

INHERITANCE OF GLUME LENGTH IN RAGI, *ELEUSINE CORACANA* (Gaertn), THE FINGER MILLET

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The earhead of *Eleusine coracana* is a terminal whorl of digitate spikes radiating from the apex of a culm. Each of the spikes consists of two rows of sessile spikelets. The spikelets usually contain 5 to 10 glumes each, of which the two lower-most are barren and the rest are paleate, each enclosing a complete flower. When the grains set and develop, they peep out of the glume and present the seriate appearance characteristic of this earhead.

The average length of the glumes in the spikelet of a normal type of cultivated *ragi* in South India, is as follows from bottom to top.

Table I.

Glume	I	...	...	Average Length in mm.
"	II	...	...	4.0
"	III	...	...	5.0
"	IV	...	...	4.5
"	V	...	...	4.5
"	VI	...	...	4.0
"	VII	...	...	3.5
"	VIII	...	...	3.5
"	IX	...	...	3.0
"	X	...	...	3.0

It will be noticed that the first is shorter than the second. The second is the longest glume. There is a gradual reduction in this length towards the top glumes. This trend in glume length may be said to be general in all the *Eleusines* including the wild ones, *E. indica* and *E. aegyptiaca*. In the wild *Eleusines* the grains are small and long, and are well enclosed by the glume and palea. In the cultivated *ragi* the grain is a bit longer than the wild ones and considerably thicker, so that the spherical grains push apart the glume and the palea, and get visible.

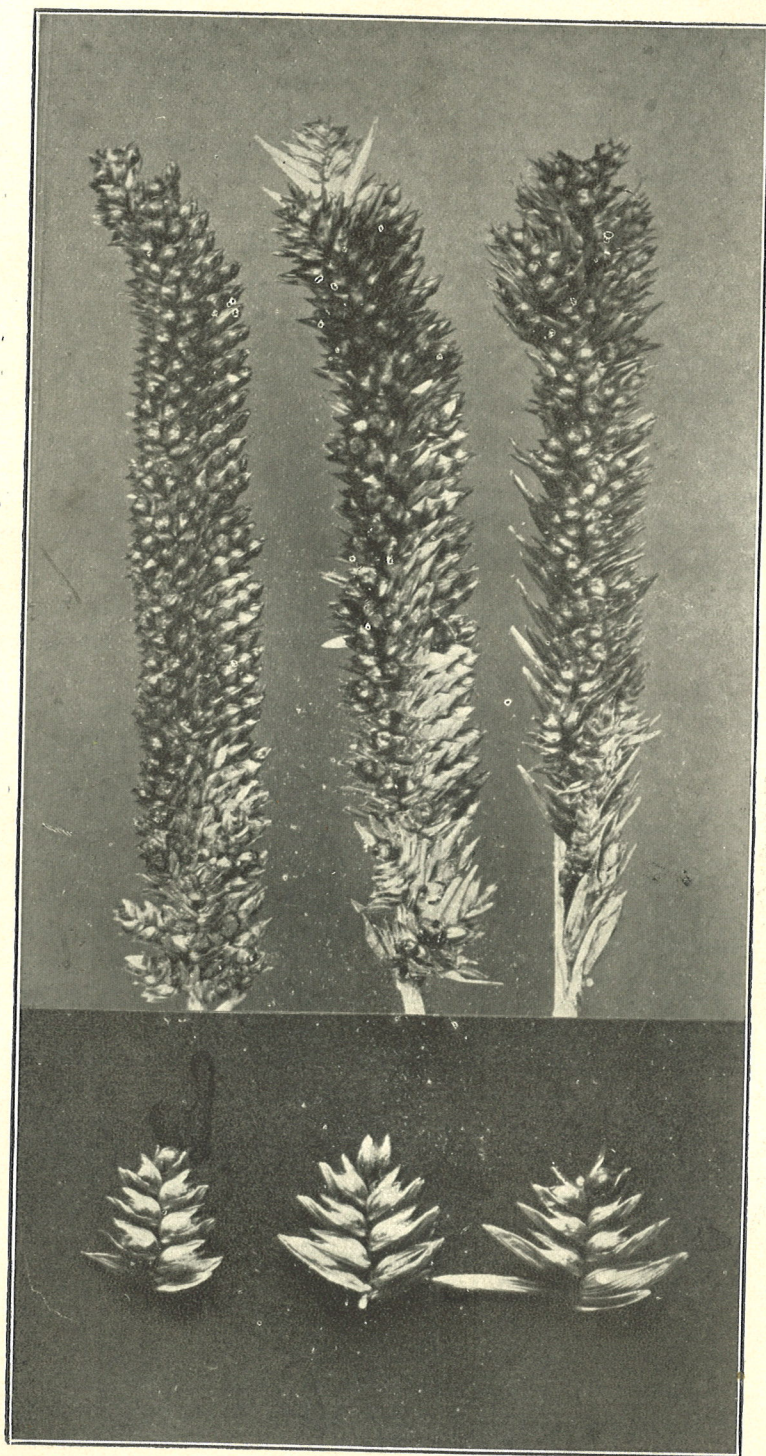
In M. S. 1567, an African variety of *ragi* from Nyassaland, a type was noticed where the glumes of the spikelet were longer than normal short ones. The spikelet, (due to the long glumes) presented a chaffy look and had an obovate appearance instead of the usual ovate of the common *ragi*. This type was suspected to be an abnormality, possibly pathological. But as the growth and appearance in subsequent years was the same, it was put down to be a varietal characteristic surviving in the original habitat of this "African Millet". The relative glume and palea lengths of this type and that of the local cultivated *ragi* are given below:—

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GLUME LENGTHS IN RAGI,
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Short.

Medium.

Long.

Table II. Length of Glumes and Palea.

		Local—Short Glume.		African—Long Glume.	
		Glume.	Palea.	Glume.	Palea.
Glume		mm.	mm.	mm.	mm.
I		4.0	—	4.0	—
"	II	5.0	—	8.0	—
"	III	4.5	4.0	8.5	4.0
"	IV	4.5	3.5	7.0	4.0
"	V	4.0	3.0	6.0	4.0
"	VI	3.5	3.0	5.0	4.0
"	VII	3.5	3.0	4.5	4.0
"	VIII	3.0	3.0	4.0	3.5
"	IX	3.0	3.0	3.5	3.5
"	X	3.0	2.5	3.0	3.0

It will be noted that the variety from Nyassaland has glumes definitely longer than the normal. It is remarkable that this glume length notwithstanding, the length of the palea remained the same in both the Indian and African varieties. The same equality in size was noticed in the grain also. It will thus be seen that the difference lay in the length of the glumes only. It is the large glume of the African variety that partially hides the grain and gives the earhead its chaffy look.

The inheritance of this "Glume Length" character was pursued. In crosses between normal and long glumes, the first generation plants had the normal Short glumes and in the second generation the following segregations of the glume lengths, Short, Medium and Long (see Fig.) were obtained.

Table III. Inheritance of Glume Length.

F ₂ Family No.	Segregating for glume lengths.		
	Short.	Medium.	Long.
E. C. 2953	152	122	34
" 2958	142	155	53
" 2961	131	124	40
" 2962	124	128	42
" 2963	116	125	42
Total	665	654	211

To interpret these ratios, 90 selections were carried forward from family E. C. 2958 to a third generation. The behaviour of these selections is given below:—

Table IV. Family E. C. 2958—F₃.

Character of Selections.	Number of Families.	Behaviour in F ₃			(x ²)	P value.
		Short.	Medium.	Long.		
Short (14)	1	203				
	2 (3:1)	105	42	—	.9	.3 < P < .5
	3 (9:6:1)	205	166	32	4.1	.1 < P < .2
	8 (27:27:10)	276	255	98	.8	.5 < P < .7
Medium (52)	10		532			
	27 (3:1)		1639	538	.1	.7 < P < .8
	15 (9:7)		446	321	1.2	.2 < P < .3
Long (24)	24			1509		
Total	90					

The long glume is about twice the length of the short glume and juts prominently beyond the grain. The length of this glume and the comparatively hidden grains, gave the earhead a characteristic chaffy look, which afforded a dependable qualitative guide in the grouping of the segregates.

Table IV reveals that in Table III we had the rather rare 27:27:10 ratio whose P value is between '1 and '2. A study of Table IV shows that there are three factors determining glume length. These may be designated G_{11} , G_{12} and G_{13} . All the three factors should be present to give a normal Short glume. Any two of them make a Medium glume. Each one of them or none produces a Long glume. The general fit of the figures in Table IV to the theoretically expected behaviour will be evident.

A Long glume connotes wild affinities and economic disabilities. In this closely pollinated millet there must have been Longs of many races and of different genetic constitutions. When these came together, they also brought together supplementary factors, whose joint effect was an inhibition in glume length. Any two of the three factors for glume length might bring about the first stage of the desired reduction. The Medium lengths being thus brought about, they needed only an additional factor to bring about the normal glume length with its visible grains. This additional factor could be available in many of the sister Mediums and some of the original Longs. There are thus afforded many opportunities at a supplementary endeavour, which neutralize in some measure the paucity of chances at cross pollination and subsequent selection. A shortening thus secured, selective forces must obviously have helped to perpetuate the normal Short glume with its visible grain. This triple play of factors offers, therefore, a decent chance for an elimination of the undesirable length in the glume. This phenomenon gives a glimpse of one of the many ways in which genetic factors play on each other, towards an evolutionary advance.

Summary. The Short length of the glume in a normal cultivated *ragi* is due to the presence of three dominant factors G_{11} , G_{12} and G_{13} functioning as inhibitors of glume length. Any two of the above three, increase the length of the glume and give a *Medium* length. Each of them singly, or none, gives a *Long* glume. The inter-play of these factors results in a 27:27:10 ratio of Short:Medium:Long glumes.