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INHERITANCE OF LIGHT DEPENDENT PURPLE PIGMENTATION IN CHICKPEA

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ABSTRACT

The inheritance of light dependent purple (LDP) pigmentation is worked out in the marked crosses of chickpea. The *simple* leaf, non-LDP line ICC - 10301 and *Imperipinnate* leaf, *green line ICC - 32* were crossed by LDP pigmented, *Imperipinnate* leaf plants. The F_1 produced only LDP pigmented, *Imperipinnate* leaf plants in the two crosses. The F_2 segregated in two categories of LDP *vs* non LDP pigmented plants in a ratio of 9 : 7, suggesting complimentary interaction of two genes. The *simple leaf* segregation was found to be 1 : 3 with regard to *Imperipinnate* leaf, which is dominant.

Key words : *Cicer arietinum*, light dependent purple (LDP), *simple* and *Imperipinnate* leaf

The use of markers in a crop cultivar gives an added advantage in chracterizing and in maintaining the genetic purity. Many morphological marker for shape, size and pigmentation are used in different crops [1]. A light dependnet purple pigmentation (LDP) was identified [2] in a chickpea cultigen ICC-5763, which turns the plant surface purple in the light exposed portions of the plant. The unexposed or diffusely exposed portions of the plant remained green. The present investigations has been carried out to study the inheritance of LDP, so that it can be incorporated in the agronomically superior chickpea lines, utilized by breeders as marker.

MATERIALS AND METHODS

The LDP line ICC 5763 was crossed with non LDP lines ICC - 10301 (*simple leaf*) and ICC - 32 (*Imperipinnate* leaf; non pigmented seed, plant and flower) at IARI field, Delhi during *rabi* 1992. The F_1 and F_2 progenies were raised in subsequent years. The three parents used in this study are summarised in table 1 for their specific morphological and genetic characters. The data on plant pigmentation and simple leaf segregation were recorded and analyzed using chi-square to test the goodness of fit for different genetic ratios in F_2 progenies.

Table 1. Description and features of Chickpea and their Crosses

Genotupe	Characters
ICC - 5763	LDP plants are characterized by developing purple pigmentation in light exposed surface. The under surface of pigmentation remains green but turns purple if exposed to direct light; brown angular seeds; imperipinnate (wild) leaf and pink flower (LDP; B/ANG; Sl Sl)
ICC - 10301	Non LDP; brown, angular seeds; *simple leaf* and pink flower (non LDP; B/ANG; sl sl)
ICC - 32	Non LDP; beige, owl shape seeds; *Imperipinante leaf* (non LDP; BE/OWL; Sl)
ICC - 10301 × ICC - 5736	All LDP pigmented, *Imperipinnate leaf* plants (LDP; B/ANG; Sl Sl)
ICC - 32 × ICC - 5763	All LDP pigmented, *Imperipinante leaf* plants (LDP; B/ANG; Sl Sl)

RESULTS AND DISCUSSION

The two lines ICC-10301 and ICC-32 were used as female parents in the present study. The male parent ICC-5763 having LDP pigmentation trait when crossed with the said lines produced F_1 progeny with LDP/imperipinnate leaf (wild type) in the first cross and LDP/pigmented seeds, plants and flowers in the later cross. However, potent F_1 plants either with simple leaf or a non-pigmented seed and plant from the said crosses were rejected as maternal self. The F_1 seeds harvested from the cross ICC-10301 × ICC-5763 were 18 in number, but only 14 geminated in field. All F_1 plants were LDP pigmented with imperipinnate leaf. A total of eight seeds were obtained from the second cross ICC-32 × ICC-5763. However, six out of eight F_1 plants were LDP and rest two were green. These two green plants were rejected as maternal self. Since all F_1 plants from the two marked crosses showed LDP pigmentation, it was concluded that LDP trait is governed by dominant gene(s). The F_2 population from the cross ICC-10301 × ICC-5763 segregated for plants with LDP (#344) and non LDP (#296). This population also showed segregation for simple (#171) and imperipinnate (#496) leaf (Table 2). The F_2 segregation of the cross ICC-32 × ICC- 5763 produced #201 LDP pigmented plants and #154 non LDP pigmented plants. The segregation pattern in the two sets of crosses for LDP *vs* non LDP fits well in the ratio of 9 : 7, suggesting the complementation of two genes for LDP pigmentation. The monogenic segregation for alleles *imperipinnate* vs *simple* leaf in the cross ICC - 10301 × ICC - 5763 shows a ratio of 3 : 1, further confirms the

validity of this cross [3]. The joint segregations for *LDP/imperipinnate* leaf : *LDP/simple* leaf : non-*LDP/imperipinnate* leaf : non-*LDP/simple* leaf shows that the genes for the two traits may have some association (Table 2).

Table 2. Genetic analysis for *LDP* and *simple* leaf characteristic from observed date of these crosses in chickpea

Cross	Factor pair		Genetic ratio	χ^2	Probability range
I	LDP # 344	non LDP # 296	9 : 7	1.6	.10-.25
II	+# 469	sl sl # 171	3 : 1	1.0	.10-.25
	LDP/+# 254	non LDP/+# 125	27 : 9 : 21 : 7	9.2	.05-.01
	LDP/sl sl # 81	non LDP/sl sl # 92			
III	LDP # 201	non LDP # 154	9 : 7	0.63	.10-.25
Light × Intense	Intense # 98	Dilute # 30	3 : 1	0.56	.10-.25

#Observed frequency

The LDP pigmented class of segregants from F_2 of the two crosses were segregating in the intensity of pigmentation [1, 3]. A recombinant class of simple leaf with LDP pigmentation in the cross ICC - 10301 × ICC - 5763 was found to have intense and light (dilute) pigemnted plants. The two categories of simple leaf segregants were inter crossed and F_1 plants were found to be intense pigmented in the light exposed surface. However, the F_2 segregants had same parental class of intense and dilute pigmented LDPs with no green simple leaf segregants (Table 2). The number of intense pigmented simple leaf plants were three times higher than the dilute pigmented plants (Table 2). It is envisaged that the intensely pigmented LDP component has basic gene(s) for pigmentation and one dominant gene acts as a booster to intensify the pigmentation.

The earlier inheritance studies for a LDP line [5] suggested a digenic inheritance of foliage colour with dominant and recessive epistasis in their studies. However, the present investigation does suggest the interaction of two or may be more than two genes by complimenting each other as in maize pigmentation [6], where gene *pl.* caused foliage and culm pigmentation in the light exposed portions of whole plant and the *B* gene acts as booster to *pl.* gene to intensify the pigmentation. A gene symbol *LDP* for the light dependent purple pigmentation trait, and is governed by dominant genes is envisaged. Further investigations to locate other complimentary genes involved in pigmentation synthesis are carried out.

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