Advanced Journal of Microbiology Research Vol. 2005
Available online at http://internationalscholarsjournals.org/journal/ajmr

Short Communication

Photoperiodism in *Digitaria exilis* (Kipp) Stapf accessions

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Accepted February 17, 2005

Three varieties of *Digitaria exilis* namely, white mbulus, jakashale and red dapys were grown in planting chamber and the effect of photoperiod on flowering was investigated. The photoperiods were eleven, twelve and thirteen hours. Highly significant differences (p<0.01) were recorded for the number of days to flowering as affected by photoperiods. The interaction between the photoperiods and varieties was also found to be significant (p<0.01). The results also show that white mbulus is a short day plant while Jakashale is day length neutral. Jakashale could therefore be a source of useful genes for improvement of "acha" for an all year round production.

Key words: *Digitaria exilis*, photoperiods, flowering.

INTRODUCTION

Digitaria exilis otherwise known as fonio, intaya, acha or hungry rice is a cereal crop grown in the Northern part of Nigeria. The crop is not grown outside Africa and very little archeological evidence exists on the species (Harlan, 1989). Its cultivation dates back to 5000 BC and it is the oldest African cereal (Pulseglove, 1972).

Although, a large number of the species of the genus *Digitaria* are recognized as weeds, *D. exilis* and *D. iburua* are cultivated as cereal crops and utilized as food and also in the industry for soap and beer making. At present, there are many limitations towards acha breeding. Acha is an indigenous crop that is relatively unimproved and is characterized by a number of poor traits such as small grain size and weight, fragile stem and photoperiod sensitivity (Morakinyo and Adelekun, 1997). These are among other factors that hinder its production and make it an unattractive crop with restricted cultivation in Nigeria.

Photoperiodism is one of the physiological mechanisms responsible for flowering. Flowering is an important phase of plant life cycle because the transition from vegetative to reproductive phase involves several changes in the physiology of a plant. Flowering is a decisive stage. It requires a definite period of vegetative growth and is triggered by a combined effect of age, available nutrient and moisture and photoperiod. The photoperiod may vary from plant to plant (Pandey and Sinha, 1981). In acha, flowering is known to be photoperiod dependent and this is a constraint to its large scale and all-the-year-round production.

The aim of this study is, therefore, to find out the most suitable photoperiods for flowering in *D. exilis* with a view to providing information on its photoperiod response and screening for photoperiod neutral and natural mutants.

MATERIALS AND METHODS

Three varieties of *D. exilis* used in this study were obtained from the Institute for Agricultural Research Samaru-Zaria, which was collected from Irriwai area of Bauchi State.

Green house experiment was conducted at the Department of Biological Sciences Building, University of Ilorin. Three photoperiod regimes of 11, 12 and 13 hours were selected for the three varieties of *D. exilis* viz: white mbulus, Jakashale and Red dapys in a randomized design completely with five replications. The following were the treatments:

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Table 1. Analysis of variance for photoperiodic treatments.

Source of variation	Df	SS	MS	VR value
Replication	4	421.866	105.46	3.53**
Accession (A)	2	2159.244	1079.62	68.99**
Error (a)	8	125.200	15.65	-
Photoperiod (B)	2	665.511	331.75	11.12**
A x B	4	703.022	175.75	5.89**
Error (b)	24	716.133	29.83	
Total	49	4788.977		

** Highly significant at 1% probability level.

Table 2. Mean Number of days to flowering as affected by photoperiods.

Period of light exposure	White mbulus	Jakashale	Red dapys	Mean
6.30 am - 6.30 pm (12hrs)	94.20ac	97.00ace	116.60ad	102.60a
6.30 am - 5.30 pm (11hrs)	83.80bg	101.60af	101.80bf	95.73b
6.00 am - 7.00 pm (13hrs)	100.60ah	102.60ah	111.00ah	104.73a
Mean	92.86c	100.40b	109.80a	303.06

Least significant difference (p<0.05); within accessions = 7.13, between accessions = 12.75.
Means with the same letter(s) on the same column and row are not significantly different.

1. Light exclusion by covering the whole plant with hood from 6.30 p.m. - 6.30 a.m. thereby providing 12 hours of light exposure.
2. Light exclusion by covering the whole plant with hood from 5.30 p.m. - 6.30 a.m. thereby providing 11 hours of light exposure.
3. Full day length of 13 hours (longer day) from 6.00 a.m. - 7.00 p.m. allowed.

The three photoperiod regimes were maintained daily till flowering when days to flowering were recorded. Split plot design analysis of variance was used to assess the effect of photoperiods on flowering using SAS software (1996). Ranked means were compared using least significant difference (LSD) at $p<0.05$ level (Gomez and Gomez, 1984).

RESULTS AND DISCUSSION

The result obtained from the analysis of variance for photoperiod effect on the number of days to flowering is presented in Table 1. The result obtained showed that the treatments were highly significant at $p<0.01$. Comparison of the ranked means using least significant difference (LSD) of 3.33 for varieties and 4.11 for photoperiod at $p<0.05$ level on the number of days to flowering as affected by photoperiods are presented in Table 2. The results indicate that the mean number of days to flowering were significantly different with different photoperiods in white mbulus and red dapys. There was no significant difference in the number of days to flowering in 12 and 13 hours photoperiods.

The results above show that white mbulus is a short day plant requiring shorter day length (photoperiod) for flowering. Jakashale is a day length neutral, as variation in the length of photoperiod does not significantly affect the days to flowering. Red dapys requires further investigation to determine its true reaction to photoperiod (i.e. day length). Day length neutrality is useful trait in crop production if it goes along with other desirable traits because it allows an all year-round cultivation of the crop. For it to be useful in plant breeding to improve the crop, however, there is the need to determine its mode of inheritance so as to be able to incorporate it into improved cultivars of the crop.

The result of photoperiodic simulation showed that *D. exilis* showed variation within species with respect to number of days to flowering. This result is consistent with the finding of Akenova (1988) that pearl millet exhibit variation within the species with respect to photoperiod sensitivity. He also suggested that photosensitivity can be exploited to improve forage production. Diurnal changes in climatic factors notably photoperiod and temperature has a serious effect on plant flowering. Burton (1965) observed that photosensitivity in pearl millet depends on genotype, sowing date and prevailing environmental factors such as temperature, and the geographical area in which cultivar or species is productive.

ACKNOWLEDGEMENTS

The authors are grateful to Dr. S. O. Alabi of the Institute for Agricultural Research, Ahmadu Bello University Zaria for providing Acha accessions used in this study.

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