could be an ideal alternative to reduce the initial inoculum in the soil.

ARP thanks UGC for the award of a research fellowship.

22 July 1985

1. Utkhede, R. S., *Can. J. Bot.*, 1984, **62**, 1032.
2. Utkhede, R. S. and Rahe, J. E., *Phytopathology*, 1983, **73**, 890.
3. Baker, C. J., Stavely, J. R., Thomas, C. A., Sasser, M. and Mac Fall, J. S., *Phytopathology*, 1983, **73**, 1148.
4. Turchetti, T., *Eur. J. For. Pathol.*, 1982, **12**, 36.
5. Singh, N. and Singh, R. S., *Indian Phytopath.*, 1980, **33**, 356.
6. Singh, V. and Deverall, B. J., *Trans. Br. Mycol. Soc.*, 1984, **83**, 487.
7. Scheffer, R. J., *Ann. App. Biol.*, 1983, **103**, 21.
8. Myers, D. F. and Strobel, G. A., *Trans. Br. Mycol. Soc.*, 1983, **80**, 389.
9. Baker, K. F., In: *Fungal Wilt Diseases of Plants*, 1981, Academic Press, New York, 523.
10. Podile, A. R., Prasad, G. S. and Dube, H. C., *Curr. Sci.*, 1985, **54**, 684.

SELF-SOWN PLANTS FROM BACTERIAL BLIGHT-INFECTED RICE SEEDS—A POSSIBLE SOURCE OF PRIMARY INFECTION IN NORTH-WEST INDIA

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THE reports of bacterial blight-infected seeds as the source of perpetuation of the disease in north-west India mainly referred to the seed-lots stored and used for raising rice nurseries¹⁻⁴. As information on the feasibility of survival of inoculum in seeds, lying in