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Chemical changes in properties of kusum *(Schleichera oleosa)* oil during its seeds insfestation by fungi

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Kusum *(Schleichera oleosa)* seeds were found to be infested with several fungi during one year of storage. Dominant among them were *Fusaruim solani, Aspergillus fumigatus. A flavus, A.niger* and *Paecilomyces variotii.* The biodeterioration of seeds manifested in changes in the biochemical properties of oil, which became more pronounced commensurate to increase in duration of seed-fungus association. At the end of one year the total oil content diminished to less than half, saponification value (SV) increased by 2.89% and fat acidity value enhanced by 77%. The changes in these values were gradual over the intervening months evidently because of fungal activity indicating breakdown of kusum oil into fatty acids, and loss of short chain glyceride fatty acids.

Key words : Kusum, seed oil, storage fungi, infestation, biodeterioration, oil content, saponification value (SV), fat acidity value (Fav)

INTRODUCTION

Fungal infestation of oil yielding seeds during storage affects the biochemical properties of its oil (Stansbury, 1947 ; Ward, 1955, Ward and Diener, 1961 ; Sauer and Christensen 1968 ; Lalitha Kumari *et. al.*, 1971a, 1971b; Sharma, 1977, 1981 ; Dubey and Vyas, 1978, Mandal *et. al.*, 1981; Bose and Nandi, 1982 ; Prasad and Prasad, 1982; Prasad and Singh, 1983 ; Singh and Prasad, 1987).

In this area of Chotonagpur, kusum oil and its cake are widely used for burning earthen lamps, for body massage and as organic manure respectively. During survey of storage godowns of Forest Department of this area kusum *(Schleichera oleosa)* seeds were found to be heavily infested with fungi. The results of the study on the effects of fungul infestation of kusum seeds on changes in their oil properties for the duration of one year at monthly intervals are presented here.

MATERIALS AND METHODS

The seeds of kusum *(Schleichera oleosa)* stored in gunny bags in brick built warehouses were obtained from the Forest department (Minor Forest Produce Division), Ranchi. Samples of seeds were taken each month from the same place of storage. Fungal isolations were done from the surface sterilised seeds every months to ascertain the presence and frequency of different fungi by dilution plate method. The oil content was determined for each 5g of previously dried kusum seeds. They were crushed with petroleum ether and then the oil extracted for 8hs using Soxhlet apparatus. The weight of oil taken was converted into percentage. The saponification value (SV) and fat acidity value (FAV) were determined by titration method (Meara,1955).The value taken in each case were the mean of three replicates.

RESULTS AND DISCUSSION

The seeds of kusum were found to be infested with several fungi of which the dominant ones were *Aspergillus fumigatus, A. flavus, A. niger, Paecilomyces variotii* and *Fusarium solani*. The frequency of their occurrence and variations therein during 1 year of storage has been listed in Table 4. The effect of continued fungal activity on the seed showed decrease oil content. The percentage loss in oil was linear and increased very rapidly during the first eight months (Table 1). thereafter stabilised. The

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Table 1 Changes in total oil content of kusum seeds (5 gms.) during one year of fungal attack (June '94 to May 95)

Month	Wt. (mg)	Persentage	% Change
June 94	1.41	28.2	-
Jul 94	1.34	26.8	-1.4
Aug 94	1.32	26.4	-1.8
Sep 94	1.2	24.0	-4.2
Oct 94	1.15	23.0	-5.2
Nov 94	1.13	22.6	-5.6
Dec 94	1.01	20.2	-8.0
Jan 95	0.95	19.0	-9.2
Feb 95	0.78	15.6	-12.6
Mar 95	0.71	14.2	-14.0
Apr 95	0.62	12.4	-15.8
May 95	0.56	11.2	-17.0
SD		5.833	
SE		1.683	

Table 2. Changes in Fat Acidity Value (FAV) of kusum oil during one year of fungal attack. (Jun-94 to May 95)

Month	F. A. V.	Percentage	% Change
June 94	42.2	4.22	-
Jul 94	316.1	31.61	+27.39
Aug 94	461.7	46.17	+41.95
Sep 94	522.3	52.23	+48.01
Oct 94	590.8	59.08	+55.76
Nov 94	618.1	61.81	+57.59
Dec 94	642.2	64.22	+60.4
Jan 95	729.3	72.93	+68.71
Feb 95	737.7	73.77	+69.55
Mar 95	785.3	78.53	+74.31
Apr 95	788.0	78.80	+74.52
May 95	803.1	80.31	+76.09
SD		22.6	
SE		6.53	

Table 3. Changes in saponification value of usum oils during one year of biodeterioration due to storage fungi. (June 94 to May 95)

Month	S.V	Percentage	% Change
June 94	421.1	42.1	-
Jul 94	423.3	42.33	+.23
Aug 94	426.6	42.66	+1.56
Sep 94	429.8	42.98	+1.88
Oct 94	431.1	43.11	+2.01
Nov 94	432.7	43.27	+2.17
Dec 94	435.1	43.51	+2.41
Jan 95	436.7	43.67	+2.57
Feb 95	437.2	43.72	+2.62
Mar 95	438.3	43.83	+2.73
Apr 95	438.6	43.86	+2.76
May 95	439.9	43.99	+2.89
SD		6.20	
SE		1.81	

Table 4. Fungi occurring on the surface sterilised seeds of kusum and their frequencies taken at one month interval for the duration of one year

	Frequency of occuraence (Percent)[1]													
	Control	Jun	July	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	SD
Aspergillus fumigatus	0	32	32	33	33	34	34	34	34	35	36	36	9.87	2.85
Aspergillus flavus	0	11	11	12	12	12	12	12	14	12	12	11	3.41	0.98
Aspergillus niger	0	11	11	11	12	13	14	14	14	13	12	12	3.77	1.09
Paecilomyces variotii	0	07	8	7	6	6	6	6	6	6	6	6	1.94	0.56
Fusarium solani	0	28	28	30	33	33	33	34	34	34	34	35	9.64	2.78
Mucor sp.	0	12	10	8	4	2	1	0	0	0	0	0	1.94	0.56

[1]Data are average of 1994 and 1995

results showing changes in saponification value and fat acidity value have been included in Tables 2 and 3. As evident from the results there was a progressive and consistent rise in saponification value(SV) of the oil during 12 months of fungal association. The percent rise of SV of the oil was 0.23 percent in the first month and 2.89 percent after one year (Table 3). However, fat acidity value (FAV) of the oil showed a prominently progressive increase during 1 year of fungal infestation of the seed. In a month the FAV rose by 27.39 percent and by the end of the year the rise was 76.09 percent. Loss in the oil content (Table 1) of kusum seeds during one year of fungal attack as observed in the present study was earlier reported for several oil yielding seeds (Ward and Diener, 1961; Lalitha kumari *et. al*, 1971 a; Robertson *et.al*., 1973; Sharma, 1981; Singh and Prasad, 1977, 1981, 1983a, 1983b; and Bose and Nandi, 1982). Drop in oil content of both sesame and safflower seeds when compared during 15 to 30 days of infestation, was more pronounced with *Aspergillus giganteus* and *A. ochraceous* than *Rhizoctonia solani* (Bose and Nandi,1982).On the other hand, infection of *Rhizoctonia solani* in the seeds of sesame caused more prominent oil loss than the other two *Aspergilli* (Bose and Nandi, 1982).Generally the loss in oil content was reported to vary with the type of oil seeds, form of fungus infested, type of fungal activity,

duration of infestation and prevalent humidity around the stored seeds (Ward and Diner, 1961; Sharma, 1981; Prasad and Singh, 1983).

The SV of kusum seeds oil slightly increased in 1 year of infestation. There are several reports in favour of our findings that show increases in the SVs of oil extracted from infested seeds. Lalithakumari *et. al.* (1971a, 1971b) found increases in SV of groundnut oil and castor oil following infestation. Similarly, Bose and Nandi (1982) found a very slight increase in saponification value of sunflower and sesame oil due to infestation of these seeds by *Aspergillus giganteus* and *A. sydowi.* In sunflower and sesame oil the SV increased more rapidly after 15 days of seeds infestation by *A. ochraceous* and *Rhizoctonia.* Singh and Prasad (1983b) found an increase in the SV of sesame oil at 15 and 30 days of separate seeds infestation by *A. flavus* and *Alternaria alternata.* Singh and Prasad (1987) reported that increase in the relative humidities was in linear fashion when the seeds were infested with *A. flavus, Fusarium moniliformae* and *Drechslera hawaiiensis.* Duration of incubation and the type of fungus infesting the seeds is known to determine the extent of change in chemical properties of the oils.

A prominent increase in fat acidity value (FAV) of kusum oil risen by upto 27.39% in one month and 76.9% within one year of seeds infestation indicated that constant, progressive and vigorous breakdown and degradation of lipids was effected by fungal attack of the seeds. Such a prominent accummulation of free fatty acids in oil of sunflower seeds during 15 to 30 days of separate infection of *Aspergillus flavus, Alternaria alternata* and *Chaetomium globosum* was reported by Singh and Prasad (1983a). Separate infection of sunflower seeds by *A.flavus, Alternaria alternata* and *Fusarium moniliformae* (Singh and Prasad, 1981) and sesame by *Rhizopus oryzae, Chaetomium* sp. and *Alternaria niger* (Singh and Prasad, 1979) for 15 to 30 days of duration too effected enormous increase in FAV of the oil. Similar changes in FAV of sesame oil too after its seed infestation by *Apergillus flavus.Alternaria alternata* and *Drechslera hawaiiensis* was recorded by Singh and Prasad (1983b). Enormous increase in FAV of sesame and safflower oil during 15 to 30 days infestation of their seeds by *Rhizochonia solani* was noted by Bose and Nandi (1982). *Aspergillus giganteus* and *A. candidus* too effected moderate release of free fatty acids in the oil after their separate infections of safflower and sesame seeds (Bose and Nandi, 1982). The degree and extent of increase in FAV varied with duration of fungal infestation, the type of seed, and form of fungi attacking the seed (Stansbury, 1947 ; Ward, 1955; Sharma,1777, 1981;Singh ,and Prased 1987) and the extent of humidity in the vicinity of the seed store (Milner, 1950;Ward and Diener, 1961; Sharma, 1981; Bose and Nandi,1982).

It is thus apparent that one year of seed infestation of kusum predominantly and jointly by *Aspergillus fumigatus, A. niger, Aflavus, Fusarium solani,Paecilomyces variotii* and *Mucor* sp. causes biodeterioration of its oil manifested in lowered oil content and changes in many of its properties.

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