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CHANGES IN CARBOHYDRATE CONTENT IN THE SEEDS OF *SCHLEICHERA OLEOSA* (KUSUM) DUE TO BIODETERIORATION BY PATHOGENIC FUNGI DURING STORAGE

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ABSTRACT
The unsanitary and humid condition during storage of seeds of *Schleichera oleosa f. Sapindaceae* (Kusum) makes it prone to a faster biodeterioration due to colonization of mycoflora namely *Aspergillus fumigatus, Aspergillus flavus, Aspergillus niger, Fusarium solani, paccilomyces variotii and mucar* spp. These internal mycodwellers significantly decreased the carbohydrate content in comparison with the control group not infested with the fungi. In their prolonged association with the seeds for one year the glucose level dropped by as much as 50.15% of its initial value while control group by just 2.15%. Similarly, total sugar also registered a loss of 40.25 per cent with control group at 1.48 per cent. The starch in the stored seeds reduced steadily by 48.88% but the control group lost only 2.04%.

INTRODUCTION

Seeds of *Schleichera oleosa f. Sapindaceae* (Kusum) are of economic importance in Jharkhand. Its oil is used in burning lamps, varnishing, massage and medicine while oil-cake is good manure. Kusum seeds are collected just after onset of rainy season *i.e.* by the end of month of May. Conventionally seeds are stored in gunny bags in the village houses and godowns. In either case the condition is unsanitary and humid and is conducive for fungal growth leading to good scale destruction.

There are reports indicating that fungi are associated with seed surface as well as internal mycoflora (Dutta and Roy, 1987). Changes in glucose content with pathogenic association have been reported. Chaudhary and Prasad (1974) found a depletion of glucose among other nutrients in the shoot tissues of *Cajanus cajan* infected with *Fusarium oxysporum* f. sp. *udum*. It was worthwhile to seek the extent of biodeterioration occurring in the seeds in terms of carbohydrates in different forms viz. glucose, total sugars and starches.

MATERIALS AND METHODS

Kusum seeds were obtained from the godown of Ranchi forest department for the preparation of oil and oilcake on every month from June 2001 to May 2002. The experimental group seeds were kept in fifty gunny bags in godown while control group seeds were kept in three air tight container under same environmental conditions. The variation of temperature, rain fall and humidity were monitored on daily basis. Every month few seeds from all the three airtight containers and three randomly picked gunny bags were sampled for glucose, total sugar and starch estimation. Glucose content was estimated by titration method using Fehling solutions (Cole's method, 1914). Total sugar was estimated by colorimetric method using anthrone reagent (Dubois *et al*., 1951). Estimations were done in triplicate and standard deviation was calculated.

RESULTS AND DISCUSSION

Kusum seeds were collected just after onset of rainy season. The high humidity and moderate temperature (Table 1) in unsanitary condition favour colonization of fungi namely *Aspergillus fumigatus, Aspergillus flavus, Aspergillus niger, Fusarium solani, paccilomyces variotii and mucar* spp. The effect of continued fungal activity on the seeds manifested the lowered carbohydrate content. The glucose level dropped by as much as 50.15 percent in the span of one year of its initial value but the control group lost only 2.15 percent, shown in Table 2. Similarly, total sugar also registered a loss of 40.25 per cent with control group at 1.48 per cent (Fig. 1). The starch in the stored seeds reduced steadily by 48.88% but the control group lost only 2.04% (Fig. 2).

The effect of continued fungal activity on the seeds manifested in the lowered glucose, total soluble sugars and starch contents as seen in oil content (Srivastava and Pandey, 2000). Changes in glucose content with pathogenic association have been

Table 1: Environmental factors prevailing through June'01 to May'02

Month	Rain fall mm/month	Temperature°C min. ± S.D.	max. ± S.D.	Humidity %
Jun-01	133.2	22.1 ± 0.23	34.6 ± 0.11	66.3
Jul-01	254.1	20.1 ± 0.14	30.1 ± 0.21	84.6
Aug-01	152.4	21.9 ± 0.10	31.3 ± 0.22	86.5
Sep-01	43.9	23.1 ± 0.31	34.8 ± 0.24	82.5
Oct-01	20.7	21.6 ± 0.24	33.2 ± 0.19	73.4
Nov-01	2.0	18.7 ± 0.19	28.9 ± 0.20	61.2
Dec-01	0.0	13.5 ± 0.16	22.1 ± 0.21	54.8
Jan-01	1.1	11.4 ± 0.26	24.3 ± 0.09	46.4
Feb-02	0.0	14.3 ± 0.09	28.2 ± 0.11	39.6
Mar-02	3.0	21.8 ± 0.22	32.1 ± 0.14	46.9
Apr-02	0.0	29.2 ± 0.25	35.6 ± 0.11	30.8
May-02	6.0	27.4 ± 0.17	38.7 ± 0.18	23.4

reported. Chaudhary and Prasad (1974) found a depletion of glucose among other nutrients in the shoot tissues of *Cajanus cajan* infected with *Fusarium oxysporum* f. sp. *udum*. Chattopadhyaya and Nandy (1978) found carbohydrate loss due to *F. moliniforme* var subglutinum infection. Loss in amount of glucose in fruits have been reported for tomato-*Drechslera australiense* (Kapoor and Tandon, 1970); tomato-*Alternaria solani* (Mehta *et al.,* 1975); banana- *Gloeosporium musarum*(Wang, 1960) and citrus- *Xanthomonas campestris* pv*citri* (Vidhyasekaran and Durairaj, 1971) host pathogen systems.

Changes in total sugar content in the host tissues due to pathogenic actions have been reported by Craig and Hooker

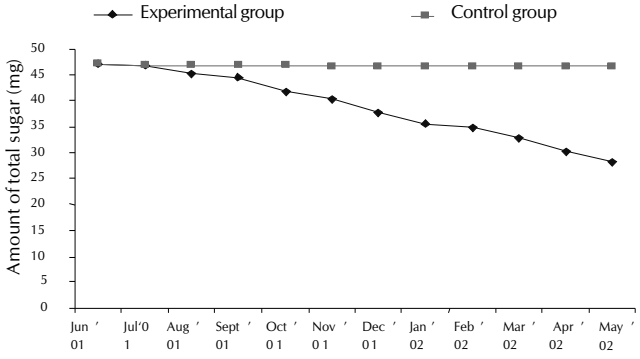

Figure 1: Amount of total carbohydrate present in 1 g of Kusum seed powder samples through one year of biodeterioration due to fungal attack, June '01 - May '02.

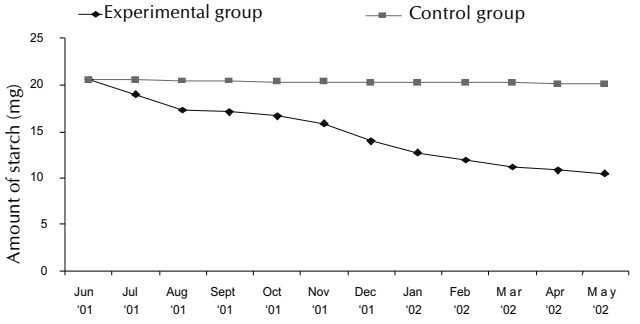

Figure 2: Amount of starch present in 1 g of Kusum seed powder samples through one year of biodeterioration due to fungal attack, June '2001 - May '02.

Table 2: Amount of glucose present in 1g of Kusum seed powder samples through one year of biodeterioration due to fungal attack, June'01 to May'02 (n = 3)

Month	Amount of glucose in mg per g of seed control group M ± S.D.	Amount of glucose in mg per g of seed experimental group M ± S.D.
Jun '01	16.75 ± 0.008	16.75 ± 0.011
Jul '01	16.69 ± 0.010	16.25 ± 0.009
Aug '01	16.64 ± 0.009	16.25 ± 0.013
Sept '01	16.61 ± 0.009	15.75 ± 0.008
Oct '01	16.60 ± 0.011	14.90 ± 0.014
Nov '01	16.56 ± 0.012	14.31 ± 0.012
Dec '01	16.53 ± 0.009	13.13 ± 0.009
Jan '02	16.51 ± 0.013	12.47 ± 0.008
Feb '02	16.49 ± 0.017	11.90 ± 0.013
Mar '02	16.45 ± 0.015	10.31 ± 0.010
Apr '02	16.41 ± 0.009	09.52 ± 0.008
May '02	16.39 ± 0.011	08.35 ± 0.010

(1961); Dhanvantari (1967); Dayal and Joshi (1968) and Padmanabhan *et al.*(1988) on different host pathogen systems.

Similarly the depletion in the starch content is commensurate with the activation of starch degrading enzymes especially beta – *amylase* (Schipper and Mirocha, 1977). The drop is due to the sugar being used by the fungal pathogens as respiratory substrates (Baker, 1965; Wu, 1973). In pigeon pea seeds infested with *Aspergillus flavus*, Sinha and Prasad (1977) found a depletion of starches. Likewise Bilgrami *et al.*, (1979) recorded a considerable decrease in the amount of starch in paddy seeds during 60 and 90 days of fungal infestation of an aflatoxin producing strain of *Aspergillus parasiticus*. Sinha *et al.,* (1981) found a considerable reduction in the starch content of Cajanus cajan seeds infested with *Aspergillus flavus* and *A. Niger*. However, these seeds, when infested with *Alternaria alternata* and *Curvularia lunata*, showed a moderate reduction in the starch contents. On the contrary, *Cajanus* seeds infested with *Fusarium moniliforme* and *Drechslera hawaiiensis* exhibited a minimum level reduction in starch contents. Later on, Singh and Sinha (1985) confirmed that infestation of *Cajanus* seeds by *Aspergillus parasiticus* caused a considerable decline in their starch contents. Prasad (1989) reported a loss of starch in fungi infested seeds of *Coriandrum indicum* and the maximum loss in starch was due to *Aspergillus flavus* followed by *Curvularia lunata*.

All these reports are concurrent to our findings. It is thus apperant that one year of seed infestation of *Schleichera oleosa* predominantly and jointly by Aspergillus *fumigatus, A. flavus, A. niger, Fusarium solanii, Paecilomyces variotii* and *Mucor* sp. causes biodeterioration of its seeds manifested in the diminishing of carbohydrate contents.

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