

DISTRIBUTION OF MORPHOLOGICAL DIVERSITY AMONG GERMPLASM LINES OF *PANICUM MAXIMUM* JACQ.

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One hundred forty one germplasm lines of *Panicum maximum* collected from South and North-Eastern Hill region of India were evaluated for yield and six morphological traits. Variability was studied in terms of range, frequency distribution and coefficient of variation (CV). The pattern of frequency distribution varied from asymmetrical unimodal for plant height to unimodal symmetrical type for length of the panicle. However, amodal trend was observed in case of leaf length. With respect to coefficient of variability, it varied from 9.45% for leaf sheath to 48.65% for fresh weight. Range of variation was of the highest order in case of plant height (97.5 to 230.0 cm) followed by leaf length (16.4 to 77.3 cm) and panicle length (19 to 53.5 cm). The extent of variability present in the genetic material under study indicates the possibility of its utilization in the breeding programmes.

INTRODUCTION

Panicum maximum was introduced in India in the last decade of eighteenth century. Initially *P. maximum* var. Makuni was introduced from Australia which is still grown in a large area. Subsequently a number of varieties such as Hamil, Rivers dale and Gatton panic were developed and came into cultivation. As such, the variation within these lines was quite less except a few varieties recently developed at Ludhiana (India) which characteristically possess soft pubescent leaves and lemmas and mostly belong to the annual type.

Broad genetic base is an important aspect for any breeding programme. Breeding the tropical forage grasses, in many cases, has its own limitation because of its apomictic and tetraploid nature. This problem is also faced with while breeding *P. maximum*. Occurrence of sexual plants have also been reported earlier (Savidan *et al.* 1989). In nature, it can be presumed that some natural crossing might have occurred between sexual and apomictic plants which could have yielded in a large number of transgressive segregants. Hence, with this presumption in mind, it was planned to collect the germplasm from those areas wherein the crop was introduced long back, and evaluate them at one place so as to document the available natural diversity.

MATERIALS AND METHODS

The collection of *P. maximum* germplasm was made from Bangalore and Dharwad in South India and Gangtok, Shillong, Imphal and Agartala in North-Eastern Hill (NEH) region of the country. Collection was made from natural grasslands, road sides and forest areas. The details of climatic conditions at the collection site are as follows :

Gangtok (Sikkim) :

Height 1200 to 1800 m above msl, temperate climate, 4000 to 5000 mm annual rainfall spread over April to October.

Shillong (Meghalaya) :

Collection/sites Shillong 1350 m msl and Barapani 900 m msl. Topography of the areas has altitudinal variations at short distances, the place receives heavy rainfall throughout the year.

Imphal (Manipur) :

Height 750 m msl. Topography is table land. Black clay soil is very fertile. 2500 to 3500 mm annual rainfall.

Agartala (Tripura) :

Place is adjacent to Bangladesh border and is at sea level. The topography is quite undulating. Rains are received from February to July.

Dharwar and Bangalore (Karnataka) :

South Indian plains at sea level, moderate rainfall from June to September.

A total of 141 germplasm lines were grown in two replication of single row of eight tussocks at a distance of 1m between rows and 75 cm between tussocks. Observations were recorded for plant height (cm), stem diameter (mm), leaf length (cm), leaf sheath length (cm), leaf width (cm), panicle length (cm) and fresh weight of eight tussocks (kg).

RESULTS AND DISCUSSION

Frequency distribution analysis and coefficient of variation of the data for six morphological traits and yield revealed considerable variation for almost all the characters under study.

The plant height ranged from 97.5 to 230cm although majority of lines attained a height between 157 to 217 cm. Frequency distribution showed nearly unimodal asymmetrical trend. Coefficient of variation (CV) was 12.45%. Most of the lines which crossed 2 m height were close to Makuni, Hamil and Gatton varieties with glabrous leaf and lemma and the lines which attained

height below 1.5 m were characteristically leafy with pubescent surface. Germplasm lines combining the two characters were also noticed and was attributed to the natural crossing which might have occurred during the course of domestication.

Variability for stem diameter ranged from 2.1 to 11.45 mm with a mean value of 5.61 mm. Frequency distribution showed nearly amodal nature as highest number of lines fell in first few groups with decreasing number in higher classes of stem diameter. Coefficient of variation was recorded 21.78%. Most of the lines with thick stem showed tendency towards perenniality and coarse leaf with, probably, less nutritive value because of high fibre content. Survival and adaptation of such lines under shade full vegetation cover is expected to be better than annual types. Symmetrical unimodal frequency distribution was observed for leaf length and the clustering of lines was around the mid value 44.17 cm. Perennial types, in general, possessed long leaves as compared to short leaves in annual types. Medium leaf length common with most of the lines were considered to be probable natural cross between the two types *viz.*, annual and Perennial types, CV was of the order of 13.48%.

Leaf sheath length did not show much variation and most of the lines possessed leaf sheath between 10.7 to 19.0 cm with mean value 16.17 cm and CV 9.45%. Frequency distribution showed asymmetrical unimodal trend. In general, long leaf sheath and small leaves were noticed in the plants with hairy leaf and leaf sheath and which belonged to the annual types.

Leaf width was observed to be quite variable among different lines. Mostly, the perennial lines resembling cultivar Gatton, Hamil and Makuni possessed glabrous broad leaves whereas pubescent narrow leaves were common with annual types. Intermediate plants with glabrous-narrow leaves were also seen. A few germplasm lines possessed erect types of leaves and flowered only for a short period once in a year in contrast to majority of the lines with flowering tendency after each cut and regeneration. Leaf width varied from 0.9 to 2.60 cm with a mean value of 1.73 cm and 11.7% CV.

Length of the panicle showed nearly asymmetrical unimodal distribution and average panicle length was 36.65 cm. Some of the lines possessed as short panicle as 19.0 cm in contrast to lines with as long as 53.5 cm panicle. Sparse distribution of spikelets over the panicles have been considered as a primary indication for the possibility of plants being self incompatible but sexual in nature (Noirot, 1989). Hence, this character is important for identification of marking such lines.

Biomass is probably, the most important character while evaluating certain species for its forage value. In the present study, yield was observed as eight tussocks fresh weight of above ground biomass. A comparative study showed

that variation for yield was quite high and this varied 0.57 kg to as high as 12 kg, although in frequency distribution most of the lines clustered on lower group (0.57 kg to 8.0 kg). Most of the lines yielding high biomass possessed long hard flowering tiller and long coarse leaves. Hence, it becomes imperative to evaluate these lines in cumulative terms of biomass yield, nutrition and digestibility.

REFERENCES

- Noirot M. 1989. The morphology relation in the panicle of *Panicum maximum* Jacq., Consequences on the pollination and the fertility. Proc. XVIth International Grassland Congress Nice. FRANCE 4-11 Oct. 1989. Vol. 1. 479-480.
- Savidan Y.H., L. Jank, J.C.B. Costs and C.B. do Valle do. 1989. Breeding *Panicum maximum* in Brazil. I. Genetic resources, modes of reproduction and breeding procedures. *Euphytica* 41: 107-112.