Advances in Bioresearch
Adv. Biores., Vol 8 (4) July 2017: 71-72
©2017 Society of Education, India
Print ISSN 0976-4585; Online ISSN 2277-1573
Journal's URL:http://www.soeagra.com/abr.html
CODEN: ABRDC3
DOI: 10.15515/abr.0976-4585.8.4.7172

Advances in Bioresearch

ORIGINAL ARTICLE

Biochemical Study of Male Sterile and Fertile Pollen Anthers in Sorghum (*Sorghum bicolor* L. Monech)

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ABSTRACT
Cytochemical studies have revealed that the sterile pollen are totally I_2KI negative and do not synthesize starch. On the other hand fertile pollen showed presence of abundant starch in their cytoplasm. Similarly biochemical studies also revealed that the sterile pollen showed lower levels of reducing and total sugars as compared to B and R line pollen. The mature fertile anthers of B and R line showed higher amounts of sugars. Sugars and starch are respiratory substrates and they play an important role in metabolism of pollen.It has been observed that during pollen maturation, single celled microspores (uni-nucleate Pollen) undergo a rapid phase of starch biosynthesis. Sucrose stored in the vacuoles of pollen is converted in to starch (Datta et al., 2001). Very little is known about the genes and the intracellular controls that regulate the sucrose – starch pathway in the microspores. Datta et al., (2001), concluded that the starch filled and starch deficient stages of fertile and sterile pollen in sorghum is due to increased and decreased sink strengths respectively, and their associated changes in carbohydrate metabolism. Panchaksharappa and Rudramuniyappa (1982), implicated that the cause of sterility in Sorghum bicolor L. Monech sterile line (2219A) is primarily to the deficiency of carbohydrate source from the maternal plant, which has further reflected in gradual deficiency of starch storage.
KEYWORDS : SUGARS, STARCH,SORGHUM BICOLOR L. MONECH.

Received 09/02/2017 Revised 20/02/2017 Accepted 08/04/2017

How to cite this article:
R. D. Borse. Biochemical Study of Male Sterile and Fertile Pollen Anthers in Sorghum (*Sorghum bicolor* L. Monech)Adv. Biores., Vol 8 [4] July 2017: 71-72.

INTRODUCTION

Significant differences between male sterile and male fertile anthers were reported in the biochemical levels of amino acids, total proteins, protein profiles, RNA, Reduced amounts of histidine, glutamic acid, glycine, leucine, phenylalanine and threonine and enhanced quantity of alanine, proline, serine and tyrosine were reported in male sterile anthers as compared to male fertile anthers (Tripathi et al., 1981). It is known that the tapetal layer is thought to be the site of synthesis for many nutrients required for developing microspores (Kaul, 1988). Young et al., (1998) observed that total respiratory rate, the rate of alternative respiration and activities of cytochrome c oxidase; malate dehydrogenase and 6-phosphoglucose dehydrogenase in the anthers of the sterile lines were lower than those in the fertile lines.

MATERIAL AND METHODS

Cytochemical localization of macromolecules like RNA, total proteins and insoluble polysaccharides were carried out from the fixed materials employing squash techniques. Cytochemical localization of RNA in the fertile and sterile pollen was performed following the method of Tepper and Gifford (1962), employing Pyronin–G reagent. Localization of total proteins the mercuric bromophenol blue method of Mazia et al., (1953) was used for cellular localization of total proteins, in the microspores and pollen of all the three lines. This method is specific for localization of total proteins (Jensen, 1962). Cytochemical

Detection of Starch Cytochemical detection of starch was carried out using I2KI reagent, as detailed by Jensen (1962).

RESULTS AND DISCUSSION

In present investigation attempts have been made to study the changes inBiochemical analysis of RNA, total proteins and Detection of Starch of gene-cytoplasmic male sterile sorghum lines has been investigated in detail with respect to differences in A, B and R lines. A comparison of A, B and R lines with respect to the above mentioned metabolites and significance of difference of metabolites between these three lines RNAThe mature fertile anthers of R line (35M) showed high amount of RNA. The fertile anthers of B line (IS 104 B) also showed similar quantity of RNA. The male sterile anthers of 104 A line contained less amount of RNA.Total ProteinsIt was observed that amount of total proteins in the male sterile anthers of 104 is significantly lower than that of fertile B and R lines anthers.In starch the mature fertile anthers of R line (35 M) showed high amount of starch. The fertile anthers of B line (104 B) also showed difference in the quantity of starch. Here both R line and B line anthers contained high amount of starch while the A line anthers possessed lower amount of starch. The difference in starch content between the A and B line and A and R line anthers is variable.

CONCLUSION

Results obtained in the present investigation also clearly indicate that non-availability of respiratory substrate (RNA, starch and total proteins) may be responsible for the observed poor growth of microspores. Due to non availability of required quantity of energy, the microspores do not synthesis metabolites like RNA and proteins. Due to this metabolism of sterile microspores suffer and the microspores start degeneration. Apparao and Shah (1988) and Avhad and Apparao (2005), have reported that non-syntheses of nucleic acids and proteins in the sterile microspores lead to male sterility.
Our experimental results indicate that the reproductive failure leading to male sterility in the two male sterile lines of sorghum (104A and 116A) is gametophytic, occurring prior to first pollen mitosis. The microspores of fertile anthers showed pollen mitosis leading to the formation of vegetative and generative nuclei. On the other hand, the microspores of sterile pollen never showed any signs of first pollen mitosis. Based on our experimental results, we propose that failure of pollen mitosis is the main reason for the observed male sterility in both male sterile lines (104 A and 116A) of sorghum. It appears that in sorghum, pollen mitosis is controlled by both dominant nuclear genes and some mitochondrial genes. Any one of these two (either a dominant nuclear gene or dominant mitochondrial gene [normal cytoplasm]) is necessary for occurrence of normal pollen mitosis.

ACKNOWLEDGEMENT

The authors are grateful to Dr. K.J.Salunke, Head, Department of Botany and Dr. P.M. Dighe, I/C Principal, P.V.P. College, Loni, for providing necessary laboratory facilities.

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