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Review Article

Significance of Guar as Potential Plant and Role in Plant Activation Metabolism

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Abstract

The grains of guar are dehusked mechanically, milled, hydrated and screened according to their use. The guar gum has many industrial applications. It is self-pollinated annual plant having 14 (2n) chromosomes number and belongs to family Fabace. Genus *Cyamopsis* belongs to sub-family ‘‘Papilionaceae’’ and the tribe ‘‘Indigofereae’’. In the textile industry, it is used in sizing, printing and in finishing. In the paper industry, enhances the sheets formation, folding and gives denser surface for the printing. In the explosion industry, it is used as a waterproofing agent. In milk products it is used as a binding agent. Their genetic diversity can be used as an active tool to predict the association between various characters in genetically different population for improvement of crop enhancement practices. Its yield with different chemical compound trait and is recognized to be related with a number of constituent traits and is extremely affected by environmental deviations. These traits are themselves consistent. The correlation is very significant in plant breeding for its consideration in dependency among two or more characters.

Keywords: Guar, genetic traits, biomedical applications, correlation, plant breeding, characters.

INTRODUCTION

The guar gum, also known as galactomannan gum obtained from guar seed endosperm which has stabilizing and the thickening properties and used in many foodstuffs and also have many industrial applications [1-3]. The grains of guar are dehusked mechanically, milled, hydrated and screened according to their use. The guar gum is white colored powder which floats freely. It is utilized in many food products all over the world. Guar gum is also called the white gold because of its large scale properties. In baked foods, it gives more resilience, increases the dough yield and also enhances the texture and the storing time. In the dairy milk products, it act as a thickening agent as it thickens the kefir, milk yoghurt and the cheeses [4, 5].

It also maintains the texture and the homogeneity of sherbets and the ice creams. In milk products it is used as a binding agent. In the condiments, it is used as a stabilizing agent as it enhances the appearance and stability of the salad dressings, relishes, barbecue sauces and the ketchups. It is used as thickening and stabilizing agent in canned soup. It is also used in dairy feeding, canned fish sauces, instant oat meals, dry soup, dry desserts and in frozen food items [6-8]. In the hydraulic fracturing, gas and shale oil extraction industries uses the 90 percent of guar gum. This percentage is obtained from Pakistan and India. In pharmaceutical industry, it is used as disintegrating and stabilizing agent. In the cosmetics industry, it is used as thickening and the conditioning agent [9, 10].

Taxonomy of Guar

Cluster bean, has been named so because of the manner in which its pods are clustered together (was earlier referred to as *C. psoralioides*). It belongs to genus *Cyamopsis*. The cultivated guar (*Cyamopsis tetragonoloba* L.) is one of the 4 species in the genus *cyamopsis*. All are native to the Africa and most are found in India and Pakistan. It is self-pollinated annual plant having 14 (2n) chromosomes number and belongs to family Fabace. Genus *Cyamopsis* belongs to sub-family ''Papilionaceae'' and the tribe ''Indigofereae''[1, 7, 10].

Table-1: Shows the Systematically Guar position

Kingdom:	**Plantae – Plants**
Sub-kingdom:	Tracheobionta - Vascular plants
Super-division	Spermatophyta - Seed plants
Division	Magnoliophyta - Flowering plant
Class	Magnoliopsida - Dicotyledons
Sub-class	Rosidae
Order	Fabales
Family	Leguminosea
Sub-family	Fabaceae - Legumes
Tribe:	Indigofereae
Genus:	Cyamopsis
Species	Cyamopsis tetragonoloba

Guar was introduced to Malaysia, Philippines and the Indonesia round 1915. But now a day it is grown in many of the regions including dry tropical and subtropical regions. In 1903, it was taken in USA and then in South-Western Oklahoma and Northern Texas. During the second World -War it was advanced as industrial gum producing crop [11-13].

Fig-1: Shows the different sources of Guar and related bioactive molecules

The genus Cyamopsis comprises three species Cyamopsis tetragonoloba, Cyamopsis senegalensis (found naturally wild in the Arashcol-Mountains at White-Nile and Red-Sea-Mountains of Sudan) and Cyamopsis Serrata. On the other hand, added another species Cyamopsis denata which is intermediate between Senegalensis and Serrata. All Three species are wild excluding Cyamopsis tetragonoloba which is the only cultivated species that has never been found in a wild. The most significant common name of cluster bean is guar and its other common names include cluster bean, guarar, siam bean and gavar. Cluster bean is a crop of arid and semi-arid sub-tropical regions. It bears around 122 names in various languages. It originated in Indo-Pak subcontinent. It is the best adapted crop to tropical and subtropical regions [1, 4, 9, 11].

Center of Origin of Guar

Dolichos faebiformis (now Cyamopsis tetragonoloba) was first introduced in the Botanical Garden of Calcutta in 1797. The seeds were sent under the Telgu name goor-chikkudkai by Dr. Johan Gehard Koeinin, a pupil of Linnaeus. Southern India the legume which was much prized by the natives as a vegetable. However, the established records & circumstantial evidence indicate that the cluster bean is of tropical African origin [12-14].

Presently, its hold a depository of 410 guar germplasm including C. senegalensis and C. serrata, which were collected from the following countries: 355 from India, 32 from Pakistan, two from Iran, one each from South Africa, Senegal, Sudan, and Zaire and ten varieties and breeding selections from the U.S. These collections covered regions of Africa, South and Southwest Asia [15, 16].

Cyamopsis was emphasized to be an isolated genus with Africa as its possible center of origin. India is the center of variability for Cyamopsis tetragonoloba. Trans-domestication process was proposed to explain the origin of cluster bean and it is reported that the cultivated cluster bean plant, Cyamopsis tetragonoloba, originated from a wild African drought tolerant species Cyamopsis senegalensis[17, 18].

It is believed to be cultivated in the Indo-Pakistan sub-continent for several generations from where it spread to Arabia, USA & other arid and semiarid regions of the regions. The Cyamopsis tetragonoloba is a summer, annual herb with no wild forms at present anywhere except in Rawalpindi and Afghanistan which are considered as one of its habitats from where it might have been introduced to India. The species Cyamopsis senegalensis has been recorded in semi-arid savannah region, Senegal to Saudi Arabia and south of Sahara. The Cyamopsis serrata and Cyamopsis dentata have been found in semi-arid regions of the Republic of South Africa, South West Asia & Botswana [19-20].

Different agricultural Techniques

Since the 1970s, Near-infrared spectroscopy (NIR) has been widely used to determine oils, proteins and many other chemicals in various cultures. The two most important seed constituents, oil and Protein contents are nutritional quality traits of seed. Conventionally, oil and protein contents are determined by lab wet-chemical methods, such as the Kjeldahl technique and Soxhlet technique for oil and combustion nitrogen analysis for protein. These conventional approaches provide precise and exact measurements of oil and protein content. But these techniques are high-lab input and cost-inefficient, labor and time-consuming and also produce chemical-residues. These methods need a well-trained operator to perform and at the same time, cannot gives multiple measurements for a single sample. Moreover, these procedures are seed-destructive and no seed can be used for planting and selection after analysis. They techniques are not suitable for large-scale analysis. Thus, these methods are unwanted for breeding programs, particularly when a limited quantity of seed is available [21-23].

Near-infrared spectroscopy (NIR) is a simple, non-destructive and fast technology for analysis of various chemical materials in crops and food with minute sample preparation. This technique offers simultaneously multiple analysis for various characters, automatic recording and reading, fast response, limited space requirement and easy operation. Near-infrared spectroscopy is such a better technology that may fulfills the requirements of breeding program for large scale assessment, because it can measure grain composition characters relatively precisely, mainly oil and protein content, much faster than other measuring techniques[24-27].

Genetic Variability

Genetic variation is the origin of species survival. Information about the accessions associated with genetic mutation plays an important role for plant breeders. Many labors highlight the use of different gene pools as an element to increase production and quality characteristics of different crops. The greater diversity in first breeding makeup ensures a better chance of producing new desired varieties of crops. Genetic variation in the source of germplasm is a selection of enhancing yield, quality and adaptableness of associated traits. Breeding techniques with valuable evidence and genetic variation leads to achievement in making decision about the breeding methods to be followed and choosing improved types [28-30].

The biometric tools support in selection method to an essential stability when two contrary desired traits affecting the basic traits are also being selected. It helps to increase diverse traits instantaneously. Consequently, existence of satisfactory genetic variation is an obligatory for all the crop enhancement plans [31-33].

Biometrical Techniques

These techniques are useful in following different ways. Correlation is used as an active tool to predict the association between various characters in genetically different population for improvement of crop enhancement practices. Correlation is very significant in the assessment of genetic variability present in the population for its consideration among two or more characters. Path coefficient analysis has been used in recognizing characters that are valuable as assortment criteria to increase crop revenue. Path coefficient analysis provides a measure of comparative significance of each independent variable to estimates the variations in the dependent one. Path coefficients demonstrate direct effect of independent trait upon dependent attributes. Path coefficient and correlation analyses helps in selecting of well performing accessions for fodder and seed. The statistical and biometrical analyses of data help to the plant breeders in making their decisions regarding development of selection criteria. Therefore, these analyses remained a concern of the young plant breeders while solving their problems related to discontinuous and continuous variation [34-37].

Correlation coefficient analysis is used as a biometrical tool to predict the association among various factors in genetically different population for improvement of crop enhancement practices. Correlation research only reveals an association; it cannot give a definite reason for why there's a relationship. Correlation finding does not reveal which variable impacts the other. It is used as an active tool to predict the association between various characters in genetically different population for improvement of crop enhancement practices. The correlation is very significant in plant breeding for its consideration in dependency among two or more characters [38-39].

In case of positive correlation when one variable increases the other variable must be increases. Like the maximum statistical number of one variable linkage with maximum statistical value of another variable. When down trend correlation is existing present like one of the variables goes down trend the other variable goes in uptrend like the maximum statistical value of one variable link to the down statistical value of the other variable [39-45].

It is reported that pods produce in plane sown germplasms of guar was truly associated to the number of clusters per plant' pod length, and weight for 100 pods and number of Pods for single plant were major part of pod harvest production. It is a biometrical approach that estimates the direct and indirect influence of one trait with another. It provides a measure of comparative significance of each independent variable to estimates the variations in the dependent one. Path coefficients demonstrate direct effect of independent trait upon dependent trait. In agricultural science, plant breeders used path coefficient analysis in identifying traits. It is a statistical analysis that is used to observe the relation between reliant variables. By using this technique, both the level and significance of useful relationship between the changes can be assessed. There are two chief necessities for path analysis: All fundamental relations among traits must go in one direction only. The characters must have clear time ordering meanwhile one attribute cannot be said to affect another unless it precedes it in time [1, 14, 19, 21, 27, 29].

Numerous studies regarding biometrical techniques have been conducted with cluster bean in India by using the fodder and grain types. Seed production is correlated positively with many traits like pod length, pod plant^{-1} and branches plant. It was reported that 100-seeds weight and pods plant were the main constituents of harvest yield. Using grain cultivation, it was reported that seed pod^{-1} and branches plant were the main constituents of production. It is suggested that ideal guar plant that which have limited number of branches but large number of clusters having greater pods with large amount of seeds [38, 39].

Yield is a compound trait and is recognized to be related with a number of constituent traits and is extremely affected by environmental deviations. These traits are themselves consistent. The comparative significance of each of the yield attributing traits can be attained by means of the technique of path analysis, as a mean of splitting the direct effects from the indirect ones through other traits. Numerous path coefficient analyses have been accompanied in guar, using grain-type cultivars [16, 18, 29].

CONCLUSION

The guar gum has many industrial applications. In the textile industry, it is used in sizing, printing and in finishing. In the paper industry, enhances the sheets formation, folding and gives denser surface for the printing. In the explosion industry, it is used as a waterproofing agent.

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