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Agricultural Industrial Significance of Cotton, Types, Cotton Varieties and Role in Disease Control

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Abstract

Cotton is the most important crop that is used for the production of fibers based products, textiles, agricultural products, medical devices and bioelectronics devices. It makes chemical bonded structure during paper making in which cellulose molecules are cross linked to the each other as forming massive structure. It is biochemically compressed of monoterpenes such as myrcene, pinene, camphene, limonene, and sabinene. *Gossypium barbadense* is comprised of proteins, fatty acids, and long chains of carbohydrates that makes through cross linked network and form intra molecular bonding. *Gossypium hirsutum* is a short-staple cotton fiber, which means that it is not as high-quality as other forms of this textile fiber. Its seeds also have applications in food industry as edible oil that can be used in shortening, margarine, salad and cooking oils, and for protective coverings. *Gossypium arboretum* has much significant economic value as compared to other cotton varieties due to its fibrous characteristics. One of the most important applications is their use in clothing for manufacturing of large varieties of clothes thus significant role in leading industries.

Keywords: Textiles, fibrous nature, cotton, cellulose molecules, biotechnological role.

INTRODUCTION

Cotton is the most important crop that is used for the production of fibers based products, textiles, agricultural products, medical devices and bioelectronics devices [1, 2]. Thus, it has wide use in the fields of industrial purposes due to its easy cultivation and fast growing conditions. It is delicious and delicate due to lofty nature. Cotton is in the mallow family and produces delicate, lovely flowers [3]. Other members of the mallow family include hollyhocks and hibiscus, used to brighten gardens all over the world. It fibers are maintained during processing of different products manufacturing like cotton buds etc. The cotton fiber forms around the seeds of the cotton plant. It helps carry the seeds long distances on the wind so the baby plant can grow up far away. It is also helpful for dispersal of seeds thus helpful to remove the wastes from different sources thus cleaning the environment [4-6].

Cotton also used for different purposes like paper making due to its fine fibers as compared to the other plants as compatible due to structural properties. It makes chemical bonded structure during paper making in which cellulose molecules are cross linked to the each other as forming massive structure [7]. Cotton lint is also made into other products including sewing thread, cordage and fishing nets. This property of cotton is used both industrial and commercial scale and preceded large amount of papers according to cellulose quality in cotton. This application of cotton is commonly used for paper making, books and other educational purposes. Short fibers are processed into a range of products, including papers, twine, automobile

upholstery, explosives, plastics and photographic film [8].

Characteristics	Gossypium hirsutum	Gossypium barbadense	Gossypium arboretum	REFERENCES
Family	Mallows	Malvaceae	Mallows	[8, 10]
Order	Malvales	Malvales	Malvales	[7, 16]
Genus	Gossypium	Gossypium	Gossypium	[2, 6]
Common Uses	Garments	wound dressing	uterine contractions	[6, 9]
Type of Applications	Industrial	Industrial	Industrial	[17, 19]
Importance	Agricultural	Agricultural, Medicinal	Agricultural, Medicinal	[22, 27]

Biochemical Potential of Cotton

Different plants are used as medicinal due to potential applications in medical as well as pharmaceutical applications. Presence of specific compound either antioxidants, polyphenols are response for their potential against the specific diseases [9]. Cotton also acts as a medicinal plant because of the chemical compounds that have been isolated from. When different compounds isolated from cotton in crude form, it give large variety of chemical and biological compounds that can be used for further industrial processes [10]. Monoterpenes such as myrcene, pinene, camphene, limonene, and sabinene isolated from cotton possess anti- microbial, anti-inflammatory, anti-cancer, anti-oxidant, and gastro-protective properties. Sometimes, cotton plant becomes infected with certain disease due to pathogens attaches that leads to economy of different crops. There is need to designed for farming as well as cultivating of cotton in clean environment so that precocity of cotton and related can be increases [11, 12].

Agricultural Role of Gossypium hirsutum

There are different types of cotton depending upon the nature of genome, particular application, biochemical composition and use in particular fields [12-14]. Gossypium hirsutum as most important type of crop used for industrial applications especially textiles. Gossypium hirsutum is a short-staple cotton fiber, which means that it is not as high-quality as other forms of this textile fiber. This crop has advantages over the cotton varieties due to its growing conditions under harsh climatic conditions. This property makes distinguish it from each other of same family member [15, 16].

Fig-1: Shows the morphological picture of Gossypium hirsutum

Biochemically, Gossypium hirsutum is comprised of different types of acids, fatty acids and polyphenols compounds [3]. These makes it sticky and softness nature. These are 2,3-dihydrobenzoic acid; salicylic acid, betaine, a fatty alcohol, a phytosterol, hirsutrin, isoastragalin, palmitic acid, oleic acid, linoleic acid, a-pinene and gossypicyanin. Its seeds also have applications in food industry as edible oil that can be used in shortening, margarine, salad and cooking oils, and for protective coverings. Thus, this type of cotton has diverse applications range with composition of acids, proteins and polyester based compounds. Its genes can me editing at genetic engineering level for production of varieties based on GMOs [16-18].

Agricultural Role of Gossypium barbadense

G. barbadense form a brush like structure initially when grown but smaller brush connected to each other and form the larger brush like delicate structure. The lobes of G. barbadense's are also more deeply cut, about twice the length of the leaf [19, 20]. Its growing ability in warm temperature leads to advanced features that helps them to survive in different temperate conditions. Proteins present in inner structure divided into two types such as N-type and C-type. C-type proteins play a central role in the biological processes of plant growth and development while the N-terminal domain categories the resistance responses and helps against the pathogenic attack and fungal infections. These functional features makes the cotton as ideal crop that possess all features as well as industrial applications [21, 22].

Gossypium barbadense is comprised of proteins, fatty acids, and long chains of carbohydrates that makes through cross linked network and form intra molecular bonding. It leads to intact bonding between fibers and thus agricultural and pharmaceutical applications. It is found in tropical areas and fibrous nature and hence used longer seed for making yarn to be woven into textile fabrics including sewing thread, cordage and fishing nets. Cotton textile cuttings and rags serve in the paper industry for the production of the best writing, book and drawing paper. Linters have also been used for the production of cellulose acetate and viscose. These viscous properties leads foundation for their uses in combination as compared to the other compounds. Cellulose and its related sugars that found

in cotton make the structure tough and crystalline structure in which cellulose molecules forming network [22-24].

Fig-2: Shows the morphological picture of Gossypium barbadense

Agricultural Role of Gossypium arboretum

Gossypium arboretum possesses the different structural characteristics that enables them to grown even harsh environments. It is comprised of different organic compounds that increase its value as medicinal uses. It has different applications in industries and toys making products. Monopoly unsaturated oil, unsaturated fatty acids . It contains palmitic acid 20–25%, stearic acid, oleic acid, and linoleic acids**.** Its branches are covered with pubescence and are purple in colour. They are more in height than other crops due to extended area of leaves and nodules [17, 19, 22]. Their leaves exhibits the star shaped due to excess amount of chlorophylls that lost by changing colour of each particular leave. The leaves are glabrescent, meaning the pubescence is lost with age, but when it is present on young leaves, it is both stellate and simple [25].

Gossypium arboretum has much significant economic value as compared to other cotton varieties due to its fibrous characteristics. One of the most important application is their use in clothing for manufacturing of large varieties of clothes thus significant role in leading industries. The fibres are spun into yarns and these are woven into fabrics, in the farm or house or in factories. As medicinal plant, it is used to treat the different infectious diseases such as coughs and all disorders of the breast and lungs they cause expectoration, and are very balsamic and astringent. Its extracts are used to inhibit the growth of cancerous cells of lung and breast thus targets them at cellular and molecular level [26, 27].

Agricultural Role in controlling Cotton and related Diseases

Many types of insects, bugs, cotton leaf worms affected the cotton varieties all around the world. Chemical based pesticides are used to control the pests and poisonous works that causing the yield to reduce at certain level. Limited control of damage by insect pests can be achieved by proper timing of planting and other cultural practices or by selective breeding of varieties having some resistance to insect damage. Biopesticides are more reliable and safe method to kills the pests using the biological tools under the umbrella of agricultural farming. There is need to improve the quality of biopesticides as pests growing under different environmental conditions [28-32].

CONCLUSION

As cotton is the most important growing crop all around the world since its applications for textiles industries. Cotton Textile Industry is very important, for it has to meet the demand for clothes and exports too. There is need to design agricultural based machineries that will helpful to increase the yield of cotton also discovery of novel compounds for editing the gene modification in different plants.

REFERENCES

1. Gipson, J. R., & Ray, L. L. (1969). Fiber elongation rates in five varieties of cotton (Gossypium hirsutum L.) as influenced by night temperature 1. Crop Science, 9(3), 339-341.
2. Ali, A., Tahir, M., Ayub, M., Ali, I., Wasaya, A., & Khalid, F. (2009). Studies on the effect of plant spacing on the yield of recently approved varieties of cotton. Pak. j. life soc. sci, 7(1), 25-30.
3. Anjum, R. U. K. H. S. A. N. A., Ahmed, A. M. I. R., Ullah, R. A. H. M. A. T., Jahangir, M. U. H. A. M. M. A. D., & Yousaf, M. (2005). Effect of soil salinity/sodicity on the growth and yield of different varieties of cotton. Int. J. Agri. Biol, 7(4), 606-608.
4. Bridge, R. R., Meredith Jr, W. R., & Chism, J. F. (1971). Comparative Performance of Obsolete Varieties and Current Varieties of Upload Cotton 1. Crop Science, 11(1), 29-32.
5. Husain, M. A., & Lal, K. B. (1940). The Bionomics of Empoasca devastans Distant on some Varieties of Cotton in the Punjab. Indian Journal of Entomology, 2(pt. 2).
6. Huang, J., Hu, R., Rozelle, S., Qiao, F., & Pray, C. E. (2002). Transgenic varieties and productivity of smallholder cotton farmers in China. Australian Journal of Agricultural and Resource Economics, 46(3), 367-387.
7. Moser, H. S., McCloskey, W. B., & Silvertooth, J. C. (2000). Performance of transgenic cotton varieties in Arizona. In 2000 Proceedings Beltwide Cotton Conferences, San Antonio, USA, 4-8 January, 2000: Volume 1. (pp. 497-499). National Cotton Council.
8. Ahmad, A., Wajid, A., Hussain, M., Akhtar, J., & Hoogenboom, G. (2016). Estimation of temporal variation resilience in cotton varieties using statistical models. Pakistan Journal of Agricultural Sciences, 53(4).
9. Blank, L. M. (1944). Effect of nitrogen and phosphorus on the yield and root rot responses of early and late varieties of cotton. Journal of the American Society of Agronomy.
10. Rains, G. C., Perry, C. D., Vellidis, G., Thomas, D. L., Wells, N., Kvien, C. K., & Dales, H. D. (2002). Cotton yield monitor performance in changing

varieties. In 2002 ASAE Annual Meeting (p. 1). American Society of Agricultural and Biological Engineers.
11. Di, J. C., Xu, N. Y., Chen, X. S., Wu, Q. J., Xiao, S. H., Liu, J. G., & Yin, J. M. (2008). Study on the resistance of different type of upland cotton varieties to cotton leaf roller (Sylepta derogata). Cotton Sci, 5.
12. Ek-Ramos, M. J., Zhou, W., Valencia, C. U., Antwi, J. B., Kalns, L. L., Morgan, G. D., ... & Sword, G. A. (2013). Spatial and temporal variation in fungal endophyte communities isolated from cultivated cotton (Gossypium hirsutum). PLoS One, 8(6), e66049.
13. Zhang, D. G., Kong, F. L., Zhang, Q. Y., Liu, W. X., Yang, F. X., Xu, N. Y., ... & Zou, K. (2003). Genetic Improvement of Cotton Varieties in the Yangtse Valley in China since 1950s Ⅰ. Improvement on Yield and Yield Components. Acta Agronomica Sinica, 2(8).
14. Sidhu, A. S., & Dhawan, A. K. (1979). Incidence of cotton leaf-roller (Sylepta derogata F.) on different varieties of cotton and its chemical control. Entomon, 4(1), 45-50.
15. Bie, S., Kong, F. L., Zhou, Y. Y., Zhang, G. M., Zhang, Q. Y., & Wang, X. G. (2001). Genetic diversity analysis of representative elite cotton varieties in three main cotton regions in China by RAPD and its relation with agronomic characteristics. Scientia Agricultura Sinica, 34(6), 597-603.
16. Rathinavel, K. (2018). Principal component analysis with quantitative traits in extant cotton varieties (Gossypium hirsutum L.) and parental lines for diversity. Current Agriculture Research Journal, 6(1), 54.
17. Wendel, J. F., Brubaker, C. L., & Percival, A. E. (1992). Genetic diversity in Gossypium hirsutum and the origin of upland cotton. American Journal of Botany, 79(11), 1291-1310.
18. Ramzan, M., Nadeem, M., Maqbool, M., & Murtaza, G. (2019). Screening of Resistant Cotton Varieties against Thrips, Thrips tabaci in Multan, Punjab, Pakistan Based on Population Dynamic. Punjab Univ J Zool, 34, 185-189.
19. Yousafi, Q., Afzal, M., Aslam, M., Razaq, M., & Shahid, M. (2013). Screening of brinjal (Solanum melongena L.) varieties sown in autumn for resistance to cotton jassid, Amrasca bigutulla bigutulla (Ishida). Pakistan Journal of Zoology, 45(4).
20. Islam, M. N., Molla, M. R., Rohman, M. M., Hasanuzzaman, M., Islam, S. M. N., & Rahman, L. (2012). DNA fingerprinting and genotyping of cotton varieties using SSR markers. Notulae Botanicae Horti Agrobotanici Cluj-Napoca, 40(2), 261-265.
21. Akhtar, M., Cheema, M. S., Jamil, M., Farooq, M. R., & Aslam, M. (2002). Effect of plant density on four short statured cotton varieties. Asian Journal of Plant Sciences.
22. Badami, R. C., Patil, K. B., Shivamurthy, S. C., & Shanbhag, M. R. (1978). Cyclopropenoids and Fatty Acid Composition of Five Varieties of Cotton Seed Oils. Fette, Seifen, Anstrichmittel, 80(7), 276-278.
23. Huangjun, L., & Myers, G. O. (2011). Combining abilities and inheritance of yield components in influential upland cotton varieties. Australian Journal of Crop Science, 5(4), 384-390.
24. Dixit, G., Srivastava, A., Rai, K. M., Dubey, R. S., Srivastava, R., & Verma, P. C. (2020). Distinct defensive activity of phenolics and phenylpropanoid pathway genes in different cotton varieties toward chewing pests. Plant signaling & behavior, 15(5), 1747689.
25. Mehrotra, K. N., & Amrit, P. (1992). Pyrethroid resistance in Helicoverpa annigera Hubner V. Response of populations in Punjab in Cotton. Pesticide Research Journal, 4(1), 59-61.
26. Bundy, C. S., & McPherson, R. M. (2000). Dynamics and seasonal abundance of stink bugs (Heteroptera: Pentatomidae) in a cotton–soybean ecosystem. Journal of Economic Entomology, 93(3), 697-706.
27. Hosseinali, F., & Thomasson, J. A. (2018). Variability of fiber friction among cotton varieties: Influence of salient fiber physical metrics. Tribology International, 127, 433-445.
28. Gawaad, A. A. A., & El-Shazli, A. (1970). Studies on Thrips tabaci Lindman. V. Attraction of different varieties of cotton to Thrips tabaci. Zeitschrift fur Angewandte Entomologie, 66(4), 391-394.
29. Nie, X., Wen, T., Shao, P., Tang, B., Nuriman- guli, A., Yu, Y., ... & Lin, Z. (2020). High- density genetic variation maps reveal the correlation between asymmetric interspecific introgressions and improvement of agronomic traits in Upland and Pima cotton varieties developed in Xinjiang, China. The Plant Journal, 103(2), 677-689.
30. Katiyar, K. N. (1977). Impact of sequence of flowering on the incidence of bollworms in some varieties of cotton. Indian Journal of Entomology, 39(4), 324-332.
31. Olsen, K. M., Daly, J. C., Holt, H. E., & Finnegan, E. J. (2005). Season-long variation in expression of Cry1Ac gene and efficacy of Bacillus thuringiensis toxin in transgenic cotton against Helicoverpa armigera (Lepidoptera: Noctuidae). Journal of economic entomology, 98(3), 1007-1017.
32. Baum, J. A., Sukuru, U. R., Penn, S. R., Meyer, S. E., Subbarao, S., Shi, X., ... & Clark, T. L. (2012). Cotton plants expressing a hemipteran-active Bacillus thuringiensis crystal protein impact the development and survival of Lygus hesperus (Hemiptera: Miridae) nymphs. Journal of economic entomology, 105(2), 616-624.