

A comparative study of *Eleusine coracana* Gaertn. and *Eleusine reniformis* Divak. *

by

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Synopsis: A comparative study of the two species of *ragi*, *Eleusine coracana* Gaertn. and *Eleusine reniformis* Divak. is reported. The former is commonly known as globular *ragi* and the latter reniform *ragi*. The two species are easily distinguishable from the seed to the mature plant. Globular *ragi* has ovate-spherical grains. The first leaf is long and narrow and is inserted at an angle of over 45°. The mature plant has an elegant appearance on account of the long flowing leaves. Reniform *ragi* has kidney shaped grains. The first leaf is short and broad and is parallel to the ground. The plant has a vigorous appearance in early stages of growth, but the mature plant looks wilted due to the presence of a large number of bent leaves. The paucity of tillering, indiscriminate lodging and lack of uniformity in grain size have perhaps rendered the reniform *ragi* an uneconomic type.

Eleusine coracana Gaertn. is widely known and described by several authors (Roxburgh 1938, Watt 1908 and Burhill 1935). As description of *Eleusine reniformis* Divak. has been rendered elsewhere (Divakaran 1959) the differences in the characteristics of the two species alone are detailed in this article.

Materials and methods: *Ragi* Co. 1 (E. C. 593) a standard type of *E. coracana* was selected for comparison with E. C. 4626, a pure line selection of *E. reniformis*. The types were grown in summer 1953 at the Millets Breeding Station, Coimbatore and their morphological characters studied and compared. Measurements of the grain, thickness of the peduncle and length of glumes and weight of earhead and grain were recorded. The volume of the grain was found by the displacement method using kerosene oil as the medium. Such of the characters that cannot be quantitatively expressed are briefly described.

Results and Discussion: During the early stages of growth i.e., during the first two months, *E. reniformis* showed rather rapid growth but the rate slackened afterwards. On account of the initial quick growth, it appeared to be more vigorous than *E. coracana* in the early vegetative stages. As the plants mature, the vigour is masked by the bent leaves that hang down and give the plants a wilted appearance. Irrespective of the weather conditions the mature plant has a type of indiscriminate lodging, which has been designated as toppling (Divakaran 1960). Lodging in *E. coracana* depends on environmental factors to a very great extent and may not occur in poor soils or in the absence of squally weather when the crop matures. The plant has an elegant appearance because of its long flowing leaves.

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The two species showed a marked difference in the shape and insertion of the coleoptyle i.e., the first leaf as the seeds germinated. In *E. reniformis* the first leaf is elliptic in shape and parallel to the ground. As the first leaf unrolled it lay flat and flush with the nursery bed and could hardly be distinguished. The coleoptyle of *E. coracana* is lanceolate in shape and inserted at an angle of over 45°.

The growth measurement of the plants at different stages are presented in Table I.

TABLE I.

Types	Growth measurement in cm. after planting			Percentage of bent leaves
	20 days	50 days	110 days	
<i>E. coracana</i>	17.4	48.8	74.9	84
<i>E. reniformis</i>	14.2	53.6	65.2	20

Note :- The height of the plants (20 and 50 days after planting) was measured to the tip of the leaf and that of mature plant (110 days) to the tip of the earhead and it represents the actual height. The apparent increased growth in the early stages is due to the longer leaves of the reniform ragi.

The other measurable traits of the two species together with their statistical significances are presented in Table II. Each measurement in the table represents the average of fifty observations.

TABLE II

Measurements of quantitative characters of reniform and normal ragi

Plant characters	Unit of measurement	<i>E. reniformis</i>	<i>E. coracana</i>	Difference Significant or not
		(E. C. 4608)	(E. C. 593)	
Plant height	Cm.	65.20 ± 2.267	74.90 ± 1.005	Significant
Tillers	Nos.	1.90 ± 0.091	3.7 ± 0.192	do.
Leaves	Nos.	12.26 ± 0.292	8.89 ± 0.208	do.
4th leaf length	Cm.	42.88 ± 0.650	38.12 ± 0.075	do.
4th leaf breadth	Cm.	1.54 ± 0.004	1.13 ± 0.023	do.
Peduncle thickness	Cm.	0.57 ± 0.011	0.39 ± 0.009	do.
Fingers	Nos.	7.58 ± 0.137	5.36 ± 0.135	do.
Finger length	Cm.	9.08 ± 0.207	9.16 ± 0.171	Not significant
Earhead weight	gms.	10.18 ± 0.315	7.96 ± 0.272	Significant
<i>Grain shape:</i>				
Length	mm.	1.89 ± 0.008	1.79 ± 0.007	do.
Breadth	mm.	1.48 ± 0.013	1.79 ± 0.007	do.
L/B Index	mm.	1.23 ± 0.011	1.01 ± 0.006	do.
Flowers in a spikelet	Nos.	10.10 ± 0.121	7.96 ± 0.095	do.
Glume length	mm.	3.20 ± 0.003	4.37 ± 0.003	do.
Grain weight (1000 grains)	gms.	2.53 ± 0.025	2.97 ± 0.026	do.
Grain volume (1000 grains)	c. c.	2.07 ± 0.260	2.24 ± 0.022	do.

Excepting for finger length the differences are statistically significant. It is observed that the number of glumes to a spikelet, glume length, spikelet shape and grain shape are identical in all plants, but the plant height, leaf length and breadth and peduncle thickness are found to be influenced by environment and varied from plant to plant. The panicle of *E. reniformis* has more spikes, spikelets and glumes than in the panicle of *E. coracana*. The glumes being long, the spikelets of *E. coracana* are lanceolate and enclose the grains. The glumes of *E. reniformis* being short the spikelets are ovate and do not enclose the grains which remain exposed between the gaping glumes. Wide variation for grain size is also observed in *E. reniformis*. This type showed 32 different sizes as against only nine in *E. coracana*. The seeds collected from 51 spikelets of each type grouped according to size as fixed by measurements are presented in table III.

TABLE III
Grain size variations in *Eleusine* spp.
(A) *E. coracana* Gaertn.

Breadth of grain in mm.	Length of grain in mm.					Total
	1.8	1.7	1.6	1.5	1.4	
1.8	19	1	...	...	...	20
1.7	2	126	...	...	...	128
1.6	...	3	25	...	...	28
1.5	...	...	...	9	...	9
1.4	...	...	...	1	5	6
Total	21	130	25	10	5	191

(B) *E. reniformis* Divakr.

Breadth of grain in mm.	Length of grain in mm.										Total
	2.0	1.9	1.8	1.7	1.6	1.5	1.4	1.3	1.2	1.1	
1.7	1	2	1	1	...	...	...	...	...	...	5
1.6	1	9	9	3	2	...	...	...	...	...	24
1.5	2	17	27	16	...	1	...	...	...	...	63
1.4	1	11	32	86	9	4	6	...	...	...	149
1.3	...	..	...	3	11	3	3	1	...	...	21
1.2	...	...	...	...	...	3	2	1	...	...	6
1.1	...	..	...	...	...	1	6	...	...	3	10
Total	5	39	69	109	22	12	17	2	...	3	278

In the table, length represents the horizontal (median) and breadth, the vertical (along the axis) measurements of the grain seating it on the micropyle. Thirty two different sizes are observed in the reniform *ragi* against nine only in the normal. Perhaps the variations in the size of reniform *ragi* may be due to the greater number of grains that are packed closely on the spikelets. The grains at the base of the spikelets are big, whilst the top ones are smaller, the top most ones being smallest. However, small or big, the grains are kidney shaped. Grain sizes 1.7, 1.4 mm. and

1.7/1.7 mm. predominate in the reniform and normal varieties respectively. The earhead of the reniform *ragi* weighs more than that of normal. The well formed reniform grains are bolder and selected samples are heavier than that of normal *ragi*. A random sample, however, was lighter owing to the mixing up of the diverse grain sizes.

Summary and Conclusion: In the wide spread family of Gramineae which has quite a number of useful and economic species of grasses, reniform grain has not been recorded to the author's knowledge. A comparative study of the normal *ragi* species with a reniform *ragi* is made. *E. reniformis* could be easily distinguished from *E. coracana* right from the seed to the mature plant. The former has as the name indicates reniform or kidney shaped grains. The grains are longer horizontally and have a constriction towards the middle in the micropylar region. This gives the characteristic shape to the grain. The coleoptyle when it emerges is elliptic in shape and is parallel to the ground. *E. coracana* grain is ovate-spherical to be more exact; not globular as usually referred to. The horizontal and vertical measurements of the ovate-spherical grains are the same but it slightly tapers towards the middle in the micropylar region. The coleoptyle is lanceolate in shape and is inserted at an angle of over 45°. Though reniform *ragi* is very robust in the early vegetative stages it assumes a wilted appearance as the plant matures on account of the predominance of bent leaves. It has also a type of indiscriminate lodging. On the other hand the traditional type of *ragi* has an elegant appearance because of its straight flowing leaves. The damage by lodging in the *E. coracana* depends on the environmental conditions and may even escape lodging. The paucity of tillering, indiscriminate lodging and lack of uniformity of grains size perhaps renders *E. reniformis* highly uneconomic and almost extinct as a cultivated type (Divakaran 1959).

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