Received: 13 Oct 2025 | Accepted: 19 Nov 2025 | Online: 02 Dec 2025

Electronic Journal of Plant Breeding

Research Note

Evaluation of spontaneous mutant lines of *Gossypium barbadense* (L.)

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Abstract
Among the species of *Gossypium*, *G.barbadenese* is being cultivated to a lesser extent due to its fragile adaption to climatic conditions. The species is having low genetic variability compared to the predominant tetraploid, *G.hirsutum.* Hence, creating variability is the prime objective of breeding in *G.barbadense,* to broaden the genetic base. Mutation occurring spontaneously are low in frequency and are often beneficial ones. In the present study, four spontaneous mutants namely EA 203, EA 68-1, E6, and EA 159 were identified and evaluated for their performance over three years. The study revealed stable performance of the mutants across the years. The mutants EA 203 and EA 68-1 are having brown lint and could be exploited for production of naturally colored cotton fabrics. The mutant EA 159 showed bigger boll size leading to higher yield and it can be used as parent for crossing to produce hybrids in order to exploit heterosis commercially.

Keywords: Extra-long staple, *G.barbadense* , mutants, brown lint, big boll

India ranks first in area and production of cotton, and second largest consumer of cotton in the world. It is grown in 11.4 million ha. In the country with a production of 299.26 lakh bales (170 kg of cotton is one bale) and productivity of 448 kg lint per ha (ICAR-AICRP (Cotton) Annual Report (2024-25). In India, ELS cotton demand is to the tune 20 lakh bales, while the production is only 2-4 lakh bales. To meet the ever-increasing demand, 60% of ELS cotton is being imported from countries like USA, Egypt and Sudan (Sankarnarayanan *et al*., 2021). Among the species of *Gossypium*, *G.barbadnese* is being cultivated in lesser area due to its fragile adaptive climatic conditions to a peculiar ecological niche. However, *G.arboreum* and *G.herbaceum* are belong to diploid and are being cultivated in neglected area (Manivannan *et al.,* 2018). It also has low genetic variability compared with the predominant tetraploid *G.hirsutum.* Hence, creating variability is the prime objective of breeding in *G.barbadense* to broaden the genetic base.

Egyptian cotton or Sea Island cotton (*G. barbadense*) accounts for 2% of world cotton production. Out of the four cultivated species, *G. barbadense* is renowned for its outstanding fibre characteristics and falls under the category, extra-long staple (ELS) cotton. ELS cotton typically denotes the cotton fibre length of 32.5 mm and above, with superior strength and better uniformity. This type of cotton is in great demand worldwide for manufacturing high quality ring spun yarns. It is also used for manufacturing sewing thread, loom yarns and blended with polyester fibres for manufacturing high quality fabrics.

G.barbadense is cultivated in India, China, Egypt, USA, Peru, Israel, Tajikistan, Turkmenistan and Uzbekistan. It is spread in unique ecological niches over the subtropical zones and is restricted to few geographical niches due to its less diversity (Hinze *et al*., 2016), when compared with upland cotton, *G. hirsutum.* It is low in yield, poor in adaptability, susceptible to sucking pests and is difficult to pick manually as it has prominent pointed edges on the

boll. However, its fibre is of superior quality and produces yarn of higher counts while spinning, resulting in premium fabric. Hence, studies on fibre quality characters in *G. barbadense* is gaining momentum. According to Bradow and Davidonis (2000), an ideal fibre is coloured white as frozen vapor, sturdy like iron, soft like silk and stretches like wool and should feel like woven wind. Among the cultivated species of the genus *Gossypium*, *G.barbadense* pose near to such an ideal cotton.

Creating variability to widen the genetic base is the primary objective of *G.barbadense* improvement. This has been realized to a limited extent, through intra specific and inter specific crossing (Dhamayanthi *et al.,* 2018). Hence, mutation could be explored to create novel variation in the genome. Variations occurring spontaneously serve as primary source of variation and it is subjected to selection in breeding programmes. However, deductions of such naturally occurring novel mutations are rare. Induced mutations play a vital role in plant breeding to create novel variations (Spencer-Lopes *et al*., 2018). But, the process of mutagenesis is tedious and is often associated with undesirable linkage. Nevertheless, harnessing the spontaneous mutations in breeding populations would be highly valuable. In the present study, spontaneous mutants identified in *G.barbadense* for multiple traits, were characterized.

The experiment was carried out in ICAR-Central Institute for Cotton Research (ICAR-CICR), Regional Station, Coimbatore from the year 2021 to 2024. Four typical spontaneous mutants namely EA 203 (Brown lint), EA 68-1 (Brown lint), E6 (Dwarf), EA 159 (Big boll size) (boll weight above 6 grams per boll) identified from various population in the field were characterized. These mutants were raised in three replicates along with the check variety Suvin, adopting a spacing of 60 x 90 cm (plant to plan x row to row). All the recommended package of practices were adopted for a better crop stand. Observations were recorded on the traits *viz*., single boll weight (gram of seed cotton per boll), Single plant yield (gram per plant of seed cotton) and Ginning out turn (%). Fibre quality parameters, namely, Upper Half Mean Length (mm), fibre strength (g/tex), fibre maturity in terms of micronaire (µ/inch) analysis was done at ICAR- Central Institute for Research on Cotton Technology (ICAR-CIRCOT), Regional Unit, Coimbatore in a High-Volume Instrument (HVI) (HVI-900, USTER, US) as per the ASTM, 2005 protocol. Fibre color was determined based on RHS color chart to fix the intensity of color in the lint. Pooled mean of three years was subjected to statistical analyses.

In the present study, four spontaneous mutants of *G.barbadense* were evaluated for their stability and performance over three cropping seasons. The mutant EA 159 recorded the highest boll weight (6.2 gram per boll) and single plant yield (141.2 gram of seed cotton per plant) (**Table 1**), The mutant EA 203 recorded the least single plant yield (86.4 gram per plant). With respect to fibre quality, the check Suvin recorded the highest UHML of (36.8 mm) and strength of 37.4 gram/tex, while the mutant EA 6 showed higher GoT of 34.5%. Micronaire is the unit of fibre maturity which decides the fibre fineness. Higher micronaire value indicates the coarse nature of fibre, which affects the dye absorption in the textile manufacturing. Micronaire range 3.5 to 4.5 is the most preferable for yarn preparation (Manivannan, 2023). In the present study, micronaire ranged from 3.5 to 3.7, which falls under desirable range. Two mutants namely, EA 203 and EA 68-1, were observed to possess brown coloured lint (**Fig. 1**). Naturally colored lint is preferred for making organic textiles and are ecofriendly since there is no need to dye them. However, these naturally colored mutants showed poor fibre quality and yield. These mutants could be further improved by hybridization with high yielding genotypes. The mutant EA 159 was observed to possess higher boll weight. The beneficial mutants identified can be utilized as a parents in *G.barbadense* improvement. Similar spontaneous mutans were reported in *G.aboreum* by Kalpande *et al.* (2020) and Waghmare and Koranne, (2000).

Table 1. Pooled mean performance of *G.barbadense* spontaneous mutant lines (2021-2024)

Mutants	Source	Unique traits	Upper Half Mean Length (mm)	Fibre Strength (g/tex)	Mic-Micronaire (µ/inch)	Ginning Out Turn (%)	Single Boll Weight (g)	Single Plant Yield (g)
EA203	Spontaneous mutant of C6002	Brown lint	29.1	28.1	3.5	32.6	3.8	86.4
EA68-1	Spontaneous mutant of CCB 68	Brown lint	28.1	23.4	3.2	32.6	3.6	90.2
EA6	Spontaneous mutant of P186	Dwarf	30.5	29.8	3.5	34.5	3.4	91.7
EA159	Spontaneous mutant of ICB 85	Big Boll	33.4	36.5	3.3	33.6	6.2	141.2
Suvin (Control)			36.8	37.4	3.7	32.5	3.6	92.3
		SEd	1.3	1.9	0.4	2.4	0.6	6.3
		CD(5%)	2.8	4.2	0.1	6.2	0.3	8.9

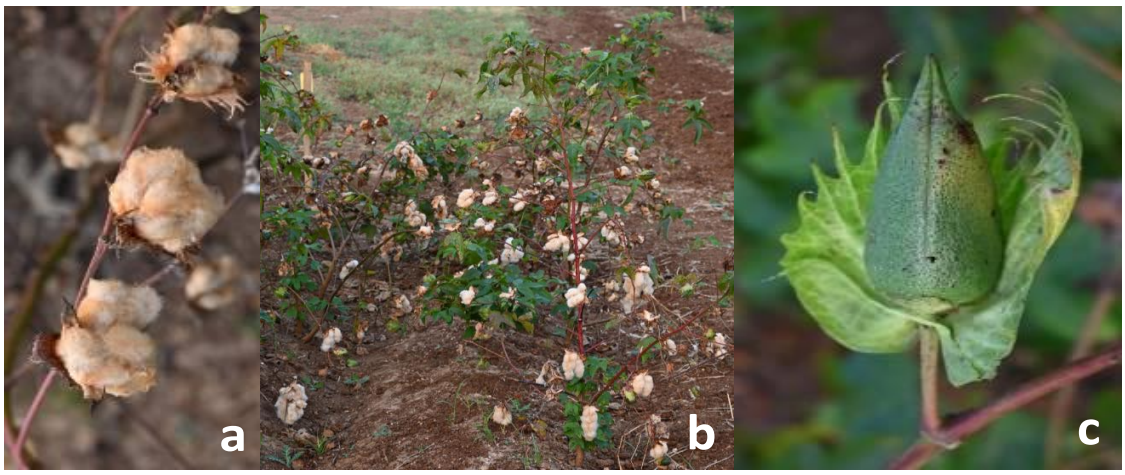

Fig.1. (a) Mutant EA 203 (brown lint); (b) EA 68-1(brown lint);(c) EA 159 (big boll)

Rajasekaran *et al.* (1996) reported chlorophyll mutants with low frequencies in *G. hirsutum*. Manivannan *et al.* (2021) and Dhamayanthi *et al*. (2024) identified a cleistogamous mutant from the progeny of an intra *barbadense* cross (Suvin x Giza-45).

ACKNOWLEDGEMENT

The authors acknowledge the research support by the Indian Council of Agricultural Research, Department of Agricultural Research and Education, Government of India.

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