Harappa Excavations 1986-1990

A Multidisciplinary Approach to Third Millennium Urbanism

Edited by Richard H. Meadow

Monographs in World Archaeology No. 3

PREHISTORY PRESS
Madison Wisconsin

Prehistory Press
7530 Westward Way
Madison, Wisconsin 53717-2009

James A. Knight, Publisher
Carol J. Bracewell, Managing Editor

ISBN 0-9629110-1-1
ISSN 1055-2316

Library of Congress Cataloging-in-Publication Data

Harappa excavations 1986–1990 : a multidisciplinary approach to third millennium urbanism /
edited by Richard H. Meadow.
p. cm. -- (Monographs in world archaeology, ISSN 1055-2316 : no. 3)
Includes bibliographical references.
ISBN 0-9629110-1-1 : $33.00
1. Harappa Site (Pakistan) 2. Excavations (Archaeology) –
– Pakistan. I. Meadow, Richard H. II. Series.
DS392.2 H3H37 1991
934 - - dc20 91-39504
CIP

Cover art: Bowl on Stand H88-1002/192-17 associated with Burial 194a
in Harappan Phase Cemetery (see Figure 13.18).

9

Urban Palaeoethnobotany at Harappa

Heather Margaret-Louise Miller
University of Wisconsin-Madison

A broad range of the questions that can be asked of macrobotanical plant remains from an urban site are highlighted, using the site of Harappa as an example. The topics addressed include the uses of domesticated and wild plants, the nature of agricultural and cooking technologies, types of fodder and fuel, and the use of plant products in manufacturing processes. The necessity of integrating palaeoethnobotanical information with archaeological contextual data, including associated artifacts, is stressed.

Beyond the more usual 'village'-oriented agricultural topics, there is an additional set of questions that can be addressed with macrobotanical remains from an urban site like Harappa, in the same way that there are additional archaeological questions to be asked of urban sites than of smaller rural sites (Figure 9.1). This paper highlights a broad range of the types of questions that *can* be asked of macrobotanical remains, particularly as applied to urban sites.[1]

Questions

(1) What crops were important? The material from Harappa fills a crucial gap in our database from South Asia. This is the first systematically collected, large sample of plant remains from any of the sites in the Indus Valley proper and can be used to test many of the current conjectures about Harappan agriculture. There are some expectations about the probable suite of plants used at Harappa based on previous work, mostly fortuitous finds (Vats 1940). Wheat (primarily forms of *Triticum aestivum*), barley (*Hordeum vulgare*), and a variety of legumes (*Lens, Pisum, Cicer, Vicia*) were probably the major food crops. However, the *range* of crops grown is still unknown for Harappa and for the Indus Valley itself. The status of possibly major crops is uncertain; examples include cotton (*Gossypium* sp.), rice (*Oryza sativa*), the various millets (*Eleusine coracana* ssp. *coracana, Panicum miliaceum, Pennisetum typhoides, Setaria italica, Sorghum bicolor* ssp. *bicolor*, etc.), mustard (*Brassica* sp.), sesame (*Sesamum indicum*), linseed/flax (*Linum usitatissimum*), grape (*Vitis vinifera*), and date (*Phoenix dactylifera*).

Determining the presence and abundance of these crops through the archaeobotanical remains is necessary to support or disprove various interpretations of Harappan agriculture. In particular, the seasons of agricultural production have been debated for the Harappan period (one *vs.* two crops per year). The number of cultivation seasons is important for discussions about labor intensity, use of irrigation canals, and so forth (Fentress 1985; Ratnagar 1986). Furthermore, plant remains provide information about contacts with other areas, such as the introduction of the 'African millets' to South Asia (Possehl 1986).

(2) What wild plants were important? The use of collected wild plants by the Harappans is almost completely unknown. While the majority of plant staples were no doubt domesticates, the extent to which wild plants were important in the diet could be

Questions for Urban Palaeoethnobotany

1. Crops
    - Agricultural Systems
    - Contacts with Other Regions
2. Collected Wild Plants
    - Food
    - Building materials, crafts
    - Environment (with caution!)
3. Agricultural Technology
    - Cultivation Methods
    - Processing Methods
4. Cooking Technology
    - Domestic
    - Commercial
5. Fodder
6. Dietary Differences
    - Wealth
    - Ethnicity
7. Fuel
    - Domestic
    - Manufacturing
8. Manufacturing
    - Brewing, Wine-making
    - Oils
    - Cotton Cloth
    - Faience, Metal

Figure 9.1: Questions for urban palaeoethnobotany.

significant; for example, a ubiquitous find at Harappa is the fruit *jujube* (apparently undomesticated *Zizyphus* sp.). A variety of woods were necessary for use in construction, crafts, and fuel (Chowdhary and Ghosh 1951; Vats 1940), and impressions of reeds used for building materials and matting are also ubiquitous.

These collected remains can reflect the resources available in the surrounding landscape and, coupled with other information about the environment (from sediments, geomorphology, pollen), can contribute to environmental reconstruction, as Thiébault has done for the Kachi Plain (Thiébault 1988). For example, the quantity, quality, and diversity of wood charcoal in some Harappan deposits is quite surprising, in that there is far more charcoal and far less dung than I expected. Due to the preliminary state of my analysis, however, it is not yet clear whether this abundance of charcoal represents environmental conditions or a selective choice of wood *vs.* dung for certain purposes (see below).

(3) What was the nature of Harappan agricultural technology? In discussions of technologies and apprenticeships, archaeologists often overlook the fact that farming too is a craft, involving specialized knowledge passed on through 'apprenticeship' and a variety of technologies. Given the constantly changing hydrology of the Indus and its tributaries, the Harappans must have been especially flexible and innovative farmers, both technologically and in terms of their social systems. An example of the latter might be social institutions permitting rapid reallotment of land, such as common land ownership by groups, in order to deal with the constant shifts in the rivers' courses.

Basic Crop Processing Stages

Harvesting

↓

Threshing
(to free grain from chaff and straw)

↓

Winnowing
(to remove light chaff and straw)

↓

Separation of grain & contaminants
(via various sieving, shaking/rocking processes)

Figure 9.2: Basic crop processing stages

Determining the nature of Harappan agricultural technology—the first stage in understanding agricultural systems—is directly approachable through the macrobotanical remains. This can be achieved through an assemblage-focused approach, concerned with classes and numbers of remains in addition to the identification of particular species.[2] The correlation of archaeological plant assemblages to particular plant processing stages (e.g., threshing, winnowing, sieving) is an especially important part of this work. The basic methodology employed rests on the premise that the *by-products of various stages of plant processing are distinguishable on the basis of their composition* (Figure 9.2). In other words, if the by-products of plant processing stages are composed of a unique combination of plant parts, such as stems, glumes, awns, grain (prime or tail), and weed seeds of various size and shape classes, then specific combinations of plant parts are indicative of specific processing stages (Dennell 1972, 1974, 1976; Hillman 1973, 1981, 1984; Jones 1983, 1984, 1987; see also Hastorf 1988).

Discerning processing stages is very important for two different classes of archaeological questions about agricultural technology: (a) methods of crop cultivation, and (b) methods of crop processing. The major application of Old World plant remains to reconstructions of ancient agricultural technology has been Dennell's, Hillman's, and Jones's work on distinguishing different agricultural processing stages (references above). Archaeological recognition of these processing stages allows palaeoethnobotanists to account for the distorting influence of processing on the original harvested crop assemblage. This is an important step in using the archaeological botanical remains as information about ancient agricultural practices like irrigation, crop rotation, fallowing, double cropping, and seasonal irrigation.

Identification of the processing stages themselves is also possible; for example, an assemblage of by-products from threshing is characteristically different from an assemblage of by-products from sieving. (A good analogy would be the assemblages of flake types generated by different stages in the production of stone tools or beads.) While research on distinguishing *between* these crop processing stages has been extensive, hopefully variation *within* the processing stages themselves is also detectable, such as the use of sieving *vs.* some other separation technique. A necessary but weak assumption made by both Hillman and Jones is that "crop processing is one of those activities which can only be achieved practically in a limited number of ways given a traditional technology" (Jones 1983: 80), such that "[i]n the execution of any one agricultural operation ... there are relatively few efficient methods available to the non-mechanised farmer, whether in terms of the overall sequence of operations that can be applied or in terms of the execution of any one operation" (Hillman 1981: 126). For instance, an example given by both Jones and Hillman is that removing small contaminants without the use of sieves would be "prohibitively time-consuming" (Jones 1983: 81, cf. Hillman 1981: 155-156).

In both South Asia and Australia, however, various shaking/rocking techniques rather than sieving processes are used to clean seeds. The general methodology used by Hillman and Jones is currently being applied to ethnoarchaeological investigations of millet processing in South Asia by Reddy (Ph.D. dissertation in preparation and Chapter 10 in this volume). If the shaking/rocking assemblages being studied by Reddy are statistically different from sieving assemblages reported by Jones (Jones 1983, 1987), the ability of this methodology to directly test the utility of *analogical* plant processing models makes it a very powerful archaeological tool.

The range of questions about processing technologies used by the Harappans is particularly broad, given their geographical position at the 'crossroads' between major world regions. Were they using 'Western Asian' processing technologies or 'South and Southeast Asian' processing technologies? Does this change over time? Or are different techniques used for different crops—sieving for *Triticum* and *Hordeum*, shaking/rocking for small round grains like millets? Could a processing technology that favored the recovery of small rounder grains be the impetus behind the selection for sphaerococcoids rather than the more usual environmental explanations?

In addition, changes in processing techniques and technology are a clue to the changing use of particular plants. Given the addition of new crops over time in this region, it will be important to determine if new processing technologies were adopted with new crops, or if the old techniques were retained. The Indus region will thus provide valuable data to test the hypothesis that new crops are more quickly adopted if they are suited to familiar technologies (D.R. Harris, personal communication).

(4) What were Harappan cooking technologies and how did they change over time? As with alterations in agricultural technologies, changes in cooking technologies are often linked to changes in the plants being used. Like other technologies, food processing technologies result in specific patterns of artifact use and refuse scatter, patterns which archaeologists must learn to recover and interpret. Unfortunately, food processing technologies are particularly difficult to recover, as they largely involve perishable items. Information is thus often limited to modern analogies, although chemical residue analysis, microwear patterns on stone tools, and shapes and placement of ceramics and grinding stones offer essential hints. Faunal analysis has taken this farther with the study of cut marks on bone, but the plant remains themselves have also been used to demonstrate technologies, such as the production of beer (Hillman 1981) and the processing of *saguaro* fruit (Miksicek 1987).

Through the careful integration of the plant information with other artifactual information, it is possible to identify changes in cooking technologies. A good example of the use of such integration comes from the site of Pirak, Pakistan, where Jarrige (1985) has correlated the adoption of rice cultivation to changes in the pottery assemblage, specifically to cooking vessels.

(5) What types of animal fodder were used at urban sites and how does this affect interpretations of human plant use? Palaeoethnobotanists have been concerned about the presence of seeds from dung in their samples, for fear of confusing assemblage interpretations (Miller and Smart 1984). Recently, however, they have realized the incredible information available about fodder from dung used as fuel (Charles 1989; Reddy 1991, Chapter 10 in this volume). Perhaps the most important topics involving fodder concern the degree to which animals are integrated into the subsistence economy. The ability to determine what animals were being fed is a tremendous advantage in discussions about the growing of crops specifically for fodder or about free-range grazing *vs.* penned livestock. The use of complementary techniques to reconstruct animal diet strengthens such discussions, such as Reddy's combined use of bone chemistry and palaeoethnobotany (Reddy, Ph.D. dissertation in preparation and Chapter 10 in this volume).

(6) In what ways can plant remains provide information about wealth and ethnicity? In terms of dietary differences, the localization of certain types of foods in certain areas of a city, including the presence of 'exotics' and special fruits, has been applied to remains from medieval Amsterdam (Paap 1984). This methodology has greater resolution with historic sites, where prestige food items are known. However, it might be applied cautiously at Harappa in looking for differences between domestic refuse in different parts of the site. Wealth is also something to consider when assessing wood *vs.* dung fires; is one seeing not simply environmental differences, but a situation complicated by individuals with differential access to resources or by 'ethnic' groups with different views about acceptable cooking fuels? Plant remains, in conjunction with other artifacts, provide an additional line of evidence for such issues.

(7) How does fuel use relate to pyrotechnology? The use of wood *vs.* the use of dung as fuel re-occurs in this paper: as an additional line of evidence about the environment; in investigations of fodder type; and as a reflection of differential resource access ('wealth'). Type of fuel is also of major importance in many high-temperature pyrotechnologies, the best-known examples being ceramics and metal-working. The type of charcoal or the presence/absence and type of dung from kiln firings may provide valuable information about firing conditions for these crafts, and should be important aspects of theoretical and experimental reconstructions of ancient technologies.

(8) What can macrobotanical remains tell us about different craft activities? The information available from plant remains about a variety of manufacturing processes has been vastly under-utilized. Together with associated artifacts, plant remains can be used to identify the presence of a variety of manufacturing procedures: brewing; wine-making; the production of a variety of plant seed-based oils (sesame, mustard, cotton); stages in cotton cloth production (including dyeing); and even faience and metal production. All of this information forms an essential data base for conjecture about exchange in plant products and their 'commercial' importance.

Conclusion

Due to the wide range of applications for archaeological macrobotanical remains, large samples must be collected from as many different contexts as possible. In order to find the rare sample containing dumped fuel from a kiln, or soda/silica ash from faience manufacturing, or dung remains providing information about fodder, or remains from specialized food processing like fermentation, it is necessary to examine large numbers of samples of mixed domestic rubbish. This is why palaeoethnobotanical analysis is so time-consuming and thus expensive. To maximize scarce archaeological funds, therefore, sampling and recovery procedures must be evaluated and customized for each site, taking into account the economic resources, available labor, site size and preservation, and conditions of excavation.

Finally, *interpretation* of plant assemblages requires knowledge of their archaeological *context* and the nature of associated artifacts. As David Clarke put it:

> It has slowly emerged that there is archaeological information in the spatial *relationships* between things as well as in *things* in themselves. Spatial relationships are of course only one kind of relationship for archaeologists to investigate and the current interest in spatial relationships is thus merely part of the current ideological shift from the study of things (artefacts) to the study of the relationships between things (variability, covariation, correlation, association, change and process) (Clarke 1977, reprinted in Clarke 1979: 457; emphasis as original).

Thus, the excavation and recording techniques employed will probably be far more important for interpretations about the role of plants in ancient societies than new laboratory techniques. For example, it is often difficult to differentiate a *tandoor/tanoor* (bread oven) from a pit used for roasting and other kinds of cooking without careful excavation, plotting, and section drawing. Careful microstratigraphic excavations can help to discern what is fill, what is collapsed roof, and what are abandoned kiln contents—all important pieces of information when sampling for *assemblages* of small items like seeds. The major challenge for palaeoethnobotany at present is the ability of excavator and plant analyst to share such spatial, relational information. The high level of communication between the various members of the Harappa team has encouraged such integration; it is a pleasure to work on such an *inter*disciplinary project.

Acknowledgements

Many thanks to the Harappa team for their teaching, patience, and support. Special thanks to the members of the Department of Human Environment, Institute of Archaeology, London, especially for a particularly frustrating seminar session on urban archaeobotany (or the lack thereof). Bill Belcher, Lisa Ferin, Patti Trocki, and Seetha Reddy supplied advice, moral support, and constructive criticism far beyond the call of duty. I am grateful to Mark Kenoyer and Richard Meadow for editing this paper.

Notes

[1] 'Macrobotanical' refers to seeds, charcoal, and other plant parts visible under a low-power microscope.
[2] See Miksicek (1987) for an excellent overall review, Hastorf and Popper (1988) for an important discussion of analyses and a range of recent examples, and Pearsall (1989) and Grieg (1989) as general handbooks of palaeoethnobotany.

References Cited

Charles, M.P.
1989 *Agriculture in Lowland Mesopotamia in the Late Uruk/Early Dynastic Period.* Unpublished Ph.D. dissertation, Institute of Archaeology, University of London, London.
Clarke, D.L.
1979 *Analytical Archaeologist.* Academic Press, London.
Dennell, R.W.
1972 The Interpretation of Plant Remains: Bulgaria. In *Papers in Economic Prehistory,* edited by E.S. Higgs, pp. 149-159. Cambridge University Press, Cambridge.
1974 Prehistoric Crop Processing Activities. *Journal of Archaeological Science* 1:275-284.
1976 The Economic Importance of Plant Resources Represented on Archaeological Sites. *Journal of Archaeological Science* 3:229-247.
Fentress, M.A.
1985 Water Resources and Double Cropping in Harappan Food Production. In *Recent Advances in Indo-Pacific Prehistory,* edited by V.N. Misra and P.Bellwood, pp. 359-368. Oxford and IBH, New Delhi.
Grieg, J.
1989 *Handbooks for Archaeologists No. 4: Archaeobotany.* European Science Foundation, Strasbourg.
Hastorf, C.A.
1988 The Use of Paleoethnobotanical Data in Prehistoric Studies of Crop Production, Processing, and Consumption. In *Current Paleoethnobotany: Analytical Methods and Cultural Interpretations of Archaeological Plant Remains,* edited by C.A. Hastorf and V.S. Popper, pp. 119-144. University of Chicago Press, Chicago.
Hastorf, C.A., and V.S. Popper
1988 *Current Paleoethnobotany: Analytical Methods and Cultural Interpretations of Archaeological Plant Remains.* University of Chicago Press, Chicago.
Hillman, G. C.
1973 Crop Husbandry and Food Production: Modern Basis for the Interpretation of Plant Remains. *Anatolian Studies* 23:241-44.
1981 Reconstructing Crop Husbandry Practices from the Charred Remains of Crops. In *Farming Practice in British Prehistory,* edited by R.J. Mercer, pp. 123-162. Edinburgh University Press, Edinburgh.
1984 Interpretation of Archaeological Plant Remains: the Application of Ethnographic Models from Turkey. In *Plants and Ancient Man: Studies in Palaeoethnobotany,* edited by W. van Zeist and W.A. Casparie, pp. 1-41. Balkema, Rotterdam.

Jarrige, J.-F.
1985 Continuity and Change in the North Kachi Plain (Baluchistan, Pakistan) at the Beginning of the Second Millennium BC. In *South Asian Archaeology 1983*, edited by J. Schotsmans and M. Taddei, pp. 35-68. Istituto Universitario Orientale, Naples.

Jones, G.E.M.
1983 *The Use of Ethnographic and Ecological Models in the Interpretation of Archaeological Plant Remains: Case Studies from Greece*. Unpublished Ph.D. dissertation, Department of Archaeology, University of Cambridge, Cambridge.
1984 Interpretation of Archaeological Plant Remains: Ethnographic Models from Greece. In *Plants and Ancient Man: Studies in Palaeoethnobotany*, edited by W. van Zeist and W.A. Casparie, pp. 43-61. Balkema, Rotterdam.
1987 A Statistical Approach to the Archaeological Identification of Crop Processing. *Journal of Archaeological Science* 14:311-323.

Miksicek, C.H.
1987 Formation Processes of the Archaeobotanical Record. In *Advances in Archaeological Method and Theory*, vol. 10, edited by M.B. Schiffer, pp. 211-247. Academic Press, San Diego.

Miller, N., and T.L. Smart
1984 Intentional Burning of Dung Fuel: A Mechanism for the Incorporation of Charred Seeds into the Archaeological Record. *Journal of Ethnobiology* 4:15-28.

Paap, N.A.
1984 Palaeobotanical Investigations in Amsterdam. In *Plants and Ancient Man: Studies in Palaeoethnobotany*, edited by W. Van Zeist and W.A. Casparie, pp. 339-344. Balkema, Rotterdam.

Pearsall, D.M.
1989 *Paleoethnobotany: A Handbook of Procedures*. Academic Press, San Diego.

Possehl, G.L.
1986 African Millets in South Asian Prehistory. In *Studies in the Archaeology of India and Pakistan*, edited by J. Jacobson, pp. 237-256. Oxford and IBH, New Delhi.

Ratnagar, S.
1986 An Aspect of Harappan Agricultural Production. *Studies in History* 2:137-153.

Reddy, S.N.
1991 Archaeobotanical Investigations at Oriyo Timbo (1989-90): A Post Urban Site in Gujarat. *Man and Environment* 16(1):73–83.

Thiébault, S.
1988 Palaeoenvironment and Ancient Vegetation of Baluchistan Based on Charcoal Analysis of Archaeological Sites. *Proceeding of the Indian National Science Academy* 54A:501-509.

Vats, M.S.
1940 *Excavations at Harappa*. Government of India Press, Delhi.