Theor Appl Genet (1991) 82:254–255

Alteration of reproductive effort by a monogenic, recessive mutation in jute (*Corchorus capsularis* L.)

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Received August 1, 1990; Accepted January 8, 1991
Communicated by B. R. Murty

Summary. Reproductive effort (RE) of a day-length neutral mutant TCJ-5, its parent, and two other cultivars of jute (*Corchorus capsularis*) was estimated as reproductive biomass/aerial biomass. Plant height at flowering and aerial biomass were significantly higher in the mutant, while the reproductive biomass at 55 days after flowering was statistically equal. Therefore, the estimated RE was significantly lower in the mutant compared to the parent and other cultivars. The lower RE of the mutant was due to delayed initiation of flowering and additional vegetative growth in this period. The results show alteration of RE by a recessive mutation.

Key words: Jute – Reproductive effort – Monogenic

Introduction

There is wide interest in determining the resources allocated to reproduction, measured as reproductive effort (RE) in different plant species (see Bazzaz et al. 1987). Various measures of RE have been used (Reekie and Bazzaz 1987), the simplest being the proportion of the inflorescence biomass to the total aerial plant biomass (Abrahamson 1979). RE based on partitioning of the carbon (Reekie and Bazzaz 1987) and energy (ΔHC or the heat of combustion) is more precise (Pitelka 1977), and it is necessary for comparisons between species having significant variation in the chemical composition of their seeds (Sinha et al. 1982; Bhatia and Mitra 1988).

In the present study, RE based on the biomass of reproductive structures to the total aerial biomass was estimated for a jute (*Corchorus capsularis*) cultivar and its day-length neutral mutant. We show that a single mutation, inherited as a Mendelian recessive trait, alters the RE and hence the relative proportion of resources allocated for reproduction. Jute is a fiber crop, extensively grown in the northeastern parts of India and in Bangladesh. The vegetative growth in jute is monopodial and unbranched up to flowering. With floral initiation, the apical dominance disappears and further biomass growth is limited to three to five axillary branches in the upper one-third of the plant. The commercial fiber is obtained from the bark and plants are harvested before initiation of seed set. Floral initiation marks the beginning of the competition between the vegetative and reproductive sinks for the plant resources. Longer duration of vegetative growth and consequent late flowering are associated with higher fiber yield in this crop.

Materials and methods

The following genotypes were used in this study.

JRC-412: the parent cultivar of the day-length neutral mutant. At Trombay it flowers in 80–90 days when planted at the normal sowing time in the month of May.

The days to flowering for the mutant and other cultivars given below are for May planting.

TCJ-5: a day-length mutant of cv JRC-412 isolated after exposure of dry seeds to fast neutrons. It flowers in 110–120 days. It is insensitive to variation in photoperiod during the first 100 days, irrespective of the time of planting during the year. It grows taller and produces larger biomass compared to the parent.

JRC-321: a high-fiber-yielding cultivar flowering in 80–90 days.

JRC-7447: a high-fiber-yielding cultivar flowering in 100–110 days.

The seeds were planted in the experimental field during the last week of May in five 3-m long rows, each with four replications. The date of flowering and plant height at flowering were recorded. At 55 days after flowering (DAF), two plants per replication were harvested 3 cm above the ground and separated into flowers, fruits, and the rest of the vegetative mass. Samples were dried at 70–80 °C in an air-circulating oven to a constant weight. The RE was estimated as reproductive biomass/aerial biomass (Reekie and Bazzaz 1987).

Results and discussion

When planted at the normal planting time, i.e., in the last week of May, the duration of the vegetative phase was

Table 1. Number of days to flower, plant height, biomass, and RE values of jute cultivars and a day-length neutral mutant

Varieties	Days to flower	Height at flowering (cm)	Total aerial biomass (g)	Biomass of flowers & fruits (g)	RE value
JRC-412	80	258	64	13.2	0.21
JRC-321	81	284	90	16.7	0.18
JRC-7447	102	334**	88	15.5	0.18
TCJ-5	118	356**	141**	11.8	0.08**
LSD at 1%		42	34	NS	0.08

** Significant at 1% level

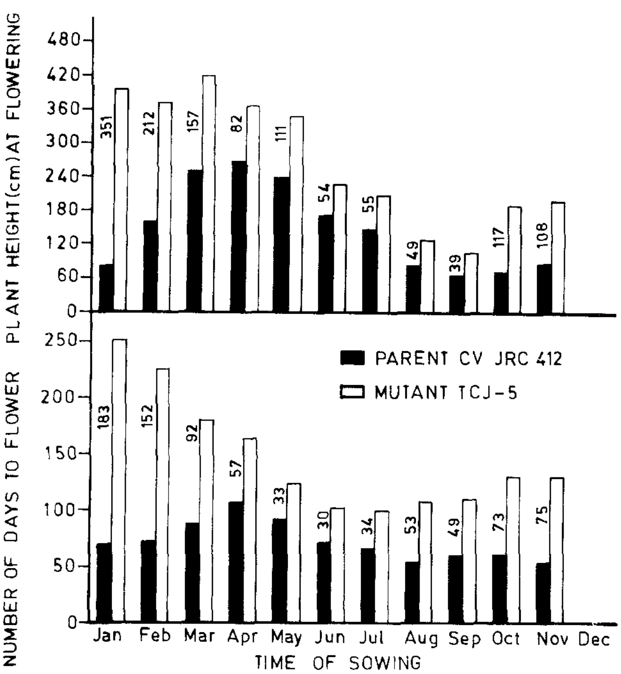

Fig. 1. Plant height and number of days to flower with different planting times. The values along the columns indicate the excess height and days to flower

80 days for cv JRC-412 and 118 days for the mutant (Table 1). Plant height at flowering and aerial biomass 55 DAF were significantly higher for the mutant. Two other cultivars, JRC-321 and JRC-7447, included for comparison, were taller and produced larger biomass than JRC-412. Fruit and flower biomass measured at 55 DAF were not significantly different among the four cultivars (Table 1). RE was significantly lower in the mutant TCJ-5 (Table 1) and statistically equal in the three cultivars. The significant increase in vegetative growth was due to delayed initiation of reproductive growth. Although the total apportionment to flowers and fruits was not altered significantly, the estimated RE was lower due to increased vegetative growth.

When planted at periodic intervals throughout the year, cv JRC-412 flowered in a minimum period of 55 days and a maximum of 107 days. For the same planting dates, TCJ-5 had an additional 30–183 days of vegetative growth (Fig. 1). Although RE for these different periods was not estimated, the plant height data show that the delayed flowering contributed to greater vegetative growth in the mutant.

Exposure to short photoperiods induces flowering in jute (Kundu et al. 1957). However, floral initiation in the mutant TCJ-5 is not affected by day length for at least 100 days and this trait is inherited as monogenic recessive (Joshua and Thakare 1986).

The results show alteration of RE by a monogenic, recessive mutation. The occurrence of such mutations in natural populations of other plant species is possible.

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