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DISCERNMENT OF MORPHOLOGY, PHENOLOGY, AND YIELD TRAITS OF *Corchorus capsularis* FOR DUAL-PURPOSE LEAF AND SEED PRODUCTION

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ABSTRACT

An experiment was conducted at Jute Agriculture Experimental Station, Jagir, Manikganj to evaluate morphological, phenological, reproductive, and seed quality traits of four jute (*Corchorus capsularis* L.) varieties (i.e., BJRI deshipat shak1, BJRI deshipat shak2, BJRI deshipat shak3 and BINA pat shak1) grown as leafy vegetables. Significant varietal differences were observed in growth and yield attributes. BINA pat shak1 produced the highest leaf biomass followed by BJRI deshipat shak1, while BJRI deshipat shak3 showed superior plant height, seed yield and quality. On the other hand, minimum seed to seed duration was found at BJRI deshipat shak2 followed by BJRI deshipat shak3. BJRI deshipat shak1 exhibited strong vegetative growth. Overall, BJRI deshipat shak3 was identified as the most promising dual-purpose variety, suitable for both leafy vegetable and seed production.

Key words: Jute, phenology, jute leaf, seed yield and quality

Introduction

Jute (*Corchorus* spp.) is widely recognized as an economically significant and environmentally sustainable bast fiber crop due to its strong, biodegradable fibers used in packaging, textiles, and bio-composites (Kundu *et al*., 2017; Roy *et al*., 2020). In addition to its industrial relevance, jute has gained prominence as a nutritious leafy vegetable, particularly in South and Southeast Asia, where the tender leaves-locally known as *pat shak* in Bangladesh-are traditionally consumed in soups and curries (Islam *et al*., 2016). These leaves are rich in vitamins A, C, and E, essential minerals such as iron and calcium, and powerful antioxidants with reported anti-inflammatory, hypoglycemic, and gastroprotective effects (Uddin *et al.*, 2014; Zakaria *et al*., 2006). Among the cultivated species, *Corchorus capsularis* L. (white jute) is especially valuable due to its adaptability, high biomass production, and potential for dual-purpose utilization in both fiber and food sectors (Basu *et al*., 2018). Recent studies have promoted jute as a multi-functional crop that can enhance agricultural diversification, rural nutrition, and farmer income (Rahman *et al*., 2021). However, systematic information on morphological traits, phenological stages, reproductive efficiency, and seed quality of jute varieties under leafy vegetable-based cultivation remains limited. Understanding these parameters is crucial for identifying early-harvesting, high-leaf-yielding, and nutritionally superior genotypes. Therefore, the present study was conducted to evaluate morphology, phenology, reproductive yield, and seed quality of selected *C. capsularis* varieties cultivated for leafy vegetable purposes, thereby supporting varietal improvement and promoting jute as a sustainable, nutrient-rich food resource.

Materials and Methods

The experiment was carried out during the 2024 cropping season at the experimental field of the Bangladesh Jute Research Institute (BJRI), Manikganj, situated at 23.86°N latitude and 90.00°E longitude. The site lies in the agroecological zone of the Young Brahmaputra Alluvial Floodplain, characterized by loamy soil with moderate fertility and nearly neutral pH (6.8-7.2) under a subtropical monsoon climate (BBS, 2022). Four white jute (*Corchorus capsularis* L.) varieties i.e., BJRI deshipat shak1, BJRI deshipat shak2, BJRI deshipat shak3 and BINA pat shak1 were used as experimental materials. Crops were sown on 25th July, 2024 at research field on Jute Agriculture Experimental Station, Jagir, Manikganj. Seeds were

collected from Gene Bank of BJRI, Dhaka and BINA head office, Mymensingh. Land was prepared 4-5 ploughing with cross ploughing followed by laddering. The experiment followed a Randomized Complete Block Design (RCBD) with three replications, where each plot measured 3.0m × 2.0m. Seeds were sown at broadcasting method. Standard agronomic practices were followed according to BJRI agronomic guidelines (BJRI, 2021). Neem-based biopesticides were applied to minimize pest infestation and ensure leaf safety for consumption (Rahman *et al*., 2020). Data on morphological and phenological traits-such as plant height, plant weight, shoot weight, leaf weight, days to flowering, days to seed maturity-were recorded from ten randomly selected plants per plot. Reproductive parameters, including number of capsules per plant, number of seed per capsule, 1000-seed weight, and seed yield per plant, were assessed at maturity, while seed quality traits (germination percentage, and field emergence) were determined according to ISTA (2018) procedures. All collected data were analyzed using ANOVA in Statistics 10, and mean comparisons were performed by Least Significant Difference (LSD) at the 5% probability level (Gomez and Gomez, 1984).

Results and Discussion

Morphological yield attributes: Significant variation was observed among the studied jute (*Corchorus capsularis* L.) varieties in terms of plant height, total biomass, shoot weight, and leaf weight (Table 1). The plant height ranged from 19.60 cm (BINA pat shak1) to 35.13 cm (BJRI deshipat shak2), indicating a wide genetic diversity in vegetative growth potential. BJRI deshipat shak2 exhibited the tallest plants, whereas BINA pat shak1 recorded the shortest. Similar variation in morphological traits among jute varieties has been reported by Rahman *et al*. (2019) and Islam *et al.* (2020), who attributed such differences to genetic factors and environmental adaptability.

Table 1. Morphological yield attributes of jute varieties as vegetable

Variety	Plant height (cm)	Plant weight/m^2	Shoot weight/m^2	Leaf weight/m^2
BJRI deshipat shak1	25.04d	975.8abc	845.8b	372.4a
BJRI deshipat shak2	35.13a	811.3d	705.7c	256.2c
BJRI deshipat shak3	32.68b	887.7cd	782.8b	301.2b
BINA pat shak1	19.60e	951.0bc	786.9b	391.9a
CV (%)	10.36	15.30	17.97	21.53

Total plant biomass per square meter (plant weight/m^2) ranged between 811.3 g (BJRI deshipat shak2) and 975.8 g (BJRI deshipat shak1), suggesting that BJRI deshipat shak1 had the highest vegetative productivity. Correspondingly, shoot weight followed a similar pattern, with BJRI deshipat shak1 producing the highest shoot yield (845.8 g/m^2) and BJRI deshipat shak2 the lowest (705.7 g/m^2). These differences might result from variations in canopy structure, internode elongation, and photosynthetic efficiency among the varieties (Sarkar *et al.,* 2018). Leaf weight, an important trait for evaluating jute as a leafy vegetable, was highest in BINA pat shak1(391.9 g/m^2) followed by BJRI deshipat shak1 (372.4 g/m^2). The high leaf biomass of BINA pat shak1 indicates its suitability as vegetable type jute, aligning with findings by Kundu *et al.* (2013), who reported that jute genotypes with shorter stature and dense foliage yield more edible biomass. Leaf weight variability also reflects genotypic differences in leaf area index and sink-source dynamics during vegetative growth (Hasan *et al*., 2021).

Phenological attributes: The phenological traits-days to first flowering, average flowering, and seed maturity-also varied significantly among the tested varieties (Table 2). Early flowering in BJRI deshipat shak2 and BJRI deshipat shak3 indicates their potential for shorter growth cycles and multiple harvests in leafy vegetable production. Delayed flowering in BINA Pat shak1 suggests prolonged vegetative growth, which is advantageous for higher leaf biomass yield but extends the overall crop duration (Islam *et al*., 2018). Days to seed maturity ranged from 62.42 days (BJRI deshipat shak2) to 100.08 days

(BINA pat shak1). The observed phenological variability may be linked to differences in photoperiod sensitivity, genetic makeup, and adaptability to environmental conditions (Rana *et al.,* 2017).

Table 2. Phenological attributes of different jute vegetable varieties

Variety	Days to 1st flowering	Days to average flowering	Days to seed maturity
BJRI deshipat shak1	57.50b	64.58b	83.67b
BJRI deshipat shak2	44.00c	48.92c	62.42cd
BJRI deshipat shak3	44.33c	49.08c	65.25c
BINA pat shak1	67.33a	77.17a	100.08a
CV (%)	10.12	11.89	9.57

Table 3. Effect of variety on seed yield and yield contributing characters of jute vegetables

Variety	Number of capsules per plant	Number of Seed per capsule	Seed yield per plant (g)
BJRI deshipat shak1	70.83c	23.42c	1.45b
BJRI deshipat shak2	94.46b	26.29b	1.92a
BJRI deshipat shak3	112.58a	30.17a	2.08a
BINA pat shak1	85.67b	20.21d	1.38bc
CV (%)	22.48	10.41	19.22

Seed yield and yield-contributing characters: The studied jute (*Corchorus capsularis* L.) varieties showed notable differences in yield-contributing traits such as the number of capsules per plant, number of seeds per capsule, and seed yield per plant (Table 3). The highest number of capsules per plant (112.58) was observed in BJRI deshipat shak3, followed by BJRI deshipat shak2 (94.46), whereas BJRI deshipat shak1 produced the lowest (70.83). The superior capsule formation in BJRI deshipat shak3 indicates a higher reproductive potential, possibly due to its better floral retention and efficient nutrient translocation during the reproductive phase. The number of seeds per capsule varied from 20.21 (BINA pat shak1) to 30.17 (BJRI deshipat shak3), highlighting significant varietal differences. BJRI deshipat shak3, having both higher capsule number and seed count, consequently produced the highest seed yield per plant (2.08 g), followed by BJRI deshipat shak2 (1.92 g). The lowest seed yield (1.38 g) was recorded in BINA pat shak1. These findings agree with Islam *et al*. (2018), who found that seed yield in jute correlates strongly with capsule number and seed count per capsule. The higher seed yield observed in BJRI deshipat shak3 may also be associated with its delayed flowering and prolonged reproductive phase, allowing sufficient assimilate accumulation. Similar trends were noted by Rana *et al.* (2017), who reported that longer reproductive durations enhance capsule filling and seed weight in *Corchorus* species.

Table 4. Seed quality attributes of jute vegetables varieties

Variety	Germination (%)	Field Emergence (%)	1000-SW (g)
BJRI deshipat shak1	73.42c	69.29ab	2.35b
BJRI deshipat shak2	79.89b	73.84a	1.79d
BJRI deshipat shak3	83.56a	74.58a	1.88c
BINA pat shak1	72.52c	67.37b	2.43a
CV (%)	10.59	6.37	2.99

Seed quality attributes: Seed quality parameters, including germination percentage, field emergence, and 1000-seed weight, also differed significantly among the varieties (Table 4). BJRI deshipat shak3 exhibited the highest germination rate (83.56%) and field emergence (74.58%), reflecting superior seed vigor and viability. In contrast, BINA pat shak1 recorded the lowest germination (72.52%) and field emergence (67.37%). The 1000-seed weight (1000-SW) ranged from 1.79 g (BJRI deshipat shak2) to 2.43 g (BINA pat shak1), indicating that BINA pat shak1 produced larger but fewer seeds compared to other varieties.

Heavier seeds typically contribute to improved seedling vigor and establishment (Rahman *et al*., 2019), although smaller seeds with high germination capacity, such as those of BJRI deshipat shak3, may enhance total plant population density.

Conclusion

BJRI deshipat shak3 exhibited superior performance in seed yield and quality attributes, while BINA pat shak1 produced the highest leaf biomass, making it most suitable for leafy vegetable production. BJRI deshipat shak1 also performed well in overall vegetative growth and shoot yield. These findings suggest that varietal selection based on growth habit and reproductive potential can optimize both leafy and seed yield, contributing to the sustainable utilization of jute as a dual-purpose crop.

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