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Induction, genetics and possible use of glabrousness in chickpea

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Summary

A glabrous mutant was identified from progenies of chickpea seeds that were treated with ethyl methane sulphonate (EMS) The mutant has no shoot hairs in contrast to the dense hairs on normal chickpeas The character is governed by a single recessive gene This mutant can be useful in certain pathological and entomological studies

Introduction

In chickpea(*Cicer arietinum* L) several mutations have been reported, and in some cases have been used in the development of commercial varieties (Shaikh et al , 1982, Haq, 1983, Kharakwal, 1983)

Some mutants may not have direct commercial value, but may be useful in specific research studies We have identified a 'glabrous mutant' from progenies of EMS-treated chickpea seeds Origin, botanical description, genetics, and possible utilization of this mutant are discussed

Materials and methods

The experiment was conducted at ICRISAT Center from 1982 to 1986, using seeds of chickpea cv Chafa, which is a desi type chickpea with a normal hairiness-pilosity During 1981/1982, seeds were treated with 12 treatments of EMS (combinations of 0 05, 0 10, 0 15, 0 20, 0 30 & 0 60% concentrations for 2, 3, 4, & 6 hours) soaking Besides the occurrence of several other mutants, a plant with a hairless (glabrous) shoot was identified This genotype was reciprocally crossed with the parent cv Chafa, and also with accession ICC 2083 which is a kabuli type and has white flowers in contrast to the normally purple (pink) flowers of desi chickpeas. F_1 and F_2 populations were grown and the number of glabrous and normal plants recorded to determine the inheritance pattern

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Results and discussion

Germination of the EMS-treated seed was normal. In the second mutagenic generation (M_2), all the treatments produced chlorophyll mutants as well as morphological mutants for growth habit, leaves, pods, seeds etc (our unpublished data) From the '0 15%, 6 h' treatment a plant with hairless shoot (including stem, leaf, and pods) was visually identified (Figure 1) In subsequent generations this characteristic bred true This is the first reported glabrous mutant in the genus *Cicer*. The glabrous mutant is a relatively weak genotype, growing vegetatively to about half the size of the parent. Plants are highly susceptible to insects such as *Heliothis*

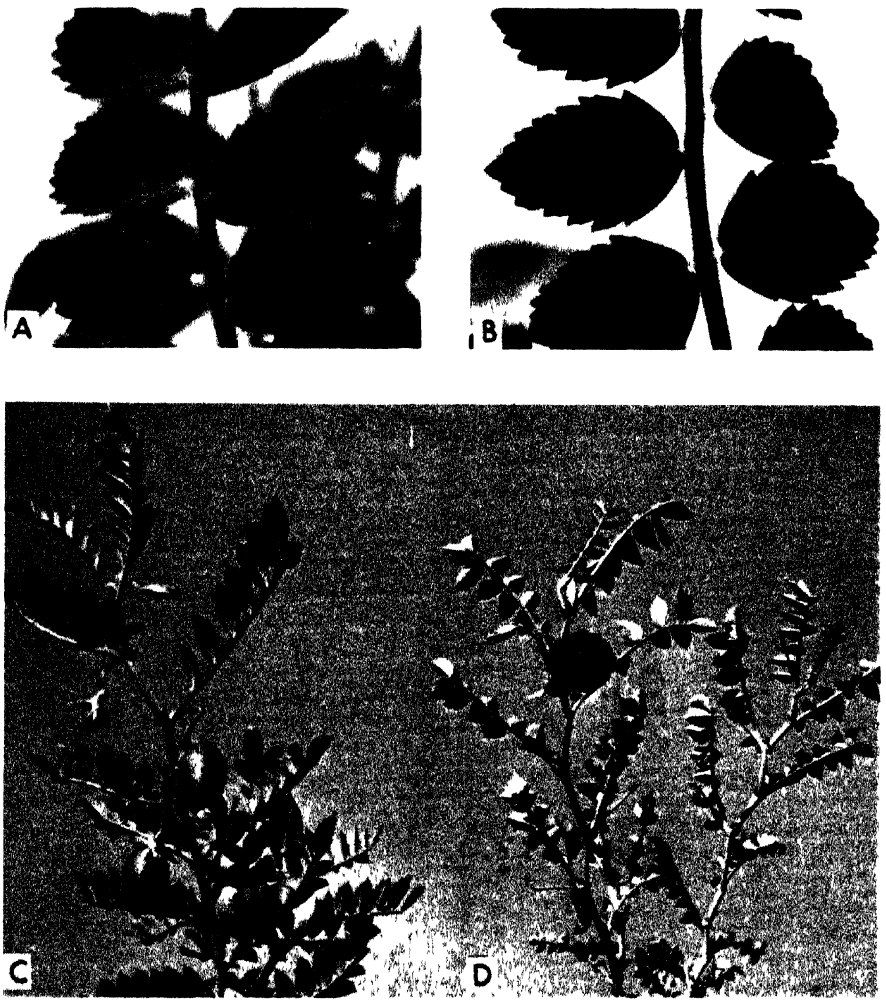

Fig 1 A) Normal chickpea leaf (with dense hairs), B) glabrous leaf of mutant, C) normal chickpea with no aphids, and D) the mutant infested with aphids

ırmigera Hub. (pod borer) and *Aphis craccivora* Koch. (black aphid), therefore, agronomic evaluation was not possible under normal field conditions. However, when the mutant was grown under good plant protection, or in the glasshouse, plants grew fairly well and produced an adequate number of seeds for maintenance. The glabrous mutant is similar to the parent in all characters except its glabrous shoot and reduced vigour. The botanical characteristics of the mutant are given in Table 1.

Genetics. All the F_1 plants had normal shoot hairs indicating that glabrousness is a recessive character. In F_2, both normal and glabrous plants were recorded, and the segregation fitted well to a 3:1 (normal:glabrous) ratio (Table 2), indicating that the characteristic is governed by a single recessive gene. In the reciprocal cross between mutant and cv. Chafa, the two F_1's were similar, and a similar pattern of segregation was noted in both the F_2 populations, revealing that the new characteristic is controlled by a nuclear gene, and that the change of cytoplasm did not make an apparent difference. The gene symbol 'glgl' is proposed for the glabrous character. This report is similar to many earlier findings that the majority of mutant characters in chickpea are governed by single recessive genes (Athwal & Brar, 1964; Rao & Pundir, 1983).

Possible use. Glabrous shoot in chickpea is a valuable trait for pathological and entomological studies. For example the stunt disease of chickpea is transmitted by the black aphid, (Nene & Reddy, 1976). While doing aphid transmission studies of the stunt disease, it was difficult to obtain the desired aphid population level on normal chickpeas (pers. commn Dr. A.M. Ghanekar, Legume Pathologist, ICRISAT). However, the glabrous mutant has proved a very satisfactory medium for aphid rearing and therefore for stunt disease transmission studies (Fig. 1D).

Most of the shoot hairs of chickpea are glandular that secrete an exudate of which malic acid is the major component. Preliminary observations (Rembold, 1981) revealed that malic acid acts as a deterrant to pod borer and borer-resistant lines secreted more malic acid than susceptible ones. The glabrous mutant would be a good differential host for pod borer because of its glabrousness and therefore its inability to produce malic acid.

To enhance its further use, we are transfering this character to other backgrounds such as long-duration, disease-resistant, and kabuli-type chickpeas.

Table 1 Brief botanical description of the glabrous chickpea mutant, ICRISAT Center, 1985/86

Plant color	Green with slight purplish pigmentation on stem
Days to 50% flowering	ca 44 days
Flower color	Pink
Seed	
color	Yellow-brown
shape	Angular
surface	Rough
no./pod	ca 1.2
mass	ca. 12.3 g 100 seeds^{-1}

Table 2 Inheritance of normal vs glabrous character of chickpea in three crosses of chickpea (assuming a 3:1 ratio pattern)

Cross	F_1type	F_2 segregation			X^2 value	Probability
		Type	Observed number	Expected number		
cv. Chafa ×	Normal	Normal	478	457.5	3.67	.05–.10
glabrous mutant		Glabrous	132	152.5		
Glabrous mutant ×	Normal	Normal	460	440.2	3.54	.05–.10
cv. Chafa		Glabrous	127	146.7		
ICC 2083 ×	Normal	Normal	529	507.7	3.55	05–.10
Glabrous mutant		Glabrous	148	169.2		

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