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

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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.

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 F₁ seeds were planted and the resulting plants were naturally self pollinated while some were backcrossed to both parents. The F₂ 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 F₁ plants from the crosses between *Sesamum indicum* and *Cerathoteca sesamoides* were having many medium hairs on their stem and petiole (Plate 1 and Figure 1).

The F₂ and backcross data from the crosses were presented in Table 1. When the F₁ plants were backcrossed to the *Cerathoteca sesamoides* parents, all the progenies were having many medium hairs on stem and petiole. The backcross progenies of the F₁ 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 F₂ 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 F₁ was crossed to the recessive parent (*Sesamum indicum*) or many medium hairs on stem and petiole when the F₁ was crossed to the dominant parent (*Cerathoteca sesamoides*).

![Figure 1: Shoots of *Cerathoteca sesamoides*, *Sesamum indicum* and their hybrids](image1)

**Table 1**

<table>
<thead>
<tr>
<th>Cros</th>
<th>Experimental</th>
<th>Theoretical</th>
<th>$X^2$</th>
<th>P</th>
<th>Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>KN-02 X KD-02</td>
<td>SP 35</td>
<td>SP 35</td>
<td>SP 35</td>
<td>0.84</td>
<td>0.90-0.80</td>
</tr>
<tr>
<td>(SELFED Sp X SP) (selfed)</td>
<td>Sp 11</td>
<td>sp 11</td>
<td>sp 11</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(KN-02 X KD-02) X KD-02</td>
<td>Sp 0</td>
<td>Sp 0</td>
<td>Sp 0</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>sp X SP X SP</td>
<td>32</td>
<td>0</td>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(KN-02 X KD-02) X KN-02</td>
<td>sp 12</td>
<td>sp 12</td>
<td>sp 12</td>
<td>1.52</td>
<td>0.70-0.50</td>
</tr>
<tr>
<td>sp X SP X sp</td>
<td>15</td>
<td>12</td>
<td>12</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Key**

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

![Plate 1: Shoots of *Sesamum indicum*, *Cerathoteca sesamoides* and their hybrid](image2)
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 \textit{Sesamum indicum} and \textit{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 \textit{Sesamum indicum} plant by (sspp) and \textit{Ceratotheca sesamoides} plants by (SSPP), the change from \textit{Ceratotheca sesamoides} plants form to \textit{Sesamum indicum} plant form could have been caused by the mutation of S→s and P→p. This suggests that \textit{Sesamum indicum} plants were derived from \textit{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 \textit{Solanum macrocarpon} and \textit{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 \textit{Sesamum indicum} and \textit{Ceratotheca sesamoides} 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 \textit{Sesamum indicum} and \textit{Ceratotheca sesamoides} could therefore be considered as conspecific.

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Literature


