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Studies on Germination and Emergence of *Rumex maritimus*

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Rumex maritimus (Jangli Palak) is seen to be dominating the weed flora in wheat fields in Haryana where there has been a shift in herbicide usage from isoproturon to acetolactate synthetase (ALS) and acetyl coenzyme carboxylase (ACCase) inhibitors. The weed belongs to the family Polygonaceae of the class Dicotyledoneae amongst Angiosperms. The weed can be seen growing wild on the banks of ponds and ditches. In cropped areas, it gains height more than the wheat plant. It produces numerous flowers in panicled racemes. The flowers are small and possess a single whorl of perianth characteristic of the sub-class Monochlamydeae. The flowers set fruits which are single seeded nuts enclosed within inner perianth that become enlarged and winged with toothed margins. Seed dormancy, soil moisture, temperature and light all influence the weed seed germination and establishment. Weed emergence may also be affected by soil depths. An understanding of the factors that lead to the germination and emergence of this weed would be useful in predicting its potential spread into new areas.

Rumex maritimus seeds were collected in the month of April in 2002 and 2003 from farms of Haryana Agricultural University Regional Research Station, Uchani, Karnal and stored in glass bottles at room temperature. For germination studies, these were used 20-30 days after harvest. For studies on growth parameters these were sown in the month of November, six months after harvest.

Twenty-five seeds were placed on Whatman filter paper No. 1 in plastic petridishes (9 cm dia). The filter paper was moistened with distilled water or test solution. Germination was determined by visible radicle protrusion. Germination was studied in growth chambers under constant temperatures (10-25°C) in diffused light. To assess dormancy period, seeds were subjected to a germination test at 15-20°C one month after harvest. To assess the effect of darkness a set of petridishes was put in cardboard boxes in the growth chambers. Seeds with as well as without the perianth were used in the study.

To study the effect of osmotic stress, aqueous solutions with osmotic potential of 0, -0.02, -0.05, -0.2, -0.4 mPa were prepared by dissolving appropriate amounts of polyethylene glycol (PEG, 8000) in deionized water (Burlyn and Kaufmann, 1973). Sodium chloride solutions of 0, 40, 80, 120 and 160 mM were prepared to study the influence of salt stress. Germination was tested at 15±2°C. To study emergence, 10 seeds were planted in soil in 5 cm dia x 10 cm deep plastic cones at depths of 0, 2, 4 and 6 cm. Soil used was sandy loam soil. Plants were watered as needed to maintain adequate soil moisture. Emergence was defined as the appearance of two cotyledons. To study the morphological parameters, 20 plants of the weed species were selected randomly from the crop fields. Plant height, number of branches (primary and secondary), number of inflorescences and the number of fruits per plant were counted. One hundred fruits were opened for estimating the number of seeds per fruit. The number of seeds produced per plant was counted. Number of seeds m^{-2} was calculated by multiplying with the mean infestation m^{-2}. One hundred seeds in five replicates were weighed to determine the 100-seed weight. Percentages have been arcsine transformed. Regression analysis was performed on data for salt stress. Standard errors were calculated for the rest of the data.

The weed seeds germinated when tested at 10-15°C one month after harvest. Seed germination was 50-60% without perianth within 12-15 days. Those with perianth showed only 17-21% germination after 30 days. The germination percentage decreased with increase in temperature with no germination at 25°C

Table 1. Germination of *Rumex maritimus* seeds at varying temperatures

Temperature	Light condition	Perianth	Germination (%)
10°C	Light	+	20 (12)
	Dark	+	19 (11)
	Light	–	50 (59)
	Dark	–	29 (24)
15°C	Light	+	17 (9)
	Dark	+	21 (13)
	Light	–	50 (60)
	Dark	–	47 (55)
20°C	Light	+	0
	Dark	+	0
	Light	–	9 (3)
	Dark	–	9 (3)
25°C	Light	+	0
	Dark	+	0
	Light	–	0
	Dark	–	0

Original values in parentheses transformed to arcsine.

(Table 1). This is indicative of the fact that temperature for optimum germination of the weed is 15°C and the presence of fruit wall or perianth around the seed acts as a strong barrier to germination. Light did not affect germination.

Emergence of seedlings decreased rapidly with increasing planting depths. Seedling emergence from seeds without perianth from a depth of 2 cm within 30 days was 35%. This percentage declined to 8% when the seeds were placed at a depth of 4 cm. Emergence of seedlings from seeds with perianth was delayed by 90 days. The percentage emergence from a depth of 2 cm was 50% lesser (Table 2).

Germination of Rumex seeds was totally inhibited at osmotic stress higher than 0.5 mPa which indicates the sensitivity of the seeds to low water potential (Fig. 1). Germination was inversely related to NaCl concentration (Fig. 2). It was 60% at less than 40 mM NaCl and was lowest at 160 mM NaCl. This indicates that even at higher soil salinity the seeds may germinate.

Table 2. Effect of seedling depth on emergence (%) of *Rumex maritimus*

Depth of sowing (cm)	Perianth	Per cent emergence			
		Days after sowing			
		30	60	90	120
2	+	0	0	0	16 (8)
	–	34 (32)	34 (32)	36 (36)	39 (40)
4	+	0	0	0	16 (8)
	–	8 (2)	8 (2)	8 (2)	14 (6)

Original values in parentheses transformed to arcsine.
DAS–Days after sowing.

The mature plants in the fields attain a height of 160±20 cm. The average number of primary and secondary branches ranged between 10-12. The number of fruits per plant was 16000. Since the fruits have only one seed the number of seeds per plant remains the same as the number of fruits. In cropped areas where no herbicides are used the infestation level may vary from 8-20 plants m^{-2}. Seed rain m^{-2} may be as high as 3,20,000.

The data suggest that with such high seed rain and no seed dormancy, the weed invasion would be high under moist and even slightly saline soils. The seeds lying at a depth and with their seed coat intact may not germinate, but those lying on the surface and without the fruit wall possess a fairly good chance of establishment in newer areas.

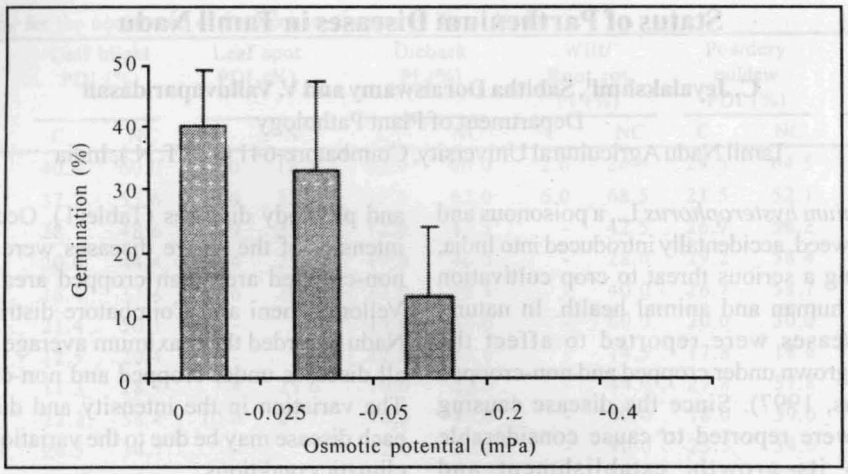

Fig. 1. Effect of osmotic potential on germination of *Rumex maritimum* seeds without perianth at 15±2°C.

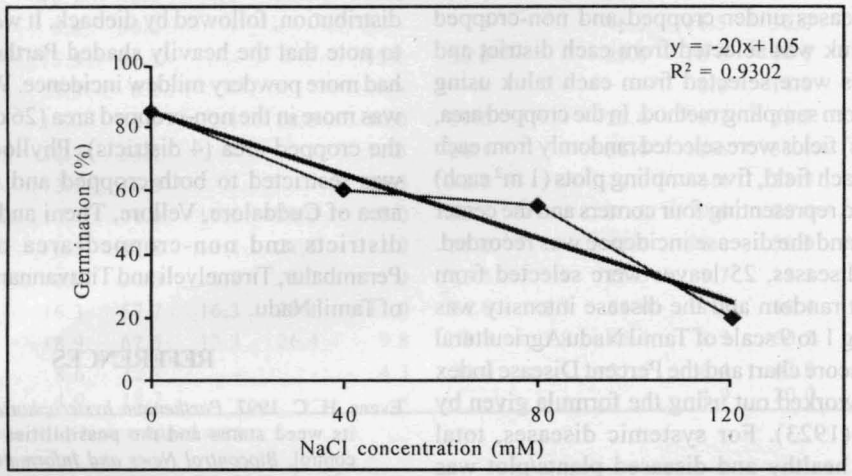

Fig. 2. Effect of NaCl concentration on germination of *Rumex maritimum* seeds without perianth at 15±2°C.

REFERENCE

Burlyn, E. M. and M. R. Kaufmann, 1973. The osmotic potential of polyethylene glycol, 6000. *Plant Physiol.* **51** : 914-916.