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Studies on the Germination and Viability of *Parthenium hysterophorus* L. in its Compost

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Parthenium hysterophorus is a fast spreading obnoxious weed all around the world. The weed left as such in soil of the area acts as a seed bank due to its higher seed production capacity and extended dormancy period. Composting of *Parthenium* is recommended as the seeds deprive their viability due to the generation of high heat during composting (Ramamoorthy *et al*., 2003). However, insufficient temperature in compost piles is unable to complete destruction of the weed seeds viability to check the germination of seeds in its compost (Laxmi and Gupta, 2008). In an experiment with wheat, authors have also observed the growth of *Parthenium* plants in pots which have received self prepared *Parthenium* compost where temperature during active composting stage was 55 ^{o}C. Aim of the present investigation was to know the probable reason for the germination of *Parthenium* seeds in its compost and find out the suitable way of its utilization so that its hazards could be minimized.

Seeds along with their white scale were taken out from mature and semi-mature flowers of *P. hysterophorus* and heat shocked in an incubator at the temperature of 40, 45, 50, 55, 60 and 65^{o}C ± 1 for 72 h. Winged black seeds from heat shocked seeds were carefully taken out from their scale with the help of needles and used to test their per cent viability *in vitro* and germination *in vivo* as well as *in vitro* conditions taking 20 randomly selected seeds in completely randomized design (CRD) with three replications.

For *in vitro* study of seed viability, seeds were soaked in water, cut half by blade and placed them in a sterilized petri dish with filter paper soaked in sufficient amount of 1% 2,3,5 Triphenyl tetrazolium chloride (TTC) solution and incubated at 25 ^{o}C in dark. After 24 h, seed pieces showing positive dehydrogenase and those have turned to red were counted and their half count was taken for calculating the percentage of viable seeds. For *in vitro* germination study, seeds were placed between two layers of filter paper in sterilized petri dishes with absorbent cotton -filter paper pads. The paper was kept moist by adding 10 ml of sterilized water and kept in growth chamber at 24.5±0.5^{o}C with 60% humidity. After nine days, normal seedlings were counted. A seedling with well developed radical and an intact plumule was considered as normal seedling. For *in vivo* germination study, seeds were sown in *Parthenium* free permanent earthen pots filled with soil and FYM separately in multi locations. Sufficient moisture was maintained regularly till 50 days of sowing. Growing plants were considered as took birth from germination of heat shocked seeds. Seeds immediately separated from fresh lot of heat unshocked mature flowers were taken randomly as control for *in vitro* and *in vivo* studies.

Heat shocked seeds in *Parthenium* free permanent soil as well as FYM pots showed restraint germination of *Parthenium* in multi locations till four weeks of sowing. This indicates that *Parthenium* seeds have heat acclimation potential to save their viability against heat shock. White thin scale which envelops the *Parthenium* seed probably acts as semi-insulator may protect the seed viability against the heat shock. Further, germination of heat shocked *Parthenium* seeds may be due to synthesis of heat shock proteins (HSPs) which have been implicated in improved thermal tolerance in seeds by stabilizing other proteins which easily get denatured by heat (Lin *et al*., 1984; Vierling, 1991). Seeds separated from fresh unheated flowers showed zero per cent of germination though they had an average of 80% viability of seed *in vitro* (Table 1). This indicates that *Parthenium* seeds may have embryo dormancy which probably is broken down by high temperature. Though, it has been reported that seeds of *Parthenium* don't have dormancy period and are capable to germinate any time when moisture is available (Sankaran, 2007). Furthermore, heat unshocked seeds germinated in pots due to radiant heat (>25 ^{o}C) for a longer period. However, all viable seeds could not show normal germination.

In soil, heat shocked seeds showed germination upto 55^{0}C. Greater germination percentage was recorded in organic medium than soil medium. This indicates that

Table 1. Effect of heat shocking on germination and viability of *Parthenium hysterophorus* seeds

Heat shock (Temp. °C)	Germination *in vivo* (%)		Germination *in vitro* (%)	Viability *in vitro* (%)
	Soil pots	Manure pots		
40	50	60	60	60
45	35	40	40	45
50	25	30	30	40
55	10	15	15	25
60	0	10	10	15
65	0	0	0	0
Control (No heat shock)	70	80	0	80
LSD (P= 0.05)	4.2	4.9	3.3	3.6

soil containing high amount of organic matter is conducive to the germination of *Parthenium* seeds. Temperature of heat shocking adversely influenced the viability and germination of *Parthenium* seeds both *in vivo* and *in vitro* conditions and significantly decreased with increase in temperature of heat shocking.

Heat shocking of seeds beyond 55^0C showed no germination in soil, while 10% germination was recorded in manure pots. Further, heat shocking at 65^0C completely destroyed the viability of *Parthenium* seeds as no germination was observed *in vitro* as well *in vivo*. This reveals that temperature prevailing below 60^0C at active composting stage would be unable to destroy the 100% viability of *Parthenium* seeds. Hence, application of such compost certainly is able to birth the new *Parthenium* plants to next generation.

During active stage of composting, temperature of 60-65^0C for three days is desirable to complete destruction of the viability of *Parthenium* seeds failing will not serve the purpose. Vegetative generation of *Parthenium* occurs from the root crown of the plant. Therefore, cutting of either flowered or unflowered *Parthenium* for composting would not be a solution to reduce its hazards. Henceforth, to check the vegetative propagation as well as seed multiplication, composting of uprooted *Parthenium* prior to flowering would be an effective measure.

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