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Change in seed index of fresh and infested *Jatropha* seeds

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ABSTRACT

Jatropha curcas L. has been considered a potential source of seed oil for the production of biofuel. The aim of this study was to estimate the seed index of *Jatropha* seeds after deterioration under storage condition. For estimation of seed index fresh, stored as well as infested *Jatropha* seeds were used. Seeds were infested with six dominant fungi *viz. Alternaria alternata, Aspergillus flavus, Aspergillus fumigatus, Aspergillus niger, Fusarium chlamydosporum* and *Penicillium glabrum* separately and weight of 100 seeds (fresh and infested both) were determined during different period of storage. The seed index (100 seeds) of *Jatropha* seeds was declined from 3 months to 12 months of storage and also due to fungal infestation. *Alternaria alternata* infested *Jatropha* seeds were deteriorated much faster than other dominant seed mycoflora infested seeds.

KEY WORDS:

Physic nut, seed mycoflora, deterioration, seed index

INTRODUCTION

Jatropha curcas L. is a small tree that grows originally in areas near the equator. The oil plant *Jatropha curcas* L., a multipurpose drought resistant, perennial plant belonging to Euphorbiaceae family (Gubitz *et al*., 1999). For the production of plant oils (bio-diesel), *Jatropha curcas* is one species that has received much attention recently (Achten *et al*., 2007; Fairless, 2007).

The seeds of physic nut are a good source of oil, which can be used as a diesel substitute (Kumar and Sharma, 2008; Srivastava *et al*., 2011). Depending on the variety, the decorticated seeds contain 40-60% of oil (Liberalino *et al*., 1988; Gandhi *et al*, 1995; Sharma *et al*., 1997; Wink *et al*., 1997; Makkar *et al*., 1997; Openshaw, 2000) which is used for many purposes such as lighting, as a lubricant, for making soap (Rivera-Lorca and Ku-Vera, 1997) and most importantly as bio-diesel. The seeds can be burned directly, without extracting the oil, to provide an alternative to kerosene lamps (Slavin, 2008). Seed yield usually ranges from 1–5 t ha^{-1} (Heller, 1996; Jongschaap *et al*., 2007; Abou Kheira and Atta, 2008). About 30 % of the seed weight is pure plant oil (Jongschaap *et al*., 2007). Mycorrhiza (a symbiotic association between a fungus and the roots of a plant) can increase the biomass and seed production with 30 % after seven months (Achten *et al*., 2008). Singh *et al*., 2008 noted, if a holistic approach is taken to utilize *Jatropha* fruit, it will give three times the energy of bio-diesel alone.

The physical characteristics of *J. curcas* seeds vary depending on their geographical origin. Generally, seed weight varies from 0.4 to 0.7 g and seed dimensions vary with length and width from 15-17 mm and 7- 10 mm, respectively (Martinez-Herrera *et al*., 2006). Singh, 1990 observed that high humidity and poor storage practices provided congenial environment for microbial attack; the dominant species being *Aspergillus* spp. and *Penicillium* spp.

The objective of the present study is to quantify the seed index of *Jatropha* seeds after fungal infestation during storage by comparing with the seed index from fresh *Jatropha* seeds.

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MATERIALS AND METHODS

The experiment was conducted in the laboratory of Department of Mycology and Plant Pathology, Institute of Agricultural Sciences, Banaras Hindu University, Varanasi from October, 2010 to September, 2011.

Estimation of Seed Index

Six dominant fungi *viz. Alternaria alternata, Aspergillus flavus, Aspergillus fumigatus, Aspergillus niger, Fusarium chlamydosporum* and *Penicillium glabrum* were selected after isolation for further studies. The seeds were infested with above dominant fungi. Weight of 100 seeds (fresh and infested both) were determined during different period of storage *i.e.,* after 3 months, 6 months, 9 months and 12 months as per ISTA (Anonymous, 1976). In case of bold seeds like maize we should take the seed index *i.e.,* weight of 100 seeds (Katayayan, 2004).

Statistical Analysis

Mean value with standard error was calculated to check the variation of isolated seed mycoflora from seeds and kernels of *Jatropha curcas* L. by agar plate method and blotter method under sterilized and unsterilized conditions, seed index, germination and moisture content during one year of storage. The term 'Standard Error' of any estimate is used for a measure of the average magnitude of the difference between the sample estimate and the population parameter taken over all possible samples of the same size, from the population (Chandel, 2002).

$$S.E. = \frac{s}{\sqrt{n}}$$

Where, S = Standard Deviation of Sample
n = Sample size

RESULTS AND DISCUSSION

Data presented in Table-1 and Fig.-1 revealed that seed index of *Jatropha curcas* L. was decreased due to infestation of selected dominant seed mycoflora *viz. Alternaria alternata, Aspergillus flavus, Aspergillus fumigatus, Aspergillus niger, Fusarium chlamydosporum* and *Penicillium glabrum*. The seed index (100 seeds) of *Jatropha* seeds was declined from 3 months to 12 months of storage. The freshly harvested *Jatropha* seeds showed maximum seed index (69.00gm). After 3 months, maximum seed index was observed in control (61.00gm) followed by *Aspergillus niger* infested seeds (59.30gm) and minimum seed index was shown by *Alternaria alternata* infested seeds *i.e.,* 56.25gm. After 6 months, maximum seed index was observed in control (58.60gm) followed by *Aspergillus niger* infested seeds (58.00gm) and minimum seed index was shown by *Alternaria alternata* infested seeds (52.60gm). After 9 months, maximum seed index was observed in control (57.30gm) followed by *Aspergillus niger* infested seeds (56.55gm) and minimum seed index was shown by *Alternaria alternata* infested seeds (51.05gm).

Table-1: Seed index (gm) of fresh and infested *Jatropha* seeds during different periods of time

Treatments	Mean ± S.E.				
	Fresh Weight	Wt. after 3 months	Wt. after 6 months	Wt. after 9 months	Wt. after 12 months
T_1	-	56.25±0.95	52.60±0.80	51.05±0.95	49.60±1.60
T_2	-	56.70±0.30	55.40±0.70	53.50±0.50	52.45±0.35
T_3	-	57.35±0.45	56.15±0.95	54.40±1.10	53.40±0.60
T_4	-	59.30±0.20	58.00±0.20	56.55±0.55	55.85±0.65
T_5	-	58.65±0.35	57.65±0.25	56.05±0.55	54.00±2.00
T_6	-	57.80±0.30	56.60±0.60	54.35±1.30	52.60±1.40
Control	69.00±1.00	61.00±1.00	58.60±0.60	57.30±0.80	56.15±0.85

T_1= Seeds infested with *Alternaria alternata* **T_2=** Seeds infested with *Aspergillus flavus*
T_3= Seeds infested with *Aspergillus fumigatus* **T_4=** Seeds infested with *Aspergillus niger*
T_5= Seeds infested with *Fusarium chlamydosporum* **T_6**= Seeds infested with *Penicillium glabrum.*

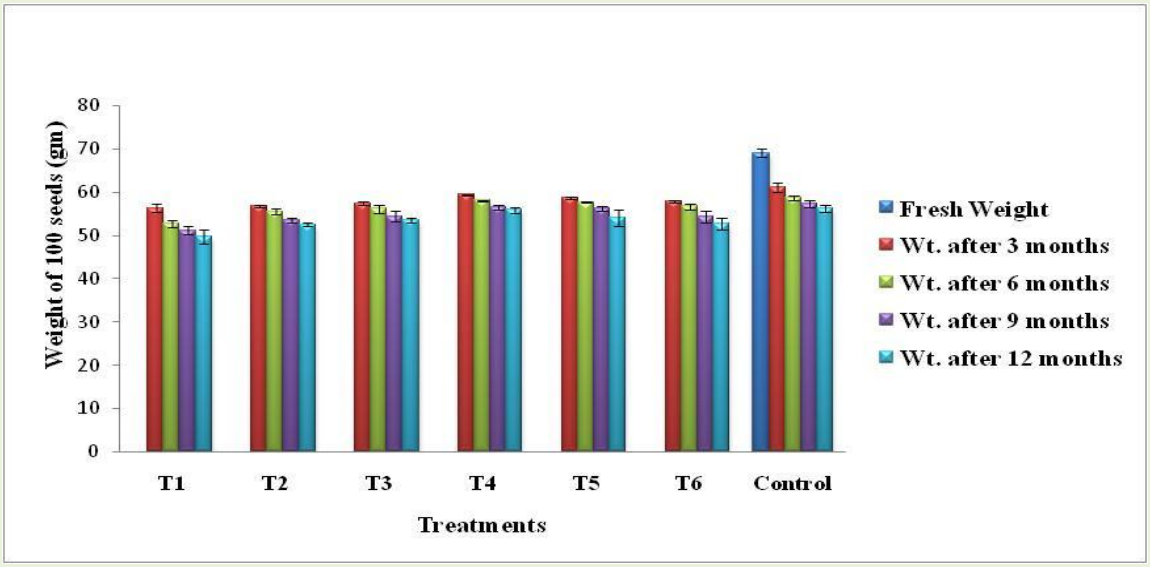

Fig.1: Seed index (gm) of fresh and infested Jatropha seeds during different periods of time

After 12 months, maximum seed index was observed in control (56.15gm) followed by *Aspergillus niger* infested seeds (55.85gm) and minimum seed index was shown by *Alternaria alternata* infested seeds *i.e.,* 49.60gm. The results showed that *Alternaria alternata* infested *Jatropha* seeds were deteriorated much faster than other dominant seed mycoflora infested seeds. Parreno-de Guzman and Aquino, 2009 were reported that the storage behavior of *Jatropha curcas* seed is one of the main constraint. Christensen and Kaufmann (1969) reported that during storage seeds or grains could be infected by fungi which cause a decrease in viability, discolouration, various biochemical changes, heating and mustiness, loss in weight, and production of toxins when it is consumed may be injurious to human and domestic animals. In many cases, fungi infecting seeds are seed-borne pathogens. Silip *et al*., (2010) reported that the fresh weight of fruits, coats, seeds, shells and kernels changed during maturation, ripening and senescence. Fruits, coats, seeds and kernels fresh weight increased significantly when the fruits were ripe or fully yellow but reduced when they started to senescence. Zaidman *et al*., 2010 were observed that seed weight of *Jatropha curcas* seed was highly variable and also seed germination rate was significantly affected by seed weight of *Jatropha curcas* seed.

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