

FUNGAL DETERIORATION OF STORED LEAVES OF TENDU (*DIOSPYROS MELANOXYLON*) IN RELATION TO SEASONAL VARIATION AND METEOROLOGICAL FACTORS.

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Qualitative and quantitative analysis of mycoflora on the leaf surfaces of *Diospyros melanoxyton* (Tendu or Bidi leaves), in stored condition was undertaken. Various species of *Aspergillus*, *Chaetomium*, *Pestalotia*, *Botryodiplodia*, *Mammaria* and *Curvularia* were found to be abundant and frequent throughout the year causing 15-20 % damage of the leaves and minimum 10% revenue loss. Fungal populations varied according to seasonal changes and climatic conditions of forest areas of Bastar- the biggest forest zone of India.

Keywords : Biodeterioration of leaves; *Diospyros melanoxyton*; Fungal flora; Storage.

Occurrence of fungal organisms as regular inhabitants on the leaf surfaces of almost all plants is now well documented¹. The variance of such organisms depend on a number of environmental factors. Populations on leaf surfaces also depend on air current, age of leaf, size and height of trees^{2,3}. Qualitative and quantitative mycofloral variations are also influenced by physico-chemical characteristic of soil^{4,5} and plant cover⁶.

Dried leaves of Tendu is used as wrapper in manufacture of Bidi which in turn is used for smoking purposes by more than 75% rural & tribal population. The leaves are collected from forests in the month of April-May, dried and stocked in godowns till it is sold out. Storage period usually exceeds 18 to 24 months and during this period quite a substantial quantity of leaves get deteriorated by fungal infestation causing a heavy loss in revenue.

Present investigations deal with the nature and composition of leaf surface mycoflora with reference to seasonal variation and climatic conditions of different forest areas of Bastar division of M.P. Percentage deterioration of the leaves have also been estimated to get an idea of loss of revenue. Mycoflora screening were done from various

distantly located godowns of Bastar division, the largest forest pocket of India providing a maximum quantity of Tendu leaves.

Dried leaf samples were collected at bimonthly intervals from different godowns, located at different forest district head quarters viz- Kanker, Jagdalpur and Dantewade, so as to cover whole Bastar division. Fifteen leaves from each sample were selected of which 10 leaves were kept in moist chamber for 5 days, maintaining temperature and R.H. to facilitate growth of the molds. From rest of the leaves, molds were isolated directly by dilution plate and agar streak method on corn- meal agar and P.D.A. Media.

Percentage deterioration and abundance of the organisms were assessed by following formulae :-

$$\text{Percentage deterioration (D\%)} \quad \frac{\text{Leaf area covered by organism}}{\text{Total leaf area}} \times 100$$

(Incubation period - 5 days)

$$\text{Abundance (Ab\%)} - \quad \frac{\text{Total No. of colonies of Individual organism}}{\text{Total No. of colonies of All organisms in all observations.}} \times 100$$

Screening studies revealed that out of 18 fungal species isolated nine sp. namely *Aspergillus niger*, *A. flavus*, *Rhizopus* sp., *Chaetomium*, *Curvularia*, *Sclerotium*, *Pestalotia*, *Mammaria* and *Penicillium*, were invariably present in all

the samples collected from different areas. Monthly isolation records show that these organisms perpetuated over the leaves throughout the year. Results clearly indicate that these nine organisms are of common occurrence in whole Bastar Forest areas and are chief deteriorating agents for the stored leaves. From deterioration percentage point of views, *Aspergillus niger*, *A. flavus*, *A. tamarii*, *Pestalotia*, *Chaetomium*, *Ciliochorella* and *Mammaria*, were found to play disastrous role causing 10 to 20% deterioration within 5 days of incubation. Longer incubation period resulted complete decomposition of the leaves. It was found that on these decomposed leaves certain toad stool sp. of *Amanita* and *Coprinus* grew frequently. These Poisonous toad stools are well known for the production of toxic compounds like Amatoxin and Phallotoxins.

Monthly screening of molds from District Kanker shows that period of Sept to December (Average rainfall 495.5 mm, RH. 92.5%, Temp. Max. 33.5, Min. 14.5) is most favourable period for the perpetuation of molds specially dominated by *Aspergillus niger*, *A. sulphureus*, *A. flavus*, with highest deterioration (upto 20%), followed by Sp. of *Pestalotia* and *Beltrania*. On the other hand *A. niger*, *Penicillium*, *Pestalotia*, *Bdellospora* and *Beltrania*, play major role in deterioration during January-February, while *Chaetomium*, *Mammaria* and *Bdellospora* Sp. play, significant role during period of March to June, when average Rainfall 35.1 mm, RH. 50% and temperature max. 44.5, min. 15.0, prevail.

Percentage deterioration of leaves in the District Jagdalpur was comparatively lesser with a tune of maximum 15%. Period of September to February were found to be most favourable for the growth of molds

dominated by *A. niger*, *A. ochraceus*, *Pestalotia* and *Mammaria*. During warmer days i.e. from March to June, *Sclerotium*, *Chaetomium*, *Pestalotia*, *Bdellospora*, *A. ochraceus* and *Curvularia* were found to play dominant role with maximum deterioration of 10-12% by *sclerotium*, *Chaetomium* and *Pestalotia*.

Screening from lots of Dantewada, reveals almost similar results as Jagdalpur. It was found that during September to December, max. damage is caused by *A. niger*, *Pestalotia*, *Chaetomium*, while *Curvularia*, *A. niger* *Chaetomium* and *Allescheriella* being the major damaging agents during March to June.

All the results indicate that in whole Bastar division, max. damage upto 15-20% of stored leaves, are caused during Sept. to December, mainly by *A. niger*, *A. flavus*, *Pestalotia* and *Beltrania*, while during dry and hot weather conditions of March to June, *Pestalotia*, *Chaetomium*, *Sclerotium*, *Mammaria*, *Bdellospora* and *Curvularia* play the significant role causing damage upto 10 to 15%.

Collection and storage of leaves is mainly done in the month of May. Leaves are dried under open sky, after bundling them. In this practice lot of partially dried leaves also get place in godowns and are mainly responsible for increasing, humidity and temperature of the storage place favoring growth of the molds.

Some deliquescent hygroscopic substances as common salt bits, calcium chloride etc., proper exhaust ventilation mechanisms, will certainly reduce the chances of growth of these molds along with antifungal fumigation, specially in the month of June and September.

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Table 1. Forest area - Bastar (Kanker)

MONTHS		JUL-AUG.	SEP.-OCT.	NOV.-DEC.	JAN.-FEB.	MAR.-APR.	MAY-JUN.	Average							
METERIOLOGICAL DATA	Av. Rain Fall (m.m.)	386.5	814.1	177.0	88.4	14.7	55.6								
	Rel. Humidity %	90.5	92.0	93.5	90.7	56.5	45.0								
	Av. Temperature °C	21.5-35.2	19.5-33.2	15.7-29.7	12.2-30.7	15.5-38.7	21.7-44.2								
Sl. No.	Name of Organisms	D ₂ %	Ab%	D ₂ %	Ab%	D ₂ %	Ab%	D ₂ %	Ab%	D ₂ %	Ab%	D ₂ %	Ab%		
1.	<i>Aspergillus niger</i>	18.3	17.3	20.5	14.7	20.4	10.5	21.6	12.3	20.1	14.0	20.1	1.37		
2.	<i>A. flavus</i>			12.7	11.7	19.3	9.4			8.5	8.2	13.5	9.7		
3.	<i>A. tamarii</i>			11.7	7.3							11.7	7.3		
4.	<i>A. ochraceus</i>	10.8	6.2	7.8	9.4	9.1	4.2					9.2	6.5		
5.	<i>A. sulphureus</i>			8.8	2.9	13.2	2.6					11.0	2.7		
6.	<i>Alternaria crassa</i>			9.2	8.6							9.2	8.6		
7.	<i>Beltrania rhombica</i>			6.8	4.4	9.1	2.3	5.6	3.1			7.1	3.2		
8.	<i>Bdellospora helicoides</i>							6.6	9.2	8.6	6.2	3.8	8.2	6.3	7.8
9.	<i>Curvularia lunata</i>									6.7	10.9	6.7	10.9		
10.	<i>Chaetomium globosum</i>									17.3	16.0	12.3	15.2	14.8	15.6
11.	<i>Mammaria echinobotryoides</i>											9.1	8.2	9.1	8.2
12.	<i>Pestalotia machrottrica</i>			5.6	10.2	13.2	9.4	15.0	10.7			11.2	10.1		
13.	<i>Penicillium citrinum</i>							7.5	9.2	3.8	7.8	5.6	8.5		
14.	<i>Rhizopus nodosus</i>	6.6	11.2									4.7	10.5	5.6	10.8
15.	<i>Sclerotium rolfsii</i>	10.8	5.7	6.8	4.4							4.7	4.4	7.4	4.8
16.	<i>Trichoderma glaucum</i>					6.5	4.2	7.6	5.0			7.5	4.6		

D₂% = Deterioration percentage, Ab% = Abundance Percentage

Table 2. Forest area - Bastar (Jagdalpur)

MONTHS		JUL-AUG.	SEP.-OCT.	NOV.-DEC.	JAN.-FEB.	MAR.-APR.	MAY-JUN.	Average							
METERIOLOGICAL DATA	Av. Rain Fall (m.m.)	386.5	814.1	177.0	88.4	14.7	55.6								
	Rel. Humidity %	90.5	92.0	93.5	90.7	56.5	45.0								
	Av. Temperature °C	21.5-35.2	19.5-33.2	15.7-29.7	12.2-30.7	15.5-38.7	21.7-44.2								
Sl. No.	Name of Organisms	D ₂ %	Ab%	D ₂ %	Ab%	D ₂ %	Ab%	D ₂ %	Ab%	D ₂ %	Ab%	D ₂ %	Ab%		
1.	<i>Aspergillus niger</i>	11.8	17.4	12.6	14.6	12.2	14.0	7.8	12.3			17.5	16.4	12.4	15.1
2.	<i>A. flavus</i>					8.4	9.4					8.4	9.4		
3.	<i>A. tamarii</i>	9.0	7.6									9.0	7.6		
4.	<i>A. ochraceus</i>			14.7	9.4							14.7	9.4		
5.	<i>A. sydowi</i>					8.5	3.5	9.8	7.6			8.4	9.4	8.9	6.8
6.	<i>Beltrania rhombica</i>					6.3	2.3					6.3	2.3		
7.	<i>Bortydiplodia theobrame</i>			5.4	9.2	7.6	9.0	6.0	6.6			6.3	8.1		
8.	<i>Bdellospora helicoides</i>											7.3	8.2	7.3	8.2
9.	<i>Curvularia lunata</i>			5.2	4.3	13.6	9.0					3.7	11.7	7.5	8.3
10.	<i>Chaetomium globosum</i>									10.3	16.0	10.3	15.2	10.3	15.6
11.	<i>Cunninghamella verticillata</i>			7.2	4.3	8.4	4.7					7.8	4.5		
12.	<i>Mammaria echinobotryoides</i>	10.9	9.6	11.5	13.2	7.3	4.7	5.8	3.0			8.8	7.6		
13.	<i>Pestalotia machrottrica</i>	9.0	14.4	12.6	10.2					6.6	14.1	9.4	16.7	9.4	13.8
14.	<i>Penicillium citrinum</i>			6.3	7.4					6.6	7.8	6.4	7.5		
15.	<i>Penicillium rotundum</i>					2.4	4.1	3.6	5.2			3.0	4.6		
16.	<i>Rhizopus nodosus</i>			6.3	10.2			3.9	4.6	2.8	6.3	4.3	7.0		
17.	<i>Sclerotium rolfsii</i>	7.2	5.7			6.3	2.3	10.7	1.5			11.3	4.7	8.8	3.5

D₂% = Deterioration percentage, Ab% = Abundance Percentage

Table 3. Forest area - Bastar (Dantewada)

MONTHS		JUL.-AUG.	SEP.-OCT.	NOV.-DEC.	JAN.-FEB.	MAR.-APR.	MAY-JUN.	Average					
METERIOLOGICAL DATA		Av. Rain Fall (m.m.)	393.3	907.3	209.7	104.2	16.1	58.6	58.6				
		Rel. Humidity %	89.5	92.5	94.5	89.5	56.0	51.5	51.5				
		Av. Temperature °C	22.5-35.7	20.2-33.8	15.5-30.5	12.5-31.5	16.2-39.5	20.7-43.0	20.7-43.0				
Sl. No.	Name of Organisms	D,%	Ab%	D,%	Ab%	D,%	Ab%	D,%	Ab%	D,%	Ab%		
1.	<i>Aspergillus niger</i>			14.6	14.7	20.6	10.5			19.4	16.4	18.2	13.8
2.	<i>A. flavus</i>	7.1	13.4	8.2	11.7			8.4	4.6			7.9	9.9
3.	<i>A. sydowi</i>					4.9	3.5	3.8	7.6			4.3	5.5
4.	<i>Alleschariella arocea</i>							6.5	3.1			6.5	3.1
5.	<i>Alternaria solani</i>			7.8	6.2							7.8	6.2
6.	<i>Beltrania indica</i>			4.4	3.2	5.1	4.2					4.7	3.7
7.	<i>Curvularia lunata</i>							10.2	10.9			10.2	10.9
8.	<i>Chaetomium globosum</i>	13.5	23.0			13.7	12.5	14.0	16.0	20.0	15.2	15.3	16.6
9.	<i>Mammaria echinobotryoides</i>									5.2	8.4	5.2	8.4
10.	<i>Memnoniella levispora</i>			5.5	2.1							5.5	2.1
11.	<i>Pestalotia machroticha</i>	12.5	14.4			11.7	9.4					12.1	11.9
12.	<i>Penicillium citrinum</i>							6.7	9.2			6.7	9.2
13.	<i>Penicillium rotundum</i>					3.4	5.8					3.4	5.8
14.	<i>Rhizopus nodosus</i>	11.6	11.2	7.3	10.2	5.6	5.8	6.7	4.6	2.1	10.5	6.6	8.4
15.	<i>Sclerotium rolfsii</i>			4.5	4.4	8.8	2.3					6.6	3.4

D,% = Deterioration percentage, Ab% = Abundance Percentage

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