NEOLITHIC PLANT ECONOMY AT CHIRAND, BIHAR

VISHNU-MITTRE

Birbal Sahni Institute of Palaeobotany, Lucknow

ABSTRACT

Remains of food plants from the bottom layers of Neolithic horizon at Chirand near Patna, Bihar, comprise lentil, barley, rice, *Pisum arvense*, etc. These constitute the first record of Neolithic plant economy from North India. The Neolithic plant remains known from Burzahom in the Kashmir Valley are of weeds associated with cultivation.

From a series of C14 dates at this site, it appears that the bottom layers are younger (405 B.C.-1570 B.C.) than the overlying layers (1675-1750 B.C.). If no discrepancies are involved, the bottom layers from which the plant remains have been discovered may be dated around 3000-4000 B.C.

INTRODUCTION

THE material of soil samples and remains of food plants from the archaeological site Chirand (Lat. 25° 45′N, Long. 84° 45′gE), District Saran, Bihar, a site about 8 Km. east of Chapra and situated near the confluence of Ghagra and the Ganga, was kindly sent for investigation by Professor B. P. Sinha, Professor and Head of the Department of Ancient Indian History and Archaeology, Patna University, Patna. The soil samples were found devoid of pollen grains. The carbonized grains of cereals and legumes recovered from layer 17 of CRD-XI (Text-fig. 1) from the Neolithic horizon extending from layer 12 to 17 are described here. The layers 10-17 have been radiocarbon dated and surprisingly the top layers are older than the bottom layers (cf. Text-fig. 1). The discrepancy remains unresolved. Dr. D. P. Agarwal of Tata Instt. of Fundamental Research, Bombay, who has dated the samples (Agarwal, 1971) considers involvement of subsidence (personal communication) whereas Prof. Sinha (personal communication) believes that the bottom layers probably got contaminated with water. The layers 10-13 are consistently dated to 1050 B.C., 1580 B.C., 1675 B.C. and 1755 B.C. respectively and layers 14-16 range in age from 405 B.C. to 1570 B.C. and layer 17 is dated to 605 B.C.-1370 B.C. The top one metre of deposit comprising layers 10-13 from 6·5 m. to 7·5 m. has been deposited in 705 years. Presuming that the rate of deposition has been ± uniform, the bottom 2·7 m. (from 7·5 m. to 10·3 m.) of deposit should have been laid in about 1900 years thus dating the sample from layer 17 to 1755+1900 B.C. = 3655 B.C. The rate of deposition of these sediments is variable as seen from the consecutive dates in relation to depth (0·4 m. = 530 years, 0·3 m. = 95 years, 0·3 m. = 70 years), the calculated age could be either between 2000 and 3000 B.C. or between 3000 and 4000 B.C. Narain (1970), however, believes that the lowest layer might be as old as *C*. 2500 B.C.

The samples collected during recent excavations of the site conducted in February 1972 have not been dated yet.

The plant remains described here are the first records of cereals from the Neolithic of North India. Records from the Neolithic of Kashmir (Burzahom) are of weeds indicating indirectly the cultivation of wheat or barley (Vishnu-Mittre, 1968, 1971).

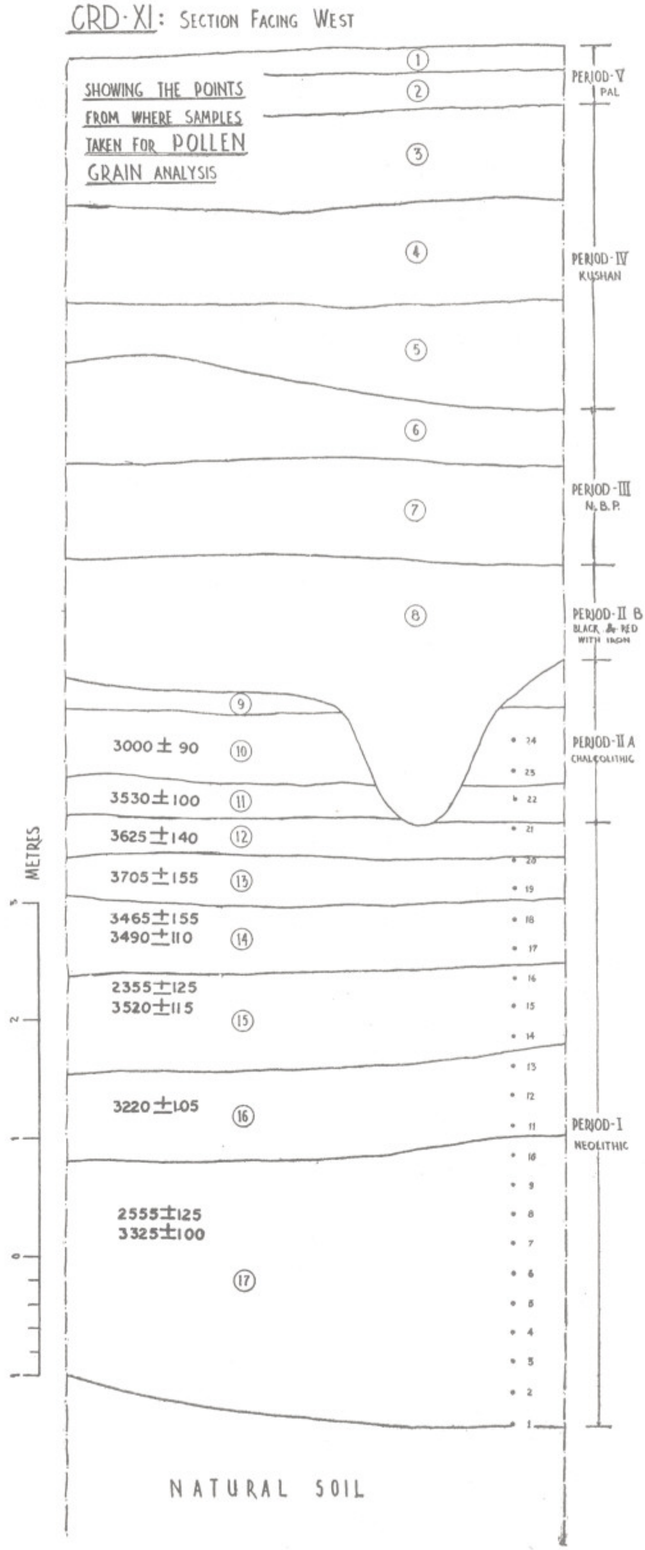
DESCRIPTION OF PLANT REMAINS CEREALS

WHEAT

Pl. 1, Fig. 2

The single kernel of wheat is short, oblong, grooved and thick with the ends broad and blunt. It measures 3·75 mm. long, 2·75 mm. broad and 1·75 mm. thick. The dorsal surface of the grain is domed, and the groove is deep. In these characters the grain of wheat approaches the grains of *Triticum sphaerococcum* Perc. In its lesser L/B, L/T, and higher B/L and T/L indices it further compares with the indices of grains of *T. sphaerococcum* as shown in Table 1 below.

The differences may be due to carbonization. The absence of transverse rippling of the shell precludes the possibility of its belonging to naked grains of barley.



TEXT-FIG. 1 — Stratigraphy of vertical section facing west. The cultural sequence is shown on the right. Position of pollen samples is indicated by black dots. The C14 dates for the layers dated are inserted. Archaeobotanical materials described in this paper were found in layer 17.

TABLE 1 — SHOWING THE VARIOUS INDICES OF MODERN AND CHIRAND WHEATS

(The dimensions of grains of various species of *Triticum* are based upon hundred grains each. The comparative discussion of statistical data of the modern species is discussed in Vishnu-Mittre, 1974)

	L/B	L/T	B/L	T/L	T/B
T. aestivum	2·68	3·07	0·37	0·32	0·87
T. compactum	2·44	3·07	0·40	0·32	0·79
T. sphaerococcum	1·76	1·62	0·56	0·61	1·09
Chirand wheat	1·36	2·14	0·73	0·46	0·63

BARLEY

Pl. 1, Fig. 2

All the thirteen grains referred to barley are very much worn out measuring about 4-5 × 2·25-3·25 × 1·50-2·25 mm. Most of them are naked since the pales are absent and the surface bears rippling marks. The grains are evenly rounded in cross-section apart from the ventral furrow which is shallow and a soft longitudinal depression on the dorsal side. Some grains show slight deviation from the straight shape suggesting that the spike was six-row and probably of the nodding type, a *Hordeum* sp. In three of the grains the surface is characterized by a faint longitudinal stripping arising from the remains of the pales or from the longitudinal surface cells of the seed coat. The cross-section of these grains is not angular. These might have belonged to the hulled barley. The measurements of six random grains are given below (Table 2).

TABLE 2 — MEASUREMENT OF RANDOM CHIRAND GRAINS OF BARLEY

	L	B	T
	4·00	2·50	1·75
	4·25	2·75	2·00
	4·80	2·80	2·25
	5·00	3·00	1·75
	5·00	3·25	1·50
	5·25	2·25	1·50
Average	4·17	2·80	1·70

RICE

Pl. 1, Fig. 1

The kernels of rice, ten in number, are all five-ribbed. Of these five are slender and five broader. The examination of kernels of wild and cultivated species of *Oryza* reveals that slender grains are usually produced by the wild species and the broader ones by the cultivated species. There are no other external morphological characters to distinguish the grains of individual species. The statistical evaluation of the various dimensions and the calculation of L/B × T indices of the wild and cultivated species of *Oryza* in India (cf. Vishnu-Mittre, 1971) has given reliable information to distinguish various species as shown in Table 4. The L/B × T indices of the carbonized grains are calculated and compared with those of the modern species (Tables 3 and 4).

L/B × T index of the large carbonized grains approaches that of *O. sativa* var. *spontanea* and *O. sativa* (cultivated) and that of the small grains is not different

TABLE 3 — DIMENSIONS OF CHIRAND GRAINS OF RICE

	L	B	T	L/B × T index
Large grains	5·00	2·25	1·25	1·85
	5·25	2·50	1·25	1·67
Small grains	4·25	1·50	1·00	2·83
	4·50	1·80	1·00	2·05

TABLE 4 — L/B × T INDICES OF CULTIVATED AND WILD SPECIES OF *ORYZA* BASED UPON HUNDRED GRAINS EACH. THE TABLE ALSO INCLUDES INDICES OF CARBONIZED GRAINS FROM CHIRAND

Species of *Oryza*	L/B × T index
Chirand large grains	1·76
Oryza sativa var. *indica*	1·71
O. sativa var. *japonica*	1·70
O. sativa var. *spontanea* Koenig	1·77, 1·79
O. perennis Moench	2·20
O. officinalis Wall.	2·36
O. rufipogon Griffiths	2·64
Chirand slender grains	2·45

from that of the wild species *O. perennis* and *O. rufipogon*. The differences could be due to carbonization. These statistical comparisons reveal that the carbonized grains were derived from both the cultivated and wild species of *Oryza*.

LEGUMES

The identification of leguminous seeds is based upon the shape of the grain and the position of the hilum scar. There is reduction in dimensions of both the grains and of hilum scar owing largely to carbonization and being uninfluenced by repeated cultivation.

Pisum arvense L.

Pl. 1, Fig. 4

The spherical seeds measuring about 2-4 mm. in size are compressed and provided with an oblong hilum scar about $1 \times 0{\cdot}50$ mm. There are smaller grains also, about $2 \times 1\text{-}1{\cdot}25$ mm., which are perhaps the abortive grains of *Pisum arvense* or of some other legume.

Lathyrus sativus L.

Pl. 1, Fig. 4, top right

Three compressed and wedge shaped seeds measuring $4{\cdot}50 \times 3{\cdot}50 \times 3$ mm. Hilum scar is $1\text{-}1{\cdot}5 \times 0{\cdot}50\text{-}0{\cdot}70$ mm.

Lens culinaris Maedik

Pl. 1, Fig. 3

There are eleven lenticular seeds with keeled edge and measuring about $2{\cdot}25\text{-}3 \times 0{\cdot}80\text{-}1{\cdot}25$ mm. Hilum scar is $1\text{-}1{\cdot}5 \times 0{\cdot}25\text{-}0{\cdot}50$ mm. Compares with small sized grains of *Lens culinaris*.

Other Legumes

Pl. 1, Fig. 5

There are a few extremely small seeds about 2 mm. in diameter. The spherical and flattened among them measure about 2×1 mm. and compare with small lentil grains; a rounded one about 2×2 mm. looks like that of *Pisum* and one $2 \times 1{\cdot}25$ mm., square to oblong seeds, seems to be that of black gram (*Phaseolus mungo*). In view of their extremely small size they may belong to weeds rather than to cultivars. Hilum scar is present in most of them and measures about $1\text{-}1{\cdot}5 \times 0{\cdot}50$ mm.

OTHER REMAINS

UNIDENTIFIED FRUIT

Pl. 1, Fig. 7

Two halves of a fruit measuring about 12 m. long, 6·7 mm. broad and 2·50 m. thick remain unidentified. They are oblong with a wrinkled surface. Inside there is a broad oval area surrounded by a tissue in vertical alignment. A distinct micropylar region is present. The rind outside seems to be less than half a millimetre thick.

UNIDENTIFIED INSECT

Pl. 1, Fig. 6

Mouth parts, the only preserved remains are shown in Plate 1, Fig. 6.

CONCLUSION

The Neolithic plant economy at Chirand consisted of barley, wheat, rice, lentil and *Pisum arvense*. Some leguminous weeds have also been recognized. The rice grains belong to both the cultivated and wild *Oryza sativa*, and probably also to *O. perennis* and *O. rufipogon*. Wheat, barley and *Pisum arvense* as identified belong to the same species as recognized from the Harappan and Chalcolithic sites in western India. The records of lentil, wheat and *Pisum* at this site predate those from the Chalcolithic of Navadatoli Maheshwar dated to 1660 B.C. (Vishnu-Mittre, 1968, 1971). The site Chirand is estimated to date from *C*. 2500 B.C. and the evidence of wheat, barley, lentil and *Pisum arvense* is suggestive of contemporaneity of Neolithic Chirand with the Harappan cultures in western India. Should the site prove earlier in age to the Harappan cultures, it would be an interesting though solitary example of the diffusion of wheat, barley and lentil from western Asia predating the Harappans.

Chirand is the first archaeological site in India which has provided substantial details of plant economy of the Neolithic period in India. Among the other Neolithic sites in the north of India, Burzahom (Kashmir Valley) has yielded indirect evidence of wheat or barley cultivation, and rice from the Neolithic of Orissa has been found to belong to *O. perennis* (Vishnu-Mittre, 1971), a wild progenitor of *O. sativa*.

REFERENCES

AGARWAL, D. P. (1971). Tata Inst. Radiocarbon Date List. Mimeogr. Circular.

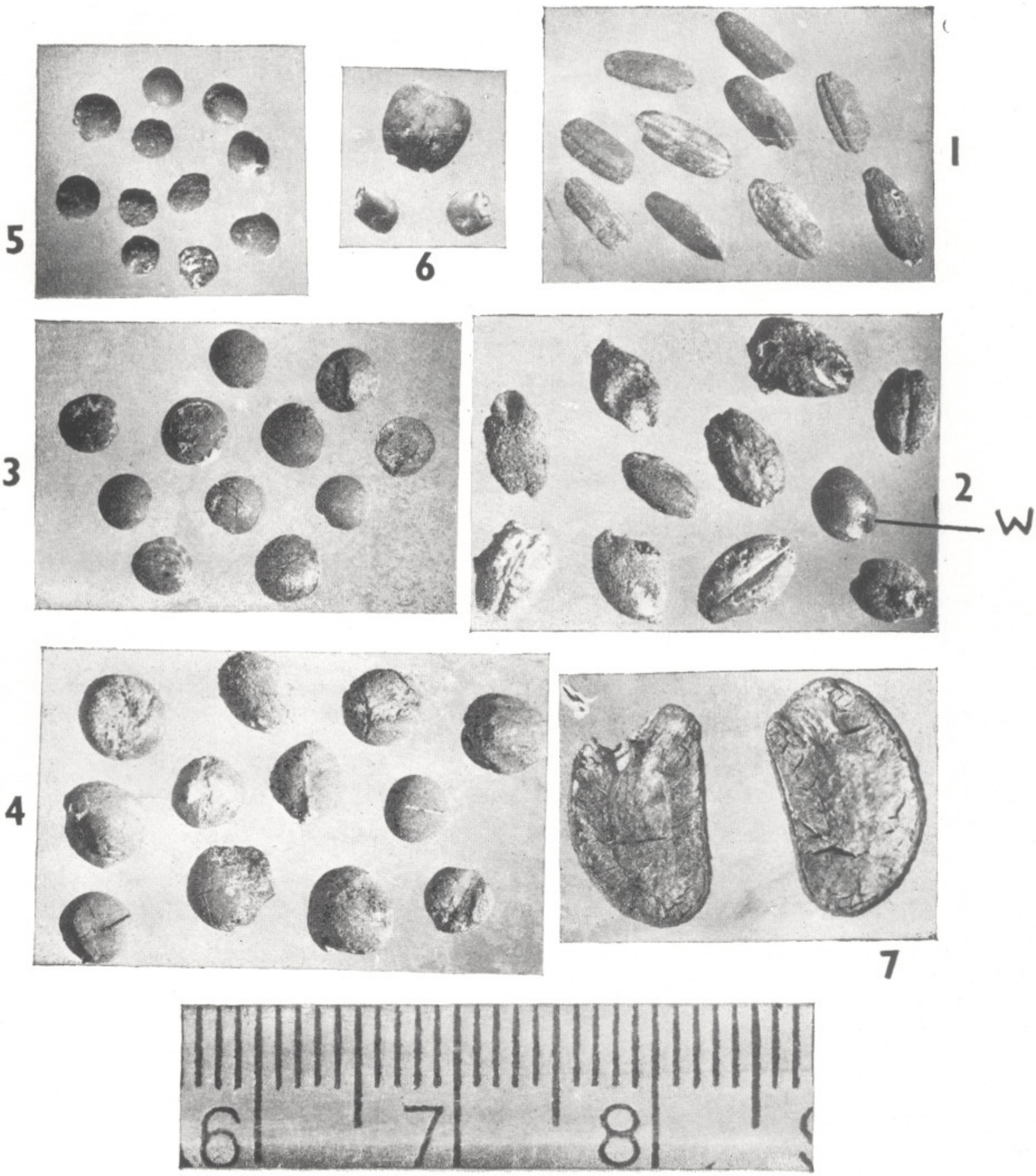
NARAIN, LALA ADITYA (1970). The Neolithic settlement at Chirand. *Jour. Bihar Res. Soc.* **46**: 1-35.

VISHNU-MITTRE (1968). Protohistoric Records of Agriculture in India. *Trans. Bose Res. Inst.* **31**: 87-106.

VISHNU-MITTRE (1974). The Beginnings of Agriculture: Palaeobotanical Evidence from India. In " *Evolutionary Studies in World Crops: Diversity and Change in the Indian Sub-Continent*, Ed. Prof. Sir Joseph Hutchinson, *Cambridge, U.K.*: 3-33.

EXPLANATION OF PLATE

1. Carbonized grains of rice. The slender grains are on the extreme left of the figure.
2. Wheat grain (*Triticum sphaerococcum*) on the extreme right marked as W. Barley grains are seen on the left of the figure.
3. *Lens culinaris* Maed.
4. *Pisum arvense* L. A single seed of *Lathyrus sativus* is seen on extreme right.
5. Other leguminous seeds
6. Mouth parts of an unidentified insect.
7. Two halves of an unidentified fruit.


5
6
1
3
2
W
4
7
6
7
8