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FURTHER CONTRIBUTION ON PROTOHISTORIC RAGI — *ELEUSINE CORACANA* GAERTN.

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ABSTRACT

The paper describes comparative morphology of Neolithic and Harappan carbonized grains identified as *Eleusine coracana* and of modern Ragi. The morphological details not described earlier are found to be similar in both, thus supporting the identification of carbonized grains to *Eleusine coracana*

Key-words — Ragi, Carbonized grains, Protohistoric (India).

सारांश

आद्य-ऐतिहासिक रागी-एल्यूसीन कोराकाना गेयर्टन० पर कुछ और अंशदान—रघुपति सावित्री एवं विष्णु मित्र

इस शोध-पत्र में निओलिथिक एवं हरप्पा कालीन कार्बनीकृत दानों की, जिनका अभिनिर्धारण **एल्यूसीन कोराकाना** से किया गया है, तथा आधुनिक रागी की तुलनात्मक आकारिकी का वर्णन है। दोनों में आकारिकी विवरण, जो पूर्वतः अवर्णित थे, समान पाये गये हैं, जिससे इन कार्बनीकृत दानों के **ऐल्यूसीन कोराकाना** से अभिनिर्धारण की पुष्टी होती है।

INTRODUCTION

THE discovery of Ragi in the carbonized plant remains at Hallur, Karnataka (Vishnu-Mittre, 1971) and dated to about *1800 B.C. has been an important addition to ancient plant economy of India. This record known from India has been of world interest particularly for its antiquity and being the first most ancient world record and more especially in regard to its postulated origin in the African continent (Mehra, 1963a, b; Hutchinson, 1965) wherefrom the archaeobotanical records are of later date.

The singular record of ancient Ragi referred to above is now duplicated by the discovery of its carbonized grains at the Harappan site Surkotada near Adesar in Kutch (Map 1). The material kindly placed at our disposal by the Archaeological Survey of India, and from locus ×A 4, 2d. 1, layer 5, depth 1·6 m, dated to 1660 B.C., TF-1307, consists of lumps of carbonized grains most of which belong to wild herbaceous plants. Amongst them were retrieved some which are identified as of Ragi.

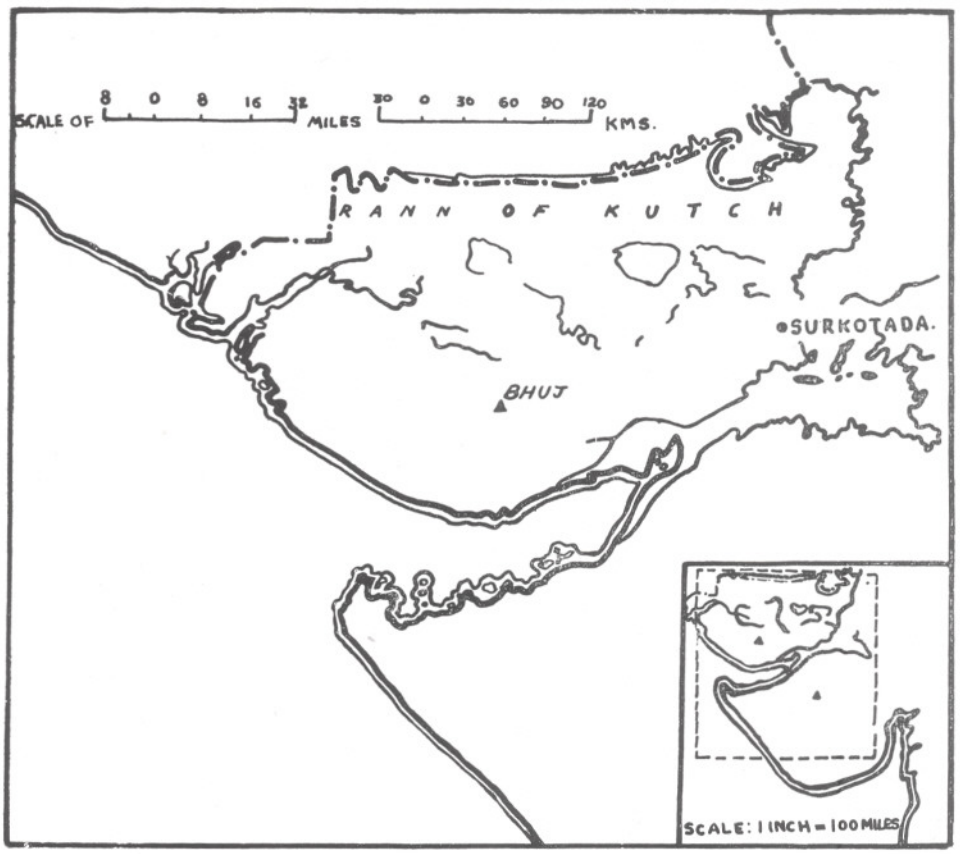
We have also re-examined carbonized Ragi grains from Hallur described and figured earlier by one of us (Vishnu-Mittre, 1971). A comparative study of the spikelets and grains of modern Ragi has also been carried out to enable identification of carbonized grains. The results of entire study are presented in this paper.

The carbonized lumps were found stored in earthenpots belonging to the white painted black and red ware referred to Period III and dated from 1790 B.C. to 1660 B.C. The Surkotada material is comparatively less charred than that of Hallur which owing to excessive charring has become fragile.

OBSERVATIONS

A grain in modern Ragi is surrounded by a loose papery membrane (pericarp)

*The material is discovered from the floor of a house in layer 9 trench 1 in the Neolithic levels, the base of which (layer 14, trench 1) is dated by radiocarbon to 3660±105 (TF-580), i.e. 1710±105 B.C. The cereal Ragi is believed to have been cultivated and consumed in the entire Neolithic at this site until evidence contrary to it has been discovered.



MAP 1 — Showing the location of Surkotada in Kutch.

and is lodged in a cavity formed by the lemma and palea, and a spikelet contains several grains each individually lodged in such a cavity formed by the lemma and palea. The grains are oblong to globose, shrunken in some, often smooth-walled when without the seed coat. The seed coat bears minute loosely to densely distributed warts or wart-like or peg-like thickenings. The hilum scar is distinctly and prominently present. The seeds measure 1·70-2·00 mm in length and 1·00-1·50 mm in breadth. The membrane enclosing the grain is provided with fine finger-print like pattern.

The Surkotada carbonized grains have also been observed to possess a loose membrane which in structural details is much the same as in modern Ragi (Pl. 1, figs 3, 4; Pl. 2, fig. 8). The seed coat bearing tubercles is remarkably alike in both (Pl. 1, fig. 1; Pl. 2, fig. 10). At the same time both the shape and position of the hilum scar are also alike. The carbonized grains measure 1·20-1·60 mm in length and 0·80-1·20 mm in breadth. The carbonized grains are indeed smaller in size than those of modern Ragi grains possibly due to the effect of carbonisation. Most carbonized grains with the seed coat reveal wide open scar with the projecting embryo, which may suggest the bursting of the grains at the time of carbonisation (Pl. 1, figs 5, 6). The oblong grains as referred to by Vishnu-Mittre (1971, pp. 126,127) to *Eleusine indica* were not discovered in the Hallur material (cf. also Vishnu-Mittre, 1974, p. 80). They are quite distinct in morphology and shape (Pl. 2, fig. 9). These morphological and anatomical comparisons between modern grains are beyond doubt that the carbonized grains belong to *Eleusine coracana*, the Ragi.

CONCLUSION

The discovery of Ragi from Kutch advances our knowledge hitherto known from Karnataka only for its wider cultivation in ancient India. Although, in south it were the Neolithic Mysoreans who had subsisted upon it, yet in Kutch the Harappans had consumed it. However, the C-14 dates at hand suggest contemporaneity of these two cultures. Both the records are the first and the oldest in the world, and none so ancient has so far been found in Africa, believed on cytogenetical grounds to be the centre of its origin (Vavilov, 1951; Darlington, 1943; Mehra, 1963a, b; Hutchinson, 1974). Its wild progenitor *Eleusine africana* (tetraploid) (Pl. 2, fig. 7) is profusely distributed as a weed in the fields of Finger millet in Africa but not found in India. The Indian wild form is *E. indica* which being diploid rules out its being the progenitor (Mehra, 1963a). According to Mehra (1963b) *E. africana* arose through crossing of *E. indica* and related taxon resulting in doubling of chromosomes. The African high laid *coracana* then arose from it by selection and Afro-Asian *coracana* from it by selection for reduced length. The seeds in both *E. africana* and *E. indica* are elliptical and those of *E. coracana* are oblong. Could selection alone bring about such a change in the shape of their seeds remains to be understood ? Its original home in Africa is apparently established and the Indian finds dated to about 1800 B.C., the only most ancient world record, would suggest ancient Indo-African cultural contacts which the archaeologists have not been able to bring out as yet.

E. indica is widely distributed today in the tropical and warm temperate regions of India. Whereas, the seeds of *E. indica* are gathered and eaten in times of scarcity. Ragi is the principal staple crop of the poor masses in states of Karnataka (Mysore) and Tamil Nadu (Madras) and elsewhere too, though the upper classes use it occasionally but more regularly in the Karnataka State. Nearly 70% of the Ragi area under cultivation lies in States of Karnataka, Tamil Nadu and Maharashtra and more than one third of it only in the Karnataka State. It is also grown in Andhra Pradesh, in uplands of Bihar and also in the Sub-Himalayan tracts. One to three seasonal crops are grown. In Karnataka and Tamil Nadu, the crop is mostly fed by monsoons, though irrigation during summer is necessary in some areas in the Maharashtra State. In Punjab it is sown in marshes.

Apart from pure crop it is also grown mixed with other crops such as species of *Dolichos*, *Cajanus cajan*, *Vigna sinensis*, etc., and as a subsidiary crop to groundnut. The finds from Karnataka are unassociated with any other crop though remains of *Dolichos biflorus* are obtained at other depths at Hallur. At Surkotada the remains are associated with seeds of *Setaria italica* and several wild species in which those of grasses and sedges abound.

Presently, Ragi is used as flour for bread, porridge, pudding, etc. and a fermented drink is also prepared from the grains. Possibly, Ragi in the past was used as food as well as for drinks: we have no positive evidence for either.

ACKNOWLEDGEMENTS

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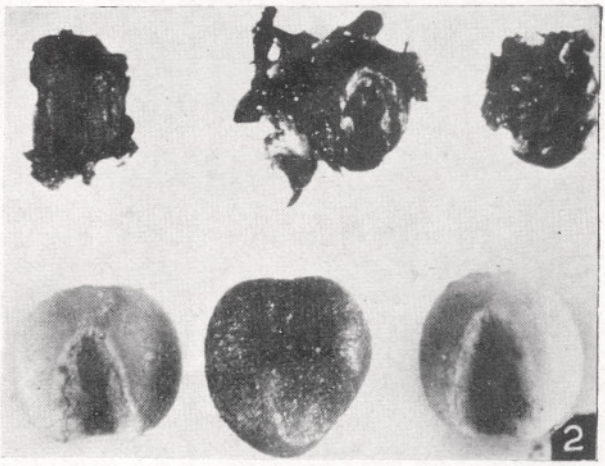
EXPLANATION OF PLATES

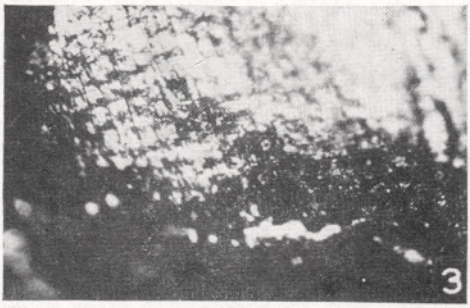
PLATE 1

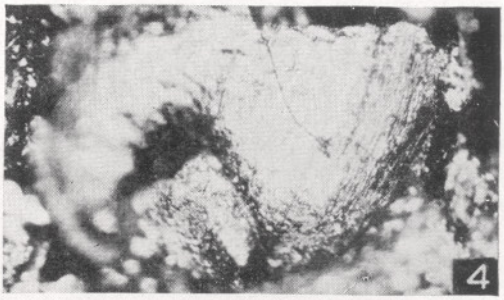
1. Seed coat bearing tubercles on carbonized seeds of *Eleusine coracana*. × 100.
2. Top row of carbonized seeds of *E. coracana*. × 16. Bottom row of modern seeds of *E. coracana*. × 16.
3, 4. Outer membrane of carbonized seeds of *Eleusine coracana*. fig. 3. × 100; fig. 4. ×150.
5, 6. Vertical view of carbonized seeds of *E. coracana* showing the embryo and the hilum scar. × 65.

PLATE 2

7. Modern seed of *Eleusine africana*. × 50.
8. Outer papery membrane of the seed of *Eleusine coracana*. × 100 (cf. Pl. 1, figs 3, 4)
9. Modern seed of *Eleusine indica*. × 50.
10. Modern seed of *E. coracana* in dorsal view with the seed coat showing tubercles. × 50 (cf. Pl. 1, fig. 1.)
11. Modern seed of *E. coracana* in ventral view. × 50.







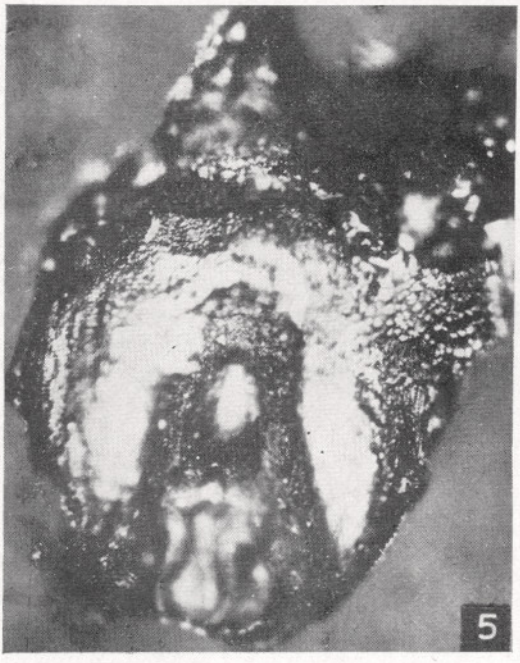
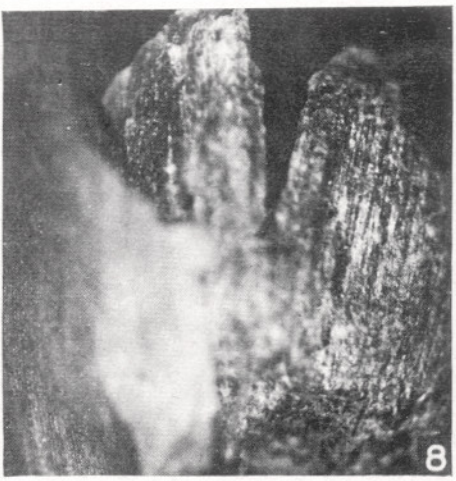
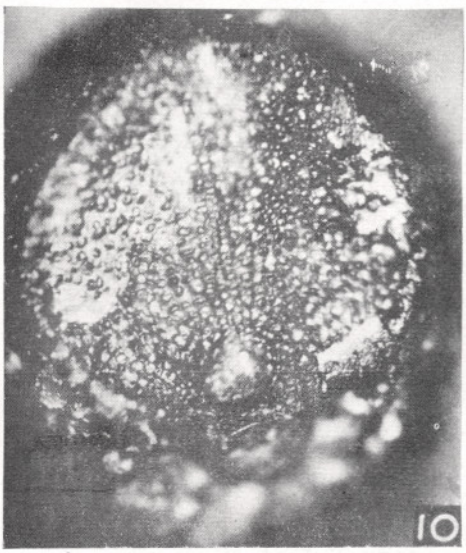


PLATE 1





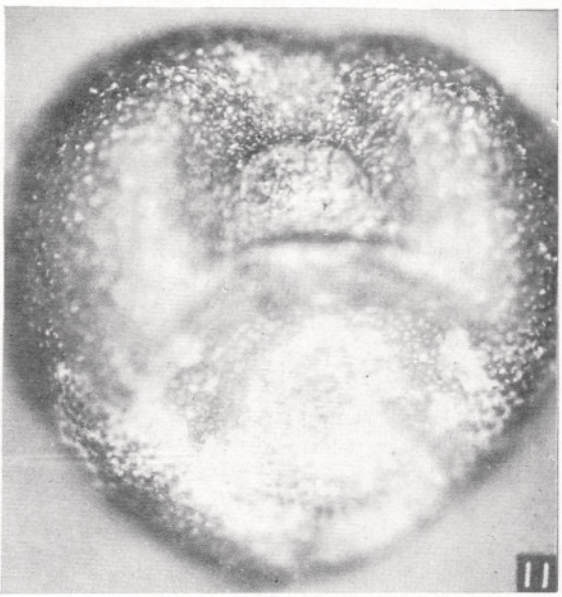


PLATE 2