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Inheritance of Hairiness of Stem and Petiole in a Selection from Local (Nigeria) Germoplasm of Sesame

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Keywords: *Sesamum indicum* L.– *Ceratotheca sesamoides* Endl.– Homozygous– Alleles

Summary

Character differences were studied in inter specific crosses involving Sesamum indicum *L. and* Ceratotheca sesamoides *Endl. Results show that inheritance of many hairs on stem and petiole was controlled by two independently assorting genes with both dominant alleles S- and P- producing many hairs in stem and petiole respectively. Only the genotypes sspp homozygous for both recessive alleles were plants with few hairs. The implications of these findings in the species evolution are discussed.*

Résumé

Héritabilité de la présence de poils sur les tiges et sur les pétioles du sésame dans un germoplasme local au Nigeria

Cette étude analyse les différences de caractères au niveau de la descendance des croisements interspécifiques entre Sesamum indicum *L. et* Ceratotheca sesamoides *Endl.*

Les résultats obtenus montrent que l'héritabilité de la présence d'une forte pilosité sur les tiges et sur les pétioles est contrôlée par deux gènes assortis et indépendants. Les deux gènes dominants S et P confèrent aux plantes une importante pilosité sur les tiges et sur les pétioles tandis qu'un allèle dominant S-pp et ss-P confère aux plantes une pilosité respectivement abondante sur les tiges st sur les pétioles. Seuls les génotypes homozygotes sspp avec deux gènes récessifs produisent des plantes avec peu de poils sur les tiges et sur les pétioles. Les implications de ces résultats dans l'évolution de ces espèces sont discutées.

Introduction

Sesame (*Sesamum indicum* L.) belongs to the family of Pedaliaceae (2, 4). It is one of the most ancient among oil seed crops cultivated in the middle belt areas of Nigeria.

The seed is commonly used as a soup thickening condiment. It is also roasted and sometimes ground together with roasted groundnut to a pasty consistency like peanut butter in appearance and flavour. Sesame has been called «the queen of the oil seed crops» by virtue of the excellent quality of the oil it produces. The oil is known to be the most resistant to oxidative rancidity among the several vegetable oils (7). *Ceratotheca sesamoides* Endl. on the other hand is a species endemic in Africa. It is closely related to *Sesamum indicum* and is commonly referred to as 'False Sesame'.

It is characterized by many medium hairs on stem and petiole, dentate leaf margin; pink flowers with purple or brown dots and sub erect growth habit (2, 6). Both *Sesamum indicum* and *Ceratotheca sesamoides* are frequently cultivated in Savannah or semi arid areas of Africa (5).

These two species exhibit different characteristics. Few of these differences have however been genetically investigated. Van Rheenen (6) studied the inheritance of colour of petiole and colour of nectary in local *Sesamum indicum* and *Ceratotheca sesamoides.* He reported that the mode of inheritance of these characters was monogenic. Falusi (1) also reported further monogenic inheritance in resistance to leaf curl disease in interspecific cross between *Sesamum indicum* and *Sesamum radiatum*. This paper is a further report on the mode of inheritance of some character difference from inter specific crosses. It also throws some light on the role of gene mutation on the development of character differences between *Sesamum indicum* and *Ceratotheca sesamoides*.

Material and method

The experimental materials were obtained from parts of central and North western Nigeria. They were identified by the morphological description of Hutchinson and Dalziel (2) and Van Rheenen (6). The species in relation to the characters studied are as follows:

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KN- 02 – *Sesamum indicum* L. (few long hairs on stem and petiole).

KD- 02 – *Cerathoteca sesamoides* Endl. (many medium hairs on stem and petiole).

The seedlings of each species were raised in plastic buckets containing sand compost fertilizer mixture. At maturity, crosses were made between the two species using flower buds emasculated just before anthesis and pollinated the second day with pollen grains from freshly dehisced anthers of the male parent. The F_1 seeds were planted and the resulting plants were naturally self pollinated while some were backcrossed to both parents. The F_2 and backcross populations were grown and the segregating seedlings were counted to determine the inheritance of the different characters under investigation. Chi-square tests were used to compare the observed and theoretical ratio.

Results

All the F_1 plants from the crosses between *Sesamum indicum* and *Ceratotheca sesamoides* were having many medium hairs on their stem and petiole (Plate 1 and Figure 1).

The F_2 and backcross data from the crosses were presented in Table 1. When the F_1 plants were backcrossed to the *Ceratotheca sesamoides* parents, all the progenies were having many medium hairs on stem and petiole. The backcross progenies of the F_1 to the *Sesamum indicum* parents however, produced phenotypic rations of one many medium hairs on stem and petiole to one many medium hairs in stem but few long hairs on petiole to one few long hairs on stem but many medium hairs on petiole to one few long hairs on stem and petiole plants.

The chi-square values obtained for the crosses showed a good fit for a digenic inheritance for an F_2 phenotypic ratio of 9: 3: 3: 1. This was confirmed in the phenotypes of the backcross progenies of either 1: 1: 1: 1 when the F_1 was crossed to the recessive parent (*Sesamum indicum)* or many medium hairs on stem and petiole when the F_1 was crossed to the dominant parent (*Ceratotheca sesamoides*).

Plate 1: Shoots of *Sesamum indicum, Ceratotheca sesamoides* and their hybrid

Plate 1.1: Shoots of *Ceratotheca sesamoides* plants showing many medium hairs on stem and petiole.

Plate 1.2: Shoots of the hybrid plant showing many medium hairs on stem and petiole.

Plate 1.3: Shoots of *Sesamum indicum* plants showing few long hairs on stem and petiole.

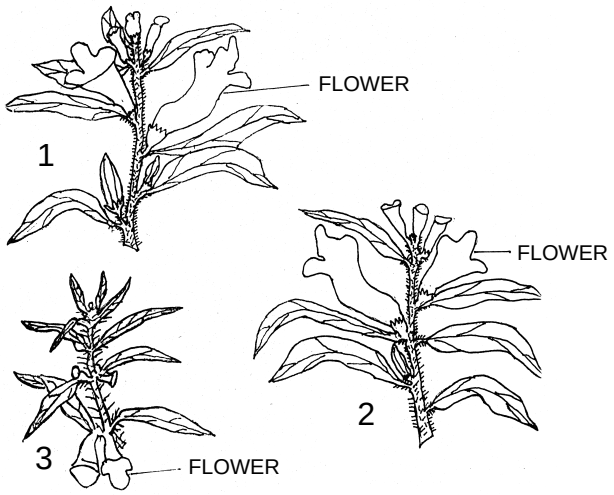

Figure 1: Shoots of *Ceratotheca sesamoides*, *Sesamum indicum* and their hybrids

Figure 1.1: Shoot of *Ceratotheca sesamoides* showing many medium hairs on stem and petiole

Figure 1.2: Shoot of the hybrid plant showing many medium hairs on stem and petiole

Figure 1.3: Shoot of *Sesamum indicum* showing few long hairs on stem and petiole.

Table 1
Inheritance of hairiness of stem and petiole in a cross between *Sesamum indicum* L. and *Ceratotheca sesamoides* Endl.

Cros	Experimental				Theoretical				χ^2	P	Ratio
	SP	Sp	sP	sp	SP	Sp	sP	sp			
KN- 02 X KD- 02 (SELFED Sp X SP) (selfed)	95	30	35	11	97	31	37	11	0.64	0.90- 0.80	9: 3: 3: 1
(KN- 02 X KD- 02) X KD- 02 sp X SP X SP	32	0	0	0	32	0	0	0	0.00	0.00	All S and P
(KN- 02 X KD- 02) X KN- 02 sp X SP X sp	15	12	10	12	12.5	12.5	12.5	12.5	1.52	0.70- 0.50	1: 1: 1: 1

Key
S= Many medium hairs in stem
P= Many medium hairs in petiole
s= Few long hairs in stem
p= Few long hairs in petiole

SP= Many medium hairs in stem and petiole
Sp= Many medium hairs in stem and few long hairs in petiole
sP= Few long hairs in stem and many medium hairs in petiole
sp= Few long hairs in stem and petiole

Discussion

The results on the inheritance of hairs suggests that the expression of many hairs in stem and petiole was due to the presence of both pairs of dominant alleles (S-P) while the presence of one allele (S-pp) or (ss-P) produced either many medium hairs in stem or petiole. This is an indication that character difference between *Sesamum indicum* and *Ceratotheca sesamoides* were simply inherited. Thus, the adaptive characteristics by which both plant species are distinguished are controlled by a small number of genes with marked phenotypic effects. By representing the genotypes of the *Sesamum indicum* plant by (sspp) and *Ceratotheca sesamoides* plants by (SSPP), the change from *Ceratotheca sesamoides* plants form to *Sesamum indicum* plant form could have been caused by the mutation of S→s and P→p. This suggests that *Sesamum indicum* plants were derived from *Ceratotheca sesamoides* plants through gene mutation.

A similar digenic though with complementary action was reported for the expression of hairiness or spininess in the crosses between *Solanum macrocarpon* and *Solanum incanum* (3). The presence of both pairs of dominant alleles was reported to produce hairiness or spininess while presence of one or absence of both gave spineless or hairless plants.

The possibility of gene exchange between *Sesamum indicum* and *Ceratotheca sesamoide*s indicates that they are both closely related and they could be classified in the same genus. Further evidence is borne by the fact that the F_1 produced by crossing them was fertile and their F_2 progenies were vigorous. Thus both *Sesamum indicum* and *Ceratotheca sesamoides* could therefore be considered as conspecific.

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