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9th March 2024

Conference Proceeding: Special Issue Editors

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Discoloration Of Head In Sorghum Due To Curvularia Lunata

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FULL PAPER

Introduction:

Sorghum is an important staple food crop of Vidarbha region; it is cultivated on very large area in Vidarbha region as a cereal as well as forage crop. Sorghum is rich in carbohydrate content, as it required less amount of irrigation and other artificial nutrients; it prove to be an good alternative for wheat and rice. At the time of flowering to physiological maturity when it get a higher moisture content in the field, various fungi start to attack and grow on the head of sorghum. Due to attack of such fungi on sorghum head, it gets infected. As compare to other pathogens associated with the head of sorghum *Curvularia* species shows their dominance. More than 19 different species of *Curvularia* were reported on infected head of sorghum (Girish et al, 2011). *C. clavata, C. cymbopogonis, C. eragrostidis, C. geniculata, C. inaequalis, C. intermedia, C. ischami, C. lunata, C. oryzae, C. ovoidea, C. pallescens, C. penniseti, C. robusta, C. senegalensis, C. siddiquii, C. sorghina, C. trifolii, C. tuberculata* and *C. verruculosa* were associated with the sorghum head. Out of which *Curvularia lunata* was most dominating. Along with the Curvularia lunata, genus like *Aspergillus, Fusarium, Cladosporium, Epicoccum, ALternaria, Phoma* and *Cylindricarpons* species also reported from grain mold complex of sorghum (Kebede et al, 2023).

Sorghum seeds infected from *Curvularia lunata* shows blackish mycelial mat present on the surface of seeds, which is loosely attached to the surface. Due to such blackish mat associated with seed surface it lead to discoloration of the seeds (Rastogi et al, 1990). This reduces the quality of seeds. Histopathological study reveals that *Curvularia lunata* infects the pericarp and aleurone layer of seeds. Due to the infection of *Curvularia lunata* to sorghum seeds reduces the germination percentage and also increases the grain mold severity (Prom et al, 2003). Seed germination was hampered

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due to the infection of *Curvularia lunata*. Grain mold disease formation and its occurrence is totally depends on the differential developmental stages of sorghum plant. Wetness duration is also responsible for the attack of pathogens. Different pathogens attack on sorghum at various developmental stages. *Curvularia lunata* shows their first appearance at the stage of flowering and it shows their maximum incidence at the time of physiological maturity of sorghum (Navi et al, 2005). Sporulation in the *Curvularia lunata* and grain mold severity due to *Curvularia lunata* drastically get increased due to increase in the relative humidity and increase in the temperature (Tonapi et al, 2007). Temperature ranges from 25^0C to 28^0C increases the sporulation in *Curvularia lunata*.

Materials and Methods:-

Collection of samples:-

Samples of sorghum head were collected from different localities of Buldana district of Maharashtra. Infected samples were collected from flowering to physiological maturity stage. Collected samples were packed in zip lock bags and bringing to laboratories for further analysis.

Isolation of Pathogens:-

Pathogens associated with the sorghum head was isolated by Agar plate method (APM) and standard blotter method (SBM).

Standard Blotter paper method:-

A pair of white blotter paper was taken and jointly soaked in sterile distilled water. Pair of soaked blotter paper were placed on sterile petri dishes, and make a chamber. 5 seeds in each plate were placed in aseptic conditions. Inoculated plates were allowed to incubate for 4-5 days at room temperature.

Agar plate method:-

Potato dextrose agar (PDA) medium were prepared and poured in sterilized petri plates, allowed to solidify. 5 seeds of infected head were inoculated on each plate and plates were incubated for 4-5 days at room temperature.

Composition of PDA (Potato dextrose agar) medium:-

Peeled potato – 100gm, Dextrose 20g, Agar 20 gm and distilled water 1000ml, pH 5.6. 100 gram of potato were taken and peeled; boiled until get soft and squeeze through muslin cloth. Then dextrose was added in it and final volume of solution was made up to 1000ml. In this solution agar was added, pH was adjusted to 5.6.

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Identification of Pathogens:-

Microscopic observations were taken by preparing microscopic slides for each isolates. Pathogens were identified with the help of standard literature and monographs.

Experimental results:-

Head samples of sorghum were collected from tehsil of Buldana district. All the infected samples were subjected to visual analysis. On the basis of visual symptoms appeared on the surface of seeds, seeds were categorized in different grades. All such seeds were used for the isolation of pathogens. Isolation of pathogens was done by standard blotter method and agar plate method. Out of 80 samples collected from different localities of Buldana district, 73 samples were infected by the attack of *Curvularia lunata*. As compare to other pathogens associated with this moldy samples *Curvularia lunata* prove to be dominating. Similar type of results was reported by (Girish et al, 2011). They reported more than 19 different *Curvularia* species associated with infected sorghum head. Out of which *Curvularia lunata* were more dominating, having 39% of incidence as compare to other species.

Table: - Incidence of Curvularia lunata on sorghum seeds at various developmental stages

Sr. No.	Name of Tehsil	Percent Incidence of *Curvularia lunata*	
		Flowering stage	Physiological maturity
1	Motala	20%	86%
2	Buldana	23%	94%
3	Malkapur	20%	91.5%
4	Nandura	18%	92%
5	Jalgaon Jamod	24%	89%
6	Sangrampur	21%	93%
7	Chikhali	24%	85.5%
8	Shegaon	23%	92.5%
9	Khamgaon	20%	90.5%

Samples collected at the time of flowering shows 22% incidence of *Curvularia lunata*. While samples collected at the time of physiological maturity shows 91.25 % of incidence of *Curvularia lunata*. Maximum incidence was recorded at the time of physiological maturity of plant. Samples collected from Jalgaon Jamod at the time of

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flowering stage shows highest incidence of *Curvularia lunata* (24%). While sample collected from Buldana at the time of physiological maturity shows highest incidence of *Curvularia lunata* (94%). Similar type of reports was given by (Navi et al, 2005). They show the maximum incidence of *Curvularia lunata* were observed at the physiological maturity stage. Out of all the samples collected from different localities, seed samples having black net like structure associated with them have maximum incidence of *Curvularia lunata* as compare to other pathogens. Blackish discoloration of sorghum seeds due to the attack of *Curvularia lunata* were reported by (Rastogi et al, 1990). They reported a black coloured macelial net like structure were loosely attached with the sorghum seeds. At the time of physiological maturity of sorghum plant, whenever it get a higher moisture content, *Curvularia lunata* attack on such sorghum head and causes disease. Due to its accumulation at the time of physiological maturity to harvesting, it may secrete certain toxic metabolites in seeds. Which may be reduces the quality and quantity of sorghum seeds.

Conclusions:-

From the results and observations it is concluded that *Curvularia lunata* is a serious constraint of sorghum. It attack on sorghum and responsible for the loss in yield. From visual observations, it reduces the quality and vigor of sorghum. As sorghum grains contain blackish mat along with them it is not good for human consumption. Due to continuous accumulation of *Curvularia lunata* on sorghum grain may lead to the deposition of certain harmful toxic metabolites in sorghum grain. For this reason it is recommended that such infected sorghum seeds were not good for the dietary purposes.

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A Comprehensive Review of Biochemical Analysis of Sheep By-Products

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A Comprehensive Review of Biochemical Analysis of Sheep By-Products

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Abstract

Sheep (*Ovis aries*) contribute significantly to global agriculture and industry through their primary products—meat, milk, and wool—and valuable by-products such as lanolin, bones, and bioactive compounds. This review provides a comprehensive analysis of the biochemical composition of sheep-derived by-products and highlights their industrial, nutritional, and environmental significance. Using advanced analytical techniques, significant progress has been made in characterizing proteins, lipids, carbohydrates, and minerals present in these materials. This paper also addresses challenges in utilizing sheep by-products and discusses future directions for research and sustainable practices.

Keywords: Sheep By-products, Lanolin, Oleic Acid, *Ovis aries*, Palmitic Acid, Sheep Wool

1. Introduction

Sheep have been domesticated for centuries, serving as a source of food, textiles, and industrial materials. While their meat and milk have been extensively studied, the biochemical potential of their by-products—including wool, bones, and lanolin—has only recently gained attention [1]. These by-products are rich in bioactive compounds and offer potential applications in nutraceuticals, cosmetics, biomedicine, and environmental sustainability.

Research and innovation have huge importance in sheep and goat meat production, processing as well as food safety. Special emphasis will be placed on the imaging and spectroscopic methods for predicting body composition, carcass and meat quality [2]. This paper delves into the biochemical composition of key sheep-derived materials, explores analytical methods used for characterization, and evaluates their applications across industries.

2. Biochemical Composition of Sheep By-Products

1. Wool

Wool, a primary by-product of sheep, is composed mainly of keratin, a fibrous structural protein [3]. There are currently no viable recycling options for the 10–15% of waste wool produced worldwide each year. In agriculture, leftover wool could be utilized as an organic amendment and source of nutrients. About 30% more organic carbon and nitrogen were added to the soil when waste wool was applied. Applying waste wool increased yield by 50% and water use efficiency by 30% compared to control. Higher biological fertility of the soil is indicated by higher soil enzymatic activity (11–27%) [4].

Composition:

- Proteins: Keratin (70-85%), which contains cysteine residues forming disulfide bonds responsible for wool's strength and elasticity [1].
- Lipids: Surface lipids include free fatty acids, wax esters, and cholesterol derivatives.
- Minerals: Sulfur, zinc, and calcium contribute to wool's unique properties.

Applications:

Keratin hydrolysates are used in regenerative medicine for tissue scaffolding.

Lanolin, derived from wool grease, is widely used in cosmetics and pharmaceuticals [5].

2. MILK:

- Sheep milk is known for its high nutritional content and biochemical richness:

Composition:

- Proteins (6-7%): Rich in caseins (α, β, κ) and whey proteins.
- Lipids (6-9%): High in medium-chain fatty acids like capric and caprylic acids.
- Carbohydrates (4.5-5.0%): Primarily lactose [6].

Micronutrients:

- Minerals: Calcium, phosphorus, potassium, and magnesium.
- Vitamins: A, D, E, and B-complex vitamins [7].

Applications:

- Used in the production of premium cheeses (e.g., Roquefort, Manchego).
- Bioactive peptides derived from milk proteins exhibit antihypertensive and antimicrobial properties.

3. BONES AND TISSUES

- Sheep bones and connective tissues are rich sources of minerals and bioactive compounds:

Bones:

- Major minerals: Calcium phosphate (hydroxyapatite) and magnesium.

Trace elements: Zinc and copper [8].

Tissues:

- Collagen: Found in connective tissue, used for gelatin and wound healing.
- Lipids: Rich in conjugated linoleic acid (CLA), a bioactive fatty acid with potential anti-cancer properties [9].

Applications:

- Collagen extracted from bones and tissues is used in biomedical applications.
- Bone meal is utilized as an organic fertilizer due to its high phosphorus content.

3. Analytical Techniques for Biochemical Analysis

1. Chromatography:

- Gas Chromatography (GC): Identifies and quantifies fatty acid profiles in wool lipids and lanolin.
- High-Performance Liquid Chromatography (HPLC): Separates and quantifies amino acids, peptides, and vitamins.

Spectroscopy:

- Fourier Transform Infrared (FTIR): Characterizes functional groups in keratin and lanolin.
- UV-Vis Spectroscopy: Measures protein and peptide concentrations in milk and tissue extracts.

Mass Spectrometry: Proteomics and Lipidomics are applied to identify and quantify complex molecules in milk and wool extracts.

Electrophoresis: SDS-PAGE: Used for protein profiling of milk proteins and wool keratin.

Table 1. Wool Composition

Component	Percentage %
Keratin	75-85
Lipids	10-15
Trace Elements	2-5
Others	2-5

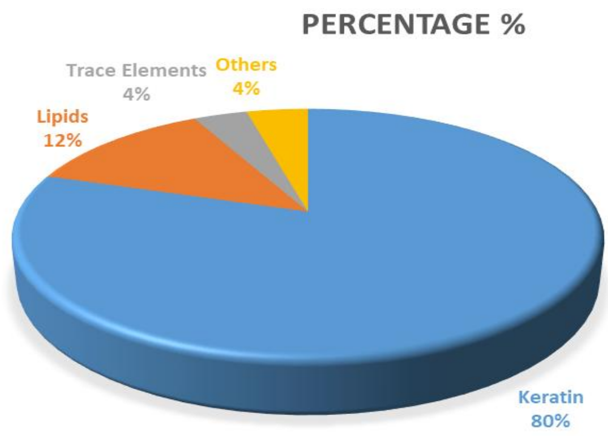

Fig. 1: Pie Chart Based om Table No. 1 Showing % Wise distribution of Wool Composition.

Table 2. Fatty Acid Composition of Lanolin [5]

Fatty Acid	Percentage %
Oleic Acid	40
Palmitic Acid	25
Linoleic Acid	15

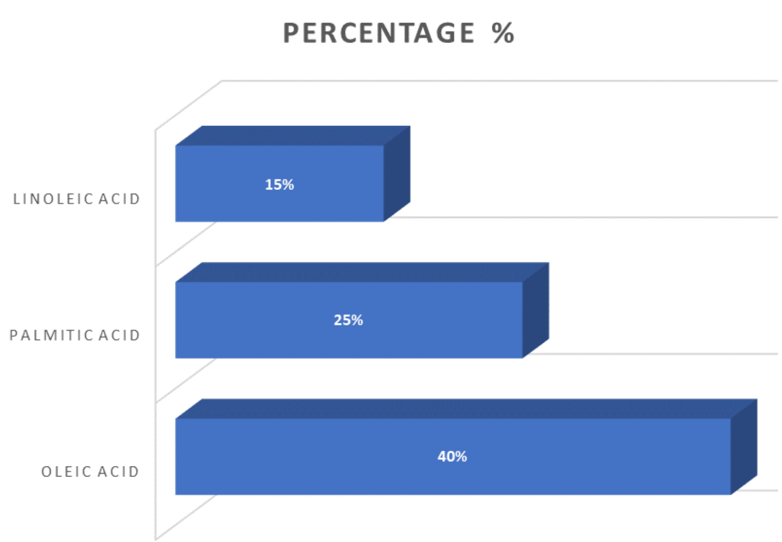

Fig. 2- Bar Graph Showing % wise Fatty Acid Composition of Lanolin developed from Table 2.

Table 3. Mineral Composition of Sheep Bones [8]

Mineral	Percentage (%)
Calcium	38-40%
Phosphorus	18-20%
Zinc	1-2%

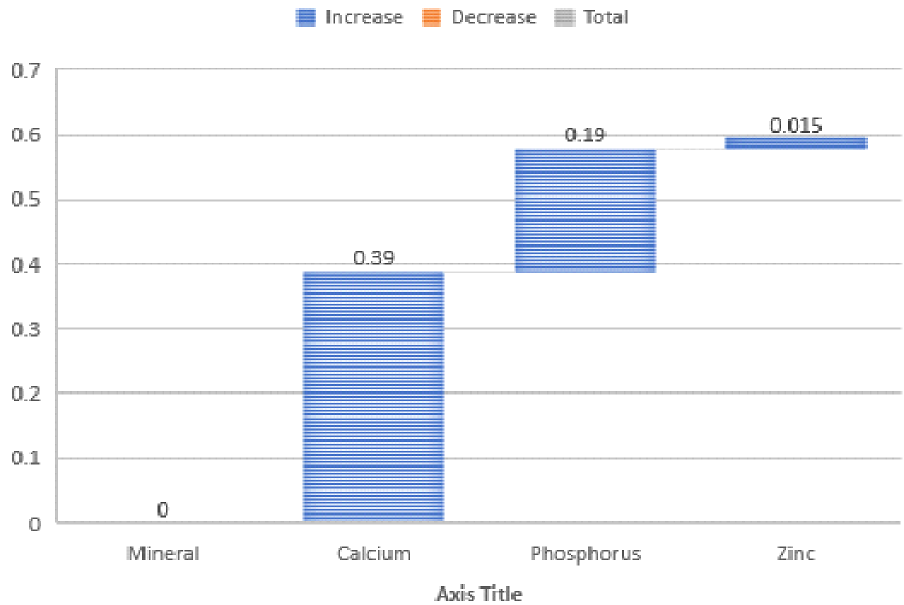

Fig. 3- Waterfall Graph Showing % Wise Distribution of Minerals in Composition of Sheep Bones

Table 4. Composition of Sheep Milk. [10]

Minerals	Percentage (% By Weight)
Protein	7
Fats	8
Lactose	5
Minerals	0.8

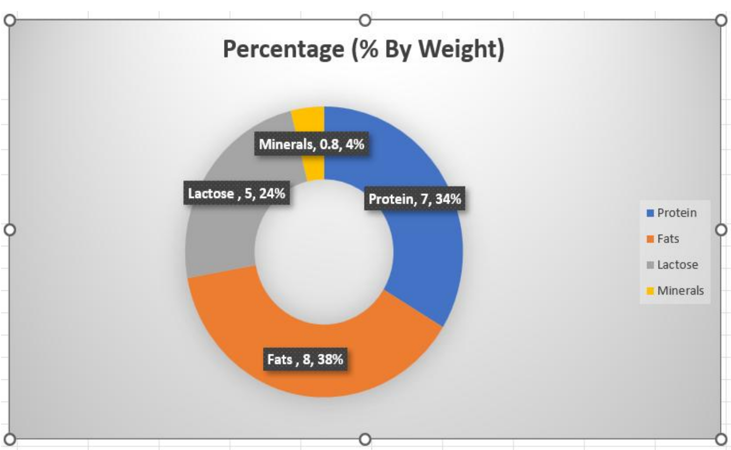

Fig. 4- Doughnut graph Showing % Wise Distribution of components in Sheep

4. Applications and Implications

A. Agricultural and Industrial Applications:

- Wool keratin is used in biodegradable plastics and textiles.
- Sheep milk-derived peptides have potential as dietary supplements.
- Bone meal serves as an organic fertilizer.

B. Biomedical Applications:

- Lanolin is used in pharmaceutical ointments for wound healing [5].
- Collagen and gelatine from tissues are used in regenerative medicine.

C. Environmental Sustainability:

- Sheep by-products like wool waste are being repurposed into eco-friendly composites.
- Utilizing bones as fertilizers reduces waste in sheep farming.

5. Challenges and Future Directions

Challenges:

- Breed-specific variability affects the composition of sheep by-products.
- Limited access to advanced biochemical analysis techniques in rural areas.

Future Directions:

- Genetic studies to enhance bioactive compound content in sheep products.
- Development of cost-effective methods for bioactive compound extraction.
- Large-scale studies on the environmental benefits of sheep by-product utilization.

6. Conclusion

Sheep by-products offer immense biochemical potential, with applications ranging from food and agriculture to medicine and industry. Advanced analytical methods have enabled the characterization of these materials, uncovering novel uses and promoting sustainable practices. Future research should focus on optimizing utilization and addressing region-specific challenges to enhance the value of these resources.

Conflicts of interest: The author stated that no conflicts of interest.

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