J. Phytol. Res. 2 (1), 1989

EFFECT OF DIFFERENT SALTS ON THE NODULATION OF *VIGNA RADIATA* (L.) WILCZECK.

S. P. AWASTHI
Department of Botany, Govt. College, Dholpur-328001, India.

The effect of different salts was studied on the nodulation of *Vigna radiata* (L.) Wilczeck. Only 0.05% of sulphates ($MgSO_4$, Na_2SO_4 and K_2SO_4) were favourable for the symbiotic effectiveness. Higher percentage of these sulphates were unfavourable and the nodulation was caused only up to 0.3% concentration. All the chlorides were unfavourable to the plant even at 0.05%. The nodulation was caused only upto 0.2% of chlorides. Sodium carbonate and bicarbornate were very toxic to the plants. The nodulation was caused only up to 0.1% of carbonates.

Keywords : *Vigna radiata*, Nodulation, Symbiotic effect.

High concentration of salts affects the nodulation. Subba Rao *et al.* (1972), Singh *et al.* (1973, 1982) have studied the effect of different salts on the nodulation of *Medicago sativa* L. In the present investigation effects of NaCl, KCl, $MgCl_2$, Na_2SO_4, K_2SO_4, $MgSO_4$, Na_2CO_3 and $NaHCO_3$ have been studied on the nodulation of *Vigna radiata* (L.) Wilczeck.

The test tube method of Vincent (1970) was employed in this experiment. The agar medium of Thornton (1930) supplemented with different concentration of salts (0.05-0.5% chlorides and sulphates of sodium, potassium and magnesium and 0.02-0.3% sodium carbonate and bicarbonate) were used separately. The pH of the medium was adjusted to 7.0 before the addition of salts. The tubes were placed in culture chamber and given a photoperiod of 14 hr of 1800 lux at 28°C. The experiment was conducted for 30 days. During the experimental period the seedlings growing in test tubes were inspected daily to determine the appearance of first nodule. The seedlings were harvested at the end of experimental period and examined.

The effect of different salts was studied on the symbiotic effectiveness of the host (*Vigna radiata*) and *Rhizobium*. High percentage of salts did not favour the plant grwoth, nodulation and nitrogen content of the plant. It was more unfavourable to the host than to *Rhizobium*. Hence, in symbiotic effectiveness the host plant was a limiting factor.

The total number of nodules and total nitrogen content of plant was

Table 1. Effect of sulphates and chlorides of Mg, Na and K on nodulation and nitrogen contents of *Vigna radiata* (Values are mean ±S.D. for five replicates)

Salt Used		Salt Concentration (%)						
		Control	0.05	0.1	0.2	0.3	0.4	0 5
$MgSO_4$	Total No. of nodules	8.41 ±0.96	8 75 ±0.89	8.00 ±0.73	6.09 ±0.54	2.78 ±0.64	—	—
	Total N_2 Contents of the Plant (%)	3.43	3.57	2.97	2.66	2.43	2.30	2.24
N_2SO_4	Total No. of nodules	8 05 ±1.12	8.30 ±0.97	8.54 ±0.83	5.55 ±0.93	4.19 ±0.67	—	—
	Total N_2 Contents of the Plant (%)	3.21	3 22	2 97	2 73	2.23	2.01	1.43
K_2SO_4	Total No. of nodules	9.10 ±1.22	9.29 ±1.06	6.51 ±0.97	4.56 ±0.63	4.46 ±0.72	—	—
	Total N_2 Contents of the Plant (%)	3.67	3.73	3.21	2.97	2.54	2.34	2.12
$Mg\ Cl_2$	Total No. of nodules	9.72 ±1.43	8.58 ±0.87	5.64 ±0.93	2.93 ±0.54	—	—	—
	Total N_2 Contents of the Plant (%)	3.58	3 14	2 87	2.75	2.54	2.48	2.29

(Contd. on page 111)

(*Contd.*)

NaCl	Total No. of nodules	9.15 ±0.93	5.77 ±0.47	5.12 ±0.37	2.37 ±0.43	—	—	—
	Total N_2 Contents of the Plant (%)	3.57	3.07	2.94	2.88	2.64	2.54	2.33
KCl	Total No. of nodules	9 44 ±1.02	7.38 ±0.97	5.74 ±0.83	4.17 ±0.87	—	—	—
	Total N_2 Contents of the Plant (%)	3.63	3.20	3.05	2.97	2.14	2.02	1.97

Table 2. Effect of sodium carbonate and sodium bicarbonate on nodulation and nitrogen content of *Vigna radiata* (Values are mean ±S.D. for five replicates)

Salt Used		Salt Concentration (%)					
		Control	0.02	0.05	0.1	0.2	0.3
Na_2CO_3	Total No. of nodules	6 56 ±0.57	4.97 ±0.33	3.63 ±0 47	2.06 ±0.22	—	—
	Total N_2 Contents of the Plant (%)	3.42	3.37	2.25	2.21	2.02	—
$NaHCO_3$	Total No. of Nodules	6.85 ±0.76	5.80 ±0.47	4.06 ±0.53	2.66 ±0.73	—	—
	Total N_2 Contents of the Plant (%)	3.43	3.21	2.97	2.54	2.43	—

maximum at 0.05% of sulphates of magnesium, sodium and potassium in comparison to those of the control. However, both the parameters decreased with the increase of suplhates; nodulation was caused only upto 0.3% (Table 1). Initiation of first nodule was not affected at 0.05% of $MgSO_4$ and K_2SO_4 but it was delayed by one day at 0.05% Na_2SO_4 and was adversely affected at higher percentage of sulphates.

All the chlorides were unfavourable to the plant even at 0.05%. Total number of effective nodules and percentage of nitrogen content of the plant decreased with the increase of chlorides (Table 1). The initiation of first nodule was delayed. The nodulation was caused up to 0.2% chlorides. Similarly, in lucerne (*Medicago sativa*) a progressive delay in the initiation of nodules and reduction in number of nodules with increasing percentage of chlorides were also reported (Subba Rao *et al.*, 1972; Singh *et al.*, 1982). However, these salts were more unfavourable to *Vigna radiata* as seen in present investigation than in *Medicago sativa*. The nodule initiation was delayed by two days at 0.05% $MgCl_2$ and KCl and by one day at 0.5% NaCl in comparison with control. A successful nodulation in *Medicago sativa* was reported upto 0.75% to 1.0% of NaCl, KCl and $MgCl_2$ (Subba Rao *et al.*, 1972; Singh *et al*, 1982). However, in present investigation the nodulation in *Vigna radiata* was checked beyond 0.2% chlorides of Na, K and Mg.

Sodium carbonate and bicarbonate were more toxic to the plant than sulphate and chlorides of Na, K and Mg. Singh *et al.* (1973) reported that seedling growth of *Medicago sativa* were inhibited at 0.4% and 0.5% carbonate and bicarbonate, respectively. However, in the present investigation seedlings of *Vigna radiata* died at 0.3% of sodium carbonate and bicarbonate (Table 2). The initiation of first nodule was delayed by two days in both carbonate and bicarbonate and nodulation was caused only upto 0.1%. Stunted root system and lean and thin shoots were observed with the increase of salt contents in the medium.

Author is grateful to Prof. H.S. Narayana, Department of Botany, University of Rajasthan, Jaipur for valuable suggestions and guidance.

Accepted March, 1989

References

Singh C S, Lakshmi Kumari M, Biswas A and Subba Rao N S 1973, *Indian J Microbiol.* **13** 125

Singh C S, Lakshmi Kumari M, Biswas A and Subba Rao N S 1982, *Proc. Indian Acad. Sci.* **76** 90

Subba Rao N S, Lakshmi Kumari M, Singh C S and Manju SP 1972, *Indian J Agric. Sci.* **42** 384

Thornton H G 1930, *Ann. Bot.* **44** 385

Vincent J M 1970, Mannual for the practical study of root nodule bacteria, Blackwell Scientific Publications, Oxford.