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Inheritance of Accessory Involucre Mutant in American Upland Cotton, *Gossypium hirsutum* L.[1]

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A MUTANT plant was found by D. R. Hooton at the Cotton Field Station, Greenville, Texas, in 1935. This mutant, included in H. C. McNamara's collection of Heritable Abnormalities as number 7, has since been known by the designation HA7. The HA7 genetic stock has been maintained in cotton genetic collections, and its use as a genetic tool has increased in recent years. However, the value of this mutant as a genetic stock has been limited, because its existence has not been formally announced and its mode of inheritance has not been recorded in the literature. In 1948 a manuscript on results of inheritance studies with this mutant was prepared but it has never been published.[3] Extensive use of HA7 in genetic experiments at College Station has resulted in an accumulation of current data on its inheritance. Furthermore, data from the unpublished manuscript mentioned above were made available.[4] The older data have been combined with the current data in the preparation of this report.

In populations or stocks involving the HA7 character, first indication of the mutant expression is that veins at the base of the leaves are parallel which results in a constriction and folding of the leaf surface (Figure 1). As fruit forms begin to develop, further manifestation of the mutant character can be noted through the absence of the calyx and the presence of three trumpet-like growths (Figure 2), one between each of the bracts and enclosed by them. As fruits develop their carpel walls are devoid of pigment glands. Fleshy appendages are formed at the base of the fruits (Figure 3). The trumpet-like growths, accessory involucre, are the most striking and consistent feature of HA7 and the one which distinguishes it from other mutants of similar general appearance.

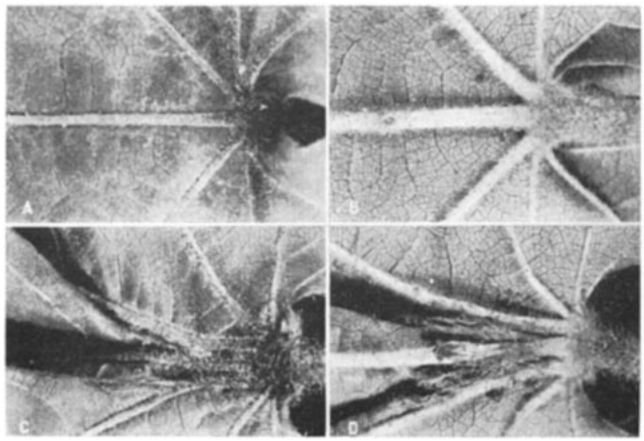

Figure 1. Basal sections from normal (A and B) and mutant (C and D) cotton leaves. A and C are upper, and B and D are lower surfaces.

HA7 plants exhibit a high degree of female sterility (Figure 4) but are pollen fertile. Cytological analyses were performed by cytologists of the Cotton Improvement Group of the Department of Soil and Crop Sciences to detect possible cytological aberrations. Analysis indicated that mutant plants had normal chromosome complements and normal chromosome pairing.

F_1 hybrids between HA7 and normal cotton plants had normal leaf venation, boll glands, fertility, and calyx, but they exhibited rudimentary forms of the accessory involucre (Figure 5); and rudimentary forms of the fleshy

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[3] J. Winston Neely and Homer G. McNamara. Mode of inheritance of accessory involucre and associated characters in Upland cotton (unpublished manuscript).

[4] I wish to thank J. Winston Neely, Vice President, Coker's Pedigreed Seed Company, for permitting the use of his unpublished data.

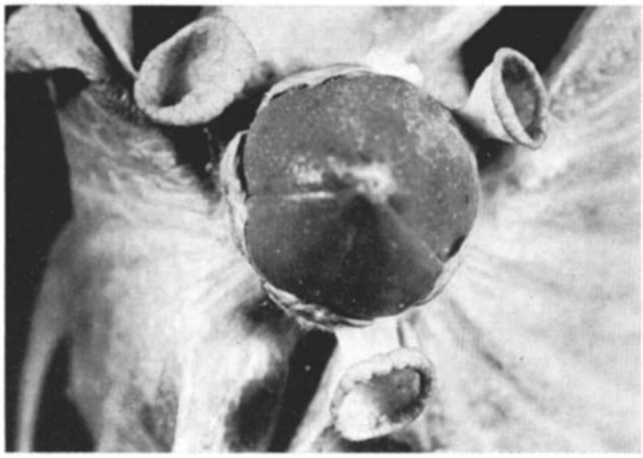

Figure 2. Five-day-old cotton fruit from mutant plant showing accessory involucre.

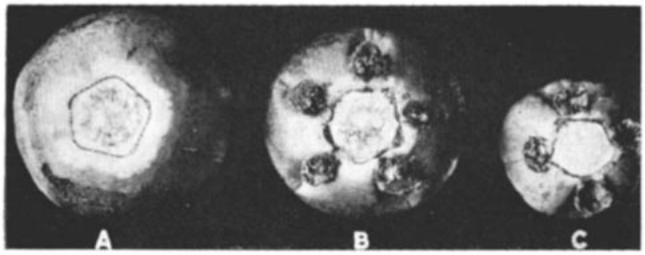

Figure 3. Basal view of mature cotton fruits showing normal (A) compared with fleshy appendages of the mutant (C) and intermediate of the F_1 (B).

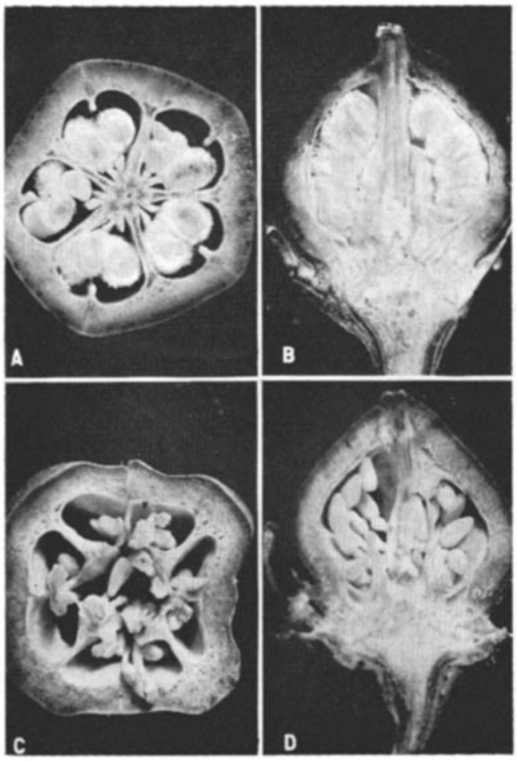

Figure 4. Cross sections and longitudinal sections of five-day-old cotton fruits comparing normal (A and B) with highly female sterile mutant (C and D).

Figure 5. Comparison of normal and mutant cotton buds (top row) and normal and mutant 5-day-old fruits (bottom row). A and D are normal, C and F are mutant and B and E are from the F_1.

Table 1. Segregation of the accessory involucre mutant (ia ia) in crosses with normal cotton plants (Ia Ia).

Population	Number of plants			X^2	p
	IaIa	Iaia	iaia		
JWN and HCMc data					
(IaIa × iaia)IaIa	56	61		0.21	.70-.50
(IaIa × iaia)F_2	53		185*	0.95	.50-.30
RJK data					
(IaIa × iaia)IaIa	103	86		1.53	.20-.20
(IaIa × iaia)IaIa	102	95		0.25	.70-.50
(IaIa × iaia)F_2	44		133*	0.001	.98-.95
(IaIa × iaia)F_2	51	130	59	2.20	.50-.30

* Homozygous and heterozygous mutant classes were pooled.

appendanges also are present (Figure 3). The degree of development of the accessory involucre in the F_1 varies, both within and between plants. The mutant expression tends to be absent on young F_1 plants, but it becomes more pronounced in fruit forms that develop as plants mature. Thus, it is always present to some degree in F_1 plants but it never develops into the trumpet shape found in the true breeding mutant parent.

Because of the high degree of female sterility, HA7 has been maintained in a heterozygous state. Three phenotypes are present in self-fertilized progeny of the heterozygous mutant stock: mutants, intermediates, and normals. Data from small maintenance populations indicate monogenic inheritance. After these observations had been made it was learned that, although it had not been reported in the literature, HA7 had been studied and its monogenic inheritance had been established. At this point the unpublished data were made available for inclusion in this report.[3]

As noted above, the distinguishing feature of HA7 is the accessory involucre. It is suggested that the mutant be called *accessory involucre*. Data in Table 1 were combined from the unpublished manuscript (JWN and HCMc) with current data (RJK), and they verify the monogenic inheritance of this mutant. The heterozygote can be identified in most genetic backgrounds. However, since it more nearly resembles the normal than the mutant phenotype, the mutant is considered to be a recessive character. We proposed that the accessory involucre mutant and normal genotypes be assigned the gene symbols *ia ia* and *Ia Ia,* respectively.