

# IJEAST

INTERNATIONAL JOURNAL
OF ENGINEERING APPLIED SCIENCE
AND TECHNOLOGY

VOLUME : 1 ISSUE : 12 Print / Issue Publication Date: 30-Nov-2016

ISSN : 2455-2143

Indexed In

WWW.IJEAST.COM

editor@ijeast.com

*International Journal of Engineering Applied Sciences and Technology, 2016*
**Vol. 1, Issue 12, ISSN No. 2455-2143, Pages 112-113**
Published Online October-November 2016 in IJEAST (http://www.ijeast.com)



# SUGAR CONTENTS IN HEALTHY AND AFFECTED LEAVES OF SORGHUM VULGARE, L. DUE TO GRAIN MOULD

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*ABSTRACT* - **Sorghum is an important food and fodder crop of India. Grain mould in sorghum is caused by *Sphacelotheca reiliana*. In the present studies post infectional changes in sugars in healthy and infected leaf of sorghum were investigated. Gradual reductions in sugar contents were observed in grains of sorghum affected with *S. reiliana*.**

*Keywords:* **Sugar, *Sphacelotheca*, biochemical, healthy, infected grains**

## I. INTRODUCTION

Grain mold is a major disease of sorghum (*Sorghum bicolor* (L.) Moench that affects grain production and quality. The disease is particularly important on improved, short and medium-duration sorghum cultivars that mature during the rainy season in humid, tropical and subtropical climates. Photoperiod-sensitive cultivars that mature after the rains often escape mould infection. Sorghum cultivars with white grain pericarp are particularly more vulnerable to grain mould than those with brown and red grain pericarp. Grain mold can be broadly defined as preharvest grain deterioration caused by several fungal species interacting parasitically and/or saprophytically with developing grain (Aher and Nair, 2003).

Grain weathering, on the other hand, is a post physiological maturity problem when grain turn discolored and tissues are damaged by fungal colonization due to wet weather. One of the first visible symptoms is pigmentation of the lemma, palea, glumes, and lodicules. Depending on the fungus involved, the grain maturity stage and severity of infection, the symptoms could be highly variable. Severely infected grain is fully covered with mould; partially infected grain may look normal and discoloured. Grain sorghum can be affected by a wide variety of diseases, which can cause serious losses of production and profitability (Thakur et al., 2003b).

Head smut is caused by the soil borne fungus *Sphaceltheca*. This pathogen can readily mutate and overwhelm plant resistance mechanisms. There are several known races of head smut, including Southern head smut. The fungal spores live in the soil and germinate in the spring. Spores will actively invade the sorghum plant in the nodal region of the shoot apex. The disease will continue to grow in the plant, actively destroying the reproductive tissues. A black mass of spores replaces some or all of the sorghum head. When infected, some hybrids are dwarfed and will tiller profusely (with all tillers producing smutted heads). Spores move with wind and water to the soil and serve as inoculum for the next year. Since each infected plant produces millions of spores, the threat of infection for the next year is increased. Head smut spores can remain viable for years in the soil (Thakur et al., 2006).

Grain mould, the most important and widespread disease of sorghum worldwide, is a major constraint to sorghum productivity. Grain mould development is particularly severe in the short duration hybrid cultivars and varieties that are grown during the rainy season under warm and humid conditions. It is caused by a number of unspecialized fungal pathogens that severely affect grain mass, seed viability, grain quality and market price.

## II. MATERIAL AND METHODS

The leaves of healthy and infected grains were dried at $75^0$C and powdered. Equal quantities of samples were extracted with 80 per cent alcohol for 24 hrs. at room temperature. The filtrates were then evaporated at $80^0$ C to almost dried and redissolved in 1 ml of ethanol. These were spotted on Whatman No.1 filter paper sheet in equal quantities in triplicate along with known sugars. Descending chromatography method (Block et al.,1955) using n- butanol, acetic acid and distilled water the ratio of 4:1:15 as solvent was employed. After air drying, chromatograms were sprayed with Benzidine reagent, air dried and then kept at $90^0$ C for 5 minute for detection of spots. The intensities of the spots were compared visually and according to their concentration were graded in five categories in Table 1.

## III. RESULTS AND DISCUSSION

During this investigation it was observed that healthy inflorescence had monosaccharides glucose and ribose in moderate quantities whereas arabinose was more. The disaccharide lactose was less. In grain mould the



monosaccharides glucose and ribose as well as disaccharides lactose completely disappeared and only very little amount of arabinose was left. It may be because the fungus utilized these sugars for its growth and sporulation in the host. The disaccharide lactose must be spit up into glucose and galactose and must be utilized by the fungus. The healthy leaves had more amount of the glucose and lactose. The rust fungus utilized only small amount of glucose whereas arabinose and lactose remained the same.

Gradual reductions in sugar contents were observed in leaves of *Sorghum vulgare* affected with *Sphacelotheca reiliana.* The degree of reduction varied with different sugars. In diseased leaves all the sugars, glucose, raffinose, rhamnose and sucrose were reduced considerably ( Sharma and Sharma, 1970). Khapake et.al., (2003) and Singh and

Tandon (1970) noticed that sucrose, glucose and fructose and malic acid were present both in the healthy and infected fruit tissues. Marked differences were, however, noticed in their intensities in certain cases. The concentration of sucrose was considerably reduced in the infected fruits. This may be attributed to sugar consumption by the pathogen or to its hydrolysis into the component sugars, glucose and fructose by the enzyme produced by the fungus (Williams and Mc Donald, 1983). These observations do not agree with those reported by Suryanarayana, et al., 1964. Deshmukh et al., (2001) and Mpofu and McLaren. (2014) also observed metabolic alterations in *Sorghum bicolor*.

It can be assumed, from the results obtained that mostly monosaccharides are utilized by phytopathogens and saprophytes for their growth and establishment in the host tissue. Some of these are capable of splitting up disaccharides also and use them for their growth and sporulation. Saprophytes that occur on moulded grains must be the ones that synthesized trisaccharides.

**Table 1: Sugar content in healthy and infected grains of sorghum**

| Plant Material | Glucose | Lactose | Arabinose | Ribose | Rhamnose |
|---|---|---|---|---|---|
| Control Healthy Grains | ++ | + | +++ | ++ | - |
| Grain smut | -- | -- | + | -- | -- |

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