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SHORT COMMUNICATION

VARIATION IN CHLOROPHYLL CONTENT IN BARLEY MUTANTS

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A field study was conducted to investigate variation in chlorophyll content in barley mutants. A significant decrease in chlorophyll content was observed in the chlorina mutant compared to parent while in most of the other mutants there was significant increase. The individual values of chlorophyll *a* and chlorophyll *b* revealed interesting trends. In the mutants, an increase in the chlorophyll *a* content had been associated with a decrease in chlorophyll *b* content. The dwarf mutant with variable chlorophyll pattern from that of parental control could be of greater use in developmental studies. Correlation studies revealed a positive association of grain yield with total chlorophylls and flag leaf area.

***Key words*: Barley, chlorophyll content, flag leaf area, mutants**

Mutation induction has become an established tool in plant breeding to supplement existing germplasm and to improve cultivars in certain specific traits. Progress in breeding of crop plants depend upon selection of favourable combination of characters available in the population. Leaf surface area per plant is an important determinant in production of photosynthates as suggested by Watson (1947). It is well known that photosynthetic efficiency depends on leaf area, chlorophyll content and the gas exchange. Chlorophyll content in leaf tissue varies with species, age of plants and growing seasons (Yurkovskii *et al.* 1977). Chlorophyll content in mutants of barley, particularly chlorina mutant, may vary from control. It is therefore possible to assess the photosynthetic efficiency of barley mutants by estimating their chlorophyll content.

Six true breeding barley mutants (dwarf, semi-dwarf, semi-dwarf with early maturity, early maturing, lax spike, and chlorina) and their control (K-169) were planted side by side in well prepared plots in the research farm of Department of Agricultural Botany, C. C. S. University at Meerut during 2000-01 and recommended agronomic and cultural practices for the crop were followed. The materials were grown under identical conditions of irrigation, fertility, climate etc. to minimize the variation due to environment in the growth and development of plants. Chlorophyll content in the leaves of the mutants and their control was estimated according to Arnon (1949). The leaves were collected at seedling stage (30 days old) and spike emergence stage (flag leaves) and the content of chlorophyll *a, b* and *total* were estimated. Correlation was estimated by standard method.

The data on chlorophyll content (chlorophyll *a, b* and *total*) of the six barley mutants along with their control are presented in Table 1. At 30 days old seedling stage, in three out of six mutants of K-169 studied here, there was significant increase in *total* chlorophylls with the value ranging from 0.0083 mg/g in lax spike mutant to 0.0098 mg/g in the dwarf mutant compared to the control value (0.0058 mg/g) while there was significant decrease in chlorina mutant (0.0046 mg/g). In semi-dwarf early maturity mutant also there was considerable decrease in the *total* chlorophylls over that of control. In the early maturing mutant, the value (0.0062 mg/g) was slightly higher over that of control. The same trend holds good with respect to individual content of chlorophyll *a* and chlorophyll *b*. The total chlorophylls were highest in the

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seedlings of dwarf (0.0098 mg/g) followed by semi-dwarf (0.0096 mg/g) and lax spike mutants (0.0083 mg/g) and lowest in chlorina (0.0046 mg/g) mutant. At spike emergence stage, the chlorophyll *a*, *b* and *total* chlorophylls in the leaf tissues were several times higher to the values that were recorded at seedling stage. Out of the six mutants studied, in three mutants there was significant increase in the *total* chlorophyll content in the leaf tissue at spike emergence stage over that of control, while in lax spike and chlorina mutants there was significant decrease (Table 1). Maximum value for *total* chlorophylls was recorded in semi-dwarf mutant (0.0316 mg/g) followed by early maturing mutant (0.029 mg/g) in comparison to control (0.0229 mg/g). The individual estimates of chlorophyll *a* and *b* in the mutants of K-169 at spike emergence stage showed interesting trends. Significant increase in chlorophyll a content had been associated with a marked decrease in chlorophyll *b* content in the mutants over control. In dwarf mutant, the *total* chlorophylls were almost same as that of control, but there was significant difference in the individual values of chlorophyll *a* and *b* between the mutant and its control. Such type of mutants with changed patterns can be of greater use in developmental studies.

It is known that photosynthetic efficiency depends on leaf area, chlorophyll content and the gas exchange (Watson 1947). Correlation between leaf area and yield (Alluwar and Deotale 1991) suggests the importance of chlorophyll and leaf area. The data on chlorophyll content (chlorophyll *a*, *b* and *total*) of both the stages suggest that the chlorophyll synthesis was badly affected in the chlorina mutants with significantly lower estimates of total chlorophylls compared to control. However, in most of the other mutants, significant increase in chlorophyll content was recorded indicating considerably higher synthesis of chlorophylls in comparison to control.

In general, there was large scale variance among the mutants and their control for chlorophyll content, flag leaf area and plant grain yield (Table 1). The total chlorophyll was positively correlated with flag leaf area (r = 0.74) and plant grain yield (r = 0.57) in the mutants of barley though it was not significant. Since leaf area and chlorophyll content are positively correlated with grain yield, these may be considered as selection criteria for the development of improved cultivars of barley. Bansal *et al.* (1999) also observed significant differences between stocks in rice for leaf area, chlorophyll *a*, *b* and *total* chlorophyll contents. Similarly, Raj and Tripathi (1999)

Table 1. Chlorophyll content (*a*, *b* and *total*) in the leaves at seedling and spike emergence stages, flag leaf area and grain yield in different mutants of barley cv. K 169.

Mutant/Control	Chlorophyll content at seedling stage (mg g^{-1} fw)			Chlorophyll content at spike emergence stage (mg g^{-1} fw)			Flag leaf area (cm^2)	Grain yield (g $plant^{-1}$)
	a	*b*	*Total*	*a*	*b*	*Total*		
K 169 (Control)	0.0028	0.0026	0.0058	0.0155	0.0074	0.0229	11.00	13.18
Dwarf	0.0052**	0.0041**	0.0098**	0.0141*	0.0090**	0.0232	9.92	7.68
Semi-dwarf	0.0051**	0.0044**	0.0096**	0.0137*	0.0179**	0.0316**	11.09	11.39
Semi-dwarf with early maturity	0.0021	0.0028	0.0050	0.0180**	0.0064	0.0245*	9.46	12.20
Early maturing	0.0031	0.0029	0.0062	0.0133**	0.0159**	0.0291**	11.65	13.30
Lax spike	0.0046**	0.0034*	0.0083**	0.0144*	0.0067	0.0216*	12.53	10.82
Chlorina	0.0023	0.0021	0.0046*	0.0109**	0.0094**	0.0203**	7.57	5.15
S. E.						0.0015	1.0205	1.149
C. V.						16.59	15.62	28.89

*, ** : significant at 5% and 1% levels, respectively.

observed correlation of leaf area and chlorophyll with grain yield in rice and suggested these traits as selection criteria.

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