LATE PREHISTORY OF THE NILE BASIN
AND THE SAHARA
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HUGH DOGGETT

A suggested history of the crops common to Ethiopia and India

Few crop plant remains have been found by archaeologists: the reconstruction of crop history is, therefore, largely conjectural. In some places, excavations are fraught with difficulty. They are very unevenly distributed. Rivers such as the Nile and the Indus deposit vast quantities of silt in areas where archaeological research would be especially valuable. Some countries, such as Ethiopia, have received relatively little archaeological study covering sites relevant to the history of the last 10,000 years. There are few facts on which to base theories.

Biased opinions

Each individual brings personal biases to his presentation of a subject. The writer admits to three, doubtless there are many others. They have resulted from over 40 years of working in agriculture and agricultural research in the developing world.

1. The problem of how the idea of agriculture first arose has not been given sufficient thought. How did people who were seed gatherers get the idea not only of sowing seed, but also of cleaning a piece of land first, and of weeding the growing crop? Doubtless the non-shedding character (persistent spikelets) exists in most wild grass populations, and can be exposed by simple selection, as Harlan *et al.* (1973 : 311) found with *Andropogon hallii.* Supposing that a seed-gatherer found one such panicle: why should he think of sowing its seed? Why should anybody sow grass seed into land where there was already an abundance of grass seed anyway? How would he know that he must search for the particular type sown when the grass seed ripened? Why should he think of cleaning a piece of land in which to sow the seeds? Why should he mark the place where the seed was sown so that he kould weed around it? Why should he think of weeding anyway? The idea that a cnowledge of plant selection and agriculture could have arisen in rain-fed grassland

ab initio seems highly improbable. These difficulties in areas where the grass in question was a major constituent of the vegetation would have been accentuated. It is all too easy to assume the existence of the idea of agriculture.

A characteristic of the three oldest civilizations of the Old World is that they all arose along rivers: in due course, each spread out along its respective river valley for hundreds of miles (Fairservice 1971). Rivers and seasonal streams provide sites where the idea of cultivation may have emerged. Many patches of silt, exposed as the rains ended and the rivers fell, would have been weed-free at first. People gathering seeds of wild grasses for food, who also fished, could well have noticed that seed dropped on these patches sometimes grew into mature plants on residual moisture. From this, the use of sickles for harvesting would have favoured the variants with persistent spikelets. Gradually, the idea of sowing these riverine flats with seed so harvested, and replanting them the following season, would have led to the accumulation of non-shedding types. People would gradually have become accustomed to the regular discipline of seed-time and harvest on silt flats needing no land preparation and no weeding. This would have provided an additional resource: fishing, food-gathering, and hunting would have continued as before. Once seeding became an established practice, it is not difficult to imagine a gradual awakening of interest in crop improvement.

This reconstruction of possible origins of agriculture also provides an explanation for the way in which people became locked into the hard labour and drudgery involved. So long as people were using the natural resources of hunting, fishing and food gathering, the population could not increase beyond what those natural resources would carry. Improved harvesting and grass-seed processing technology made better use of the resource base, but did not enlarge it. Learning to seed the silt flats deliberately was a different matter. This enlarged the resource base, and provided a way to feed an expanding population. As the population grew, more silt flats could be seeded. In due course the population expanded beyond the point of no return. No longer were hunting, fishing and food-gathering sufficient. From then on, the pressures demanded the extension of irrigation, the preparation and weeding of land to imitate the conditions on the silt flats, leading on eventually to the development of rain-fed agriculture. For that, there was a basic crop husbandry to be learnt: clearing the land, tillage, the time and method of sowing, and weed control; all to be done initially with sticks and stone axes as the only tools.

There must have been incipient agriculturalists, who withdrew before they became locked into the drudgery of subsistence agriculture. Reed (1977a) drew attention to three coastal societies: the Natufians, who developed an agriculture; the people of the Ancon-Chillon region of Peru, who finally adopted an agriculture about which they had known for a thousand years; and the peoples of the north-west coast of North America, who retained their original way of life without recourse to agriculture.

The reason why anyone ever accepted dependence upon arable agriculture as a way of life is hard to understand. Hunter-gatherers have time for leisure, and seldom suffer from lack of food. It seems probable that early agriculture was developed initially as just one more food resource among several, and that gradually changing conditions resulted in some people becoming locked into the system (Reed 1977a; Redman 1978). It is difficult to imagine people walking into it knowingly.

Certainly the ancient scripture reads in this way. At the close of the golden age when Man had become disobedient, the Lord God said to him: "Because of what you have done, the ground will be under a curse. You will have to work hard all your life to make it produce enough food for you. It will produce weeds and thorns, and you will have to eat wild plants. You will have to work hard to make the soil produce anything, until you go back to the soil from which you were formed" (Genesis, 2). Few young people from the non-affluent world of today would willingly return to the drudgery of subsistence agriculture endured by their parents, even though they have the advantage over early agriculturalists of using steel axes and hoes.

2. The second belief is that an individual crop moved only a) at the very beginning of agriculture; b) when there were settled agriculturalists to whom it could be transferred; c) when it was an auxillary food source of a pastoral people. Many pastoral people adopted a cereal crop to feed those who could not move to the distant grazing grounds with the cattle in the dry season. The crop was often grown with minimum care and attention. The pastoral people took a pride in their cattle, not in their crops – they were not agriculturalists in any professional sense.

3. The third opinion held is that settled agriculturalists do not move until they are forced by circumstances to do so. They then take their technology and HYV's as a package with them, having first located the site which they consider suited to their crops and methods. Harlan *et al.* (1976), referring to the spread of agriculture to the west and to the east from West Asia, noted that: "What moved out of the nuclear area was a complete system including barley, emmer wheat, einkorn wheat, lentil, vetch, peas, chick-pea, fava bean, rape, flax, vegetables, spices, tree and vine fruits, sheep, goats, cattle and an array of agricultural techniques".

The origin of agriculture in West Asia

During the Pleistocene, the Mediterranean region had a cold dry steppe climate: The "Mediterranean climate" had been pushed southwards into Africa by the shifting storm-tracts. The boundary date for the return of the Mediterranean climate to its present location is set at around 11,000 b.p. The transitional date varied with location, but the earliest was around 14,000 b.p. During the period prior to 12,000 b.p.,

Zagros was intensely cold, and may have been vacated by man. The wild ancestral cereals, barley and einkorn and emmer wheats, may have been absent or rare in southwestern Asia. The continental-type steppe climate probably extended also to the highlands of Palestine, though not to the lowlands. Wild barley may well have occurred for some distance along the Nile, it is still to be found in Israel as well as along the coast near the river mouth. Both wild emmer and wild einkorn probably occurred commonly in southwest Palestine. At the beginning of the seventh millennium b.c., all three "cultivated" grains were being grown further east at Ali Kosh. Emmer wheat and barley were both being grown in Egypt about 4,500 B.C. They were also being grown at Beidha in southern Jordan around 7,000 B.C. The barley from Beidha did not have conjoint internodes, so was a "cultivated wild barley". The excavations at Jarmo have shown that this internode transition occurred around 6,500 B.C. The depth of the Nile silt prevents our obtaining a true picture of the situation in Egypt at that period.

Wendorf and his colleagues recorded indications of early food production along the Nile. They found a large cereal-type pollen, tentatively identified as barley, preserved in ephemeral ponds. This pollen suddenly increased in amount to between ten and fifteen percent near the top of the sequence. They found sites with numerous grinding stones north of Aswan, dating to 12,000 - 14,000 b.p. A site at Isna *ca* 12,000 years old, yielded grinding stones and sickle blades. Barley grains were discovered at Wadi Kubbaniya, but later these proved to be more recent intrusions. This should not be allowed to obscure the other indications of "grain" production, and population increase more than 10,000 years ago. (Helbaek 1966; Harlan and Zohary 1966; Wright 1976; 1977; Reed 1977b; Wendorf *et al.* 1979; Wendorf and Schild 1984).

People and languages in Northeast Africa

The people

A long-headed, long-faced people with narrow, high-nosed skulls has been present in the eastern African region since the later Pleistocene, perhaps going back to the Third Glacial (Howells 1960). Hiernaux (1974) referred to them as "Elongated East Africans" or "Elongated Africans". Eastern Africa was defined as the Sudan, Ethiopia, Somalia, Tanzania, Kenya, Uganda, Rwanda, and Burundi.

The languages

Greenberg (1963; 1973) demonstrated that a language group, Afroasiatic, arose in this area, and subsequently differentiated into six languages: Semitic, Berber, Ancient Egyptian, Cushitic, Omotic, and Chadic. Semitic spread into

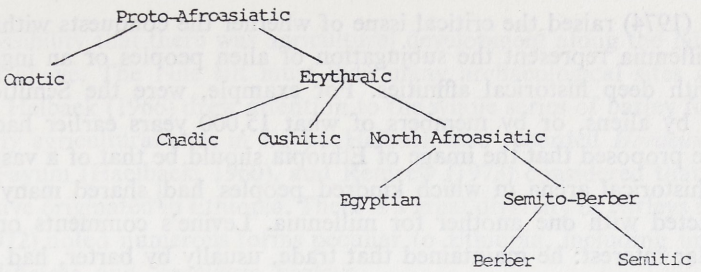

FIG. 1. Development of the Afroasiatic language family (from Ehret 1979)

Southwest Asia, and the Chad language spread across northern Africa, giving rise to a number of languages now spoken in that area, including Hausa. Ehret (1979) traced the development of this language family as shown in Fig. 1. The homeland of the speakers of proto-Afroasiatic was in Ethiopia, and extended very approximately on the western side from the Amba Farit mountains, past Lake Tana, almost as far as Lake Nasser on the Nile. On the eastern side it followed the shores of the Red Sea. The proto-Afroasiatic speakers lived at least 15,000 years ago: the time span for Cushitic covers some 7,000 - 9,000 years. Thus, this group of people who came to occupy Ethiopia, the Horn of Africa, Nubia, Egypt, and some areas of southwest Asia, spoke a common language at least 11,000 years ago, at the time when the Mediterranean flora was returning to its present locations. The people would have been able to understand each other for practical purposes, such as trade, more recently than that.

The Berbers and Chadic peoples had an important influence in North Africa: the Semitic branch furnished many names in the king-lists of the early Sumerian kings, and people from Mesopotamia were carrying their culture to India prior to 3,000 B.C. (Hawkes 1973; Piggot 1950).

Ethiopia

At one time, a romantic view was taken of Ethiopia, which was regarded as an ancient culture where many crop plants were ennobled. A reaction followed, and the view was put forward that agriculture in Ethiopia and the Horn was recent, much influenced by technology introduced from South Arabia.

The recognition that Ethiopia forms an important part of the region in which the Afro-Asiatic language developed has made the former view much the more probable. Ehret's (1979) language studies suggested that agriculture is old among at least some of the peoples using this language. He surmised that grass-seed collecting itself was invented in or near Lower Nubia, perhaps in the region between the Nile and the Red Sea, and spread from there to other areas. Simoons (1965) had earlier presented reasons for believing that agriculture was old in Ethiopia.

Levine (1974) raised the critical issue of whether the conquests within Ethiopia of past millennia represent the subjugation of alien peoples or an ingathering of peoples with deep historical affinities. For example, were the Semitic invasions incursions by aliens, or by members of what 15,000 years earlier had been one people? He proposed that the image of Ethiopia should be that of a vast ecological area and historical arena in which kindred peoples had shared many traditions, and interacted with one another for millennia. Levine's comments on trade are of particular interest: he maintained that trade, usually by barter, had constituted a major form of interaction within Ethiopia for thousands of years. Local pacts between warring factions were made, so that the markets were on neutral ground, undisturbed by fighting. Local markets dealt with regional markets, many Ethiopians would use more than one market. Trade caravans linking these markets are also old, utilising salt bars from the Afar desert and gold from the kingdom of Inarya in the southwest. Hallpike (1970; 1972) has written a perceptive and sometimes beautiful account of the Konso people, who still practise a very old agriculture.

Access to Ethiopia from the Nile is not difficult: it is possible to travel up the course of the Atbara, and up the course of the Blue Nile: also along the floor of the Abbay Trough. By 2,000 B.C., the Egyptians had established a trading post at Kerma in Nubia. Oliver and Fage (1962) stated that, from the beginning of the dynastic period at least, there was regular contact with the coasts of Eritrea, Somaliland, and southern Arabia, from where incense and myrrh were obtained. The former was important for the Egyptian religion: the latter essential for embalming the mummies. It is difficult to believe that Ethiopia was often isolated from the Nile. Sufficient information is now available for the onus of proving their case to be placed on those who maintain that Ethiopian culture and agriculture are relatively modern phenomena.

Annual crop development in Africa

There is no evidence at all for early cereal crop development prior to 1,000 B.C. in Africa other than in the north-eastern quadrant. At Kintampo, Ghana, the K6 site produced numerous cowpeas, which Flight (1976 : 212) considered were probably cultivated. The date was subsequent to 1,400 B.C. Munson (1976) suggested that the cultivated pearl millet found at Dhar Tichitt probably arrived there about 1,000 B.C., and he noted the absence of evidence for cultivation prior to 1,100 B.C. The Nok culture was probably based on agricultural production, but is unlikely to predate 1,100 B.C. (Fagg 1959 : 288). Shaw (1976 : 107; 1977) has gathered the available evidence for early annual crop agriculture in West Africa. It is likely that several of the Ethiopian crops had already reached India before 1,000 B.C., as will be discussed later, and so must have been developed in Africa well before that date.

The possibility that there was agricultural development along the Nile has been mentioned above. The Nile silt must hide many archaeological sites in northern Egypt and Helbaek (1966) drew attention to the whole series of barley forms grown on the early agricultural sites in Egypt. Helbaek also recorded *Hordeum irregulare* from the Fayum (Haelbaek, 1960), and Renfrew (1973) considered that this group seems to have originated in Ethiopia. There is a great diversity of barleys in Ethiopia. Harlan (1972) noted numerous forms peculiar to Ethiopia, including unique series of both *deficiens* and *irregulare* barleys.

According to Ethiopian tradition, barley is a very ancient crop in their country. We suggest that it may have been the first cereal crop in Ethiopia. It could have been carried there from Egypt. Alternatively, if "wild" barley was originally deliberately grown for some distance along the Nile and its tributaries, it may have been moved up into the hills, following the barley climate to higher altitudes as the general environment warmed up behind the northward movement of the Mediterranean climate.

Developments in the hills

Settled cultivators are sitting targets: after harvest, they have a stock of food which others would like to seize. The arable agriculturalists would have occupied defensive positions on the hills, although they may well have cultivated in the valleys as well, returning to their defended communities daily before nightfall.

These cultivators in the hills were caught between increasing population size on the one hand, and the climatic and ecological limitations of barley culture on the other. The latter pressure would have tended to increase as the climate became warmer and drier, and population numbers increased. These early Ethiopian agriculturalists responded to these challenges in two ways: a) by domesticating new crops adapted to warmer or more difficult conditions than those suited to barley; b) by developing a more intensive agricultural system.

The crops

Crops that can survive well on difficult soils in the barley zone included niger seed (noug, *Guizotia abyssinica*), t'eff (*Eragrostis tef*), and linseed (*Linum usitatissimum*). Noug can grow on shallow and illdrained soils, and has the reputation of suppressing weeds and being a good precursor crop. T'eff grows better than other cereals on the thin, black, peaty soils to be found in the highlands: linseed is also a crop of difficult highland soils. It is interesting that local collections of these crops show no response to fertilizer treatment. Noug was almost certainly ennobled in Ethiopia. T'eff could well have originated from one of the preferred grasses of the

grass seed collecting days, taken into cultivation as a result of knowledge of the principles of agriculture, and subjected for selection for persistent spikelets. To the casual observer, t'eff is a wild grass. Linseed could well have been introduced: the fibre (flax) was used by the Egyptians, especially for the fabric with which to bind the dead. Its putative ancestor, *L. angustifolium* is common in southern Europe and western Asia (Durrant 1976). In Ethiopia, linseed is an oilseed food crop, and like noug is widely grown by subsistence farmers in the highlands. There is much variability in Ethiopia, and also in India, where linseed is also a traditional oilseed food crop.

Tetraploid emmer wheat is an important highland crop, and also shows much variability, with forms peculiar to Ethiopia. The same combination of emmer and barley was found in ancient Egypt, going back to at least 4,500 B.C. It was probably introduced to Ethiopia at an early stage.

Two cereal crops extending from the highlands – usually rather below the "barley line" – to the lowlands, are finger millet (*Eleusine*) and sorghum. There is little doubt that finger millet was developed from *E. africana*. One archaeological find probably dates to the third millennium B.C. (Mehra 1962; 1963; Harlan 1969; Hilu and de Wet 1976; Phillipson 1977b; Hilu *et al.* 1979).

Harlan and Stemler (1976) suggested that African cereals agriculture originated south of the Sahara and north of the equator, with early cultivated sorghums (bicolor) arising in the southern Sudan-Chad region, spreading out and developing from these. The writer is not aware of any evidence to support this opinion. It seems more probable that sorghum arose in Ethiopia, as did a few other unquestionably old crops. In Ethiopia, there were skilled agriculturalists. Today, wild sorghums occur below 2,300 m. The crop could well have been ennobled in the valleys along water courses and in the upland fields of southwestern Ethiopia. Wild sorghum is commonly found as a weed in wheat fields in the 1600 to 1800 m belt between Debra Zeit and Nazareth, as well as further south. No doubt this is also true elsewhere in the country. The crop would have moved rapidly to the plains. Wetter conditions prevailed in those days, and the guinea race of sorghum, adapted to such conditions, would almost certainly have been the major race first developed, as Harlan and Stemler (1976) suggested. It has spread southwards to Malawi and beyond, eastwards to India. It moved westwards above the forest belt to the west coast of Africa – perhaps on the margins of Sutton's (1974) "aquatic culture". There, a secondary centre of variability developed. Today, guinea sorghums are found 200 miles further south, in the Sudan and Northern Uganda. Within Ethiopia, they are found in Konso, near the Sagan river in southwest Ethiopia. Occasional collections have been made in the western region, all of which showed high altitude adaptation when grown at Alamaya University in the Chercher highlands (Brhane Gebrekidan, personal communication 1982). It is probable that these occurrences in Ethiopia are relics of a former wider distribution there, under different climatic conditions.

The durra race probably arose from crosses between the early cultivated types and the wild *aethiopicum* race, which is very drought – tolerant and characterised by larger spikelets than the other wild forms. These sorghums are widespread in the drier areas of Ethiopia, and all intermediate stages from the wild type to the best high yielding durra types of the Chercher highlands are to be found in that country. Durras spread to West Africa along the southern fringe of the Sahara; to the drier parts of Tanzania in East Africa; and also to India. The only two races to reach India before the 18th century were guineas and durras.

Discoveries at Kadero, located 18 km north of the junction of the Blue and White Niles, and 6.5 km east of the main Nile channel, have thrown an interesting light on progress in the improvement of finger millet and sorghum. Numerous potsherds (about one metric ton) were obtained from two pits in the settlement, 300 pieces were selected by the excavator and given to Melania Klichowska to study (Krzyżaniak 1978; 1984; and personal communication 1985; Klichowska 1984). These carried impressions of threshed grains of sorghum and finger millet, among others. The mean dimensions of two groups of sorghum grains (15 and 11 impressions respectively) were 3.4×3.6 mm, and 3.7×3.4 mm. Twenty impressions of finger millet gave a mean of 2.1×2.0 mm. These dimensions are within the range of modern cultivars, and well outside those for the wild forbears. The calibrated dates belong to the end of the 5th millennium B.C. More remains to be learnt about this discovery – no harvesting tools were found on the site; but wherever those pots were made, cultivated types of both sorghum and finger millet were available, with fair sized grains that could be removed from their glumes without much difficulty.

Sesame (sim-sim) is another ancient crop of the medium and low altitudes, found in Ethiopia. There is considerable variability in the west of the country. Although an ancient crop in Palestine and Syria, its wild relatives occur in Africa and India, not in Central or West Asia. The indications that agriculture is older in Ethiopia than in penninsular India, tilt the balance in favour of an Ethiopian origin (Nayar 1976).

Cultural methods and soil and water management

Very important developments in land and water management essential to reduce the effects of population pressure on the land, may best be illustrated by looking at the current agriculture of the Konso. These people have lived in southwest Ethiopia for a long time, although they claim to have inherited at least some of their practices from the Mado people who they claim preceeded them. We may speculate about the order in which the various practices were developed: but the whole "package of practices" is impressive. The Konso lived in relative isolation (apart from contacts through their market system), prior to 1896.

Soil is preserved by the construction of many hundreds of miles of stone terraces, which follow the contours. They are built as dry stone walls, the soil being cut away vertically and the wall built against the vertical face. Only undressed stones from the ground near the place of construction are used, but with great skill and neatness. The terrain is steep, terraces are often about 2.5 m wide and 1.5 m high. The wall projects above the level of the field it is retaining. After heavy rain, a length of wall may collapse, but it is immediately rebuilt by the owner, who will rush out naked in a rainstorm to see what is happening to the water on his land. The land itself has a ridge on the outside, and other ridges are made at right angles to it, forming a series of boxes, like tie-ridging or basin listing, to hold the water.

Any streams are used to irrigate the fields, and the streams are walled, to protect the fields from flood water. Elaborate stone leats are constructed to allow the water to pass through a series of walled gardens. Such irrigable streams are rare: most of the stone-lined drains carry storm water, and are used as paths, especially for cattle. The run-off is carefully channelled through leats onto the land, and the owner will be there during heavy rain to see that the water is being well distributed over his land. Water for domestic use is obtained from wells, or from permanent streams (very few). Huge reservoirs have been constructed to conserve rain water for cattle: dams may be as much as 12 m high and more than 60 m in length, containing many hundreds of thousands of litres. Towns are usually situated on high ground, and the stream beds are in the valleys. Water may be collected from points half--an-hour's walk from the town, and 60 m below it.

Fertility is maintained by the liberal use of manure, which is applied once before sowing, and frequently during the growing season. Human manure is used, mixed with animal manure. In each town, there are number of places, generally along the outer walls, for defecation. The faeces dry quickly in the sun; they are collected and periodically taken to the fields as manure. This may well be a further indication of the age of agriculture in the area: it is hard to believe that the organized use of human manure would have been adopted and retained as an ancient custom if animal manure had been readily available. This custom could pre-date the adoption of cattle in Ethiopia. The manure is collected outside the homesteads to rot, and in some areas pits are dug in which the dung can mature.

The people live in walled towns with gates built in defensive positions. Only in recent years have the gates been neglected and security relaxed. The cattle (including sheep and goats) are penned within the homesteads, and are partly stall-fed. They are taken out under careful supervision along certain walled paths to the grazing area. Only a few pastures are found near the town: the greater part of the available land is situated some distance away, and the cattle are grazed there. Many of the distant fields are terraced, but not manured, and rotation with fallow is practised, where the grazing of the cattle doubtlessly contributes to fertility maintenance.

Ploughing was introduced by the Amhara: traditional cultivation used a three-pronged hoe of a type found formerly in ancient Egypt.

Konso cropping

The sketch maps show the Konso area (Fig. 2) and the lay-out of the towns in Konso (Fig. 3). The plateau of the Takadi area to the west is only a few hundred feet above the Garati region to the east, yet the cropping is different. Wheat and barley

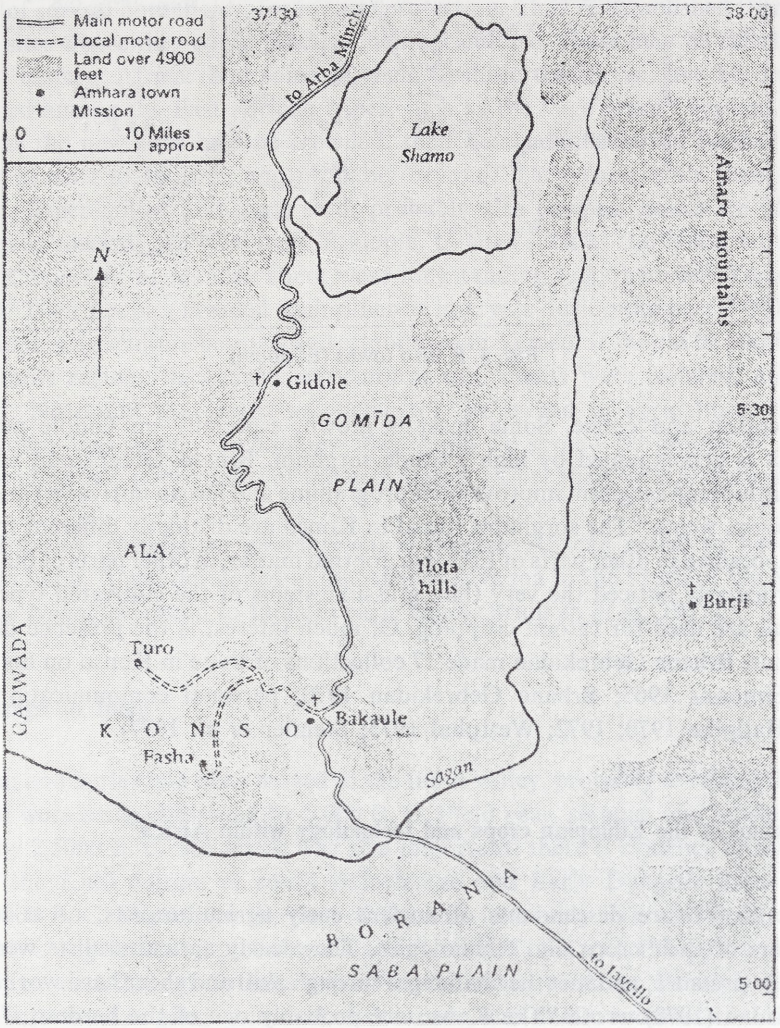

FIG. 2. The Konso area (Ethiopia)

are the main crops on the Takadi plateau; linseed, sorghum and finger millet are also grown there. These two crops are grown mainly on the lower ground – the Garati area, and ripen several weeks before the same crops on the plateau. Other crops grown are chick-peas, beans, cowpeas, horse gram (*Dolichos uniflorus*) yams and

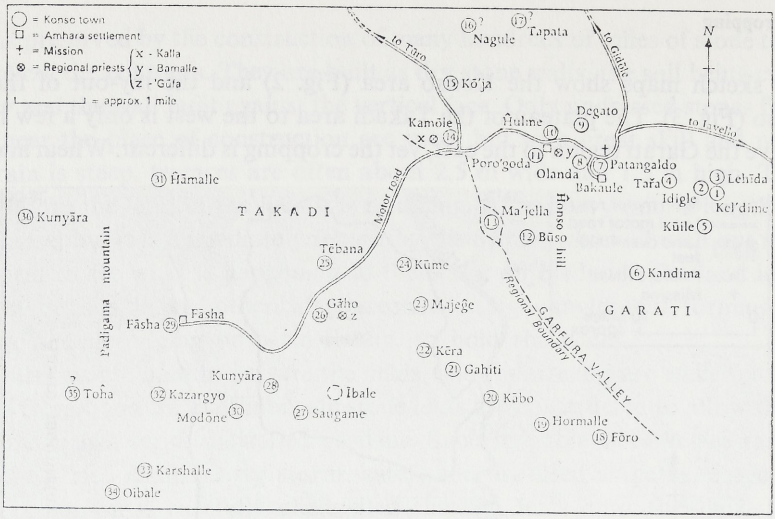

FIG. 3. Konso towns (Ethiopia)

taros, cotton and coffee. Some enset is grown, especially on Gidole mountain, where it is accompanied by high altitude sorghum. Brhane Gebrekidan who built up the Ethiopian sorghum improvement programme and has an unrival'ed knowledge of the crop, wrote "The sorghums found in Konso are distinctly different from sorghums obtained in other parts of Ethiopia, for that matter, in other parts of the world". He particularly noticed the very thin, grasslike stems of the cultivated types, many of which are used for ratoon cropping. Of much interest is the presence of guinea sorghums. Brhane Gebrekidan made 17 collections of these in Konso on his 1969/70 visit (Simoons 1965; Brhane Gebrekidan 1970; personal communications 1981, 1982; Hallpike 1970; 1972; Westphal 1975; Stemler *et al.* 1977).

The spread of the Ethiopian crops and technology within Africa

The Konso are descendants of ancient early agriculturalists, or at least the inheritors of their crops and technologies. These early agriculturalists were under relentless pressure, and met the challenges through skill and sheer hard work. Brhane Gebrekidan (1970) wrote "The Konso are probably one of the hardest, if not the hardest, working groups in Ethiopia". This was also true of the early agriculturalists. They developed new crops, intensified their production methods, yet population pressures on the land still grew. The local situation evidently required defensive positions for settled agriculturalists' towns. The only course left was emigration. There are no signs of a large-scale emigration, nor of any movement of agriculturalists on a broad front. Rather, they moved very much as the people under pressure in

the Sahel zone are moving today. The man of the family goes south, living as best he can. He prospects: and if he finds a suitable area, he returns to help his family pack up. They move, taking with them their seed and their accumulated agricultural knowledge and wisdom. It is unlikely that the movement of the ancient agriculturalists out of Ethiopia was very different. Probably they moved in rather larger groups, perhaps of several households, for mutual protection. They re-established themselves on hilly sites where they could practise their agriculture. These may be clearly identified in eastern Africa: and some of their Cushitic traditions have become well established among the East African tribes, such as the "age grade" system. In due course, as the new sites became crowded, their descendants moved further south, reaching at least to Malawi, and probably beyond. They took with them guinea sorghum, finger millet, and niger seed, probably also cowpea. Some are likely to have moved towards the west from Ethiopia, to sites such as the Nuba mountains and the Cameroun highlands. There were longstanding links between Yemen and Ethiopia. Their peoples invaded each other at intervals during the past 4,000 years, and Ethiopian agriculture became well established in Yemen. It should be emphasized that in most regions these early agricultural settlements were isolated, and very scattered. No doubt they acted as nucleii for the spread of agriculture. Gramly (1979) noted that a new technology may often be spread by groups of skilled people moving into populations of the uninitiated, rather than by a process of diffusion.

Pearl millet (*Pennisetum americanum*) is another African cereal to have been carried to India. It was developed in the African savanna to the south of the Sahara. Only race *typhoides* spread to India in early times (Brunken *et al.* 1977).

The passage to India

Wheat and barley had been moved to the Indus valley, probably overland through Iran, and were being cultivated by 5,000 B. C. Field peas, sesame, and mustard had arrived by 2,5000 B. C. Sea traffic was also important: there is evidence of sea trade between the Kulli culture of south Baluchistan and Early Dynastic Sumer soon after 2,8000 B. C. Ships from the port of Dilmum (probably Bahrein island) traded extensively along the coast, probably as far as Lothal. Trade with Ethiopia and Egypt moved by caravan through Somalia and across the straits to Aden. Ethiopia (Abyssinia) was interested in gaining control of the trade, and finally succeeded in 525 AD. The Red Sea was hazardous for small boats, and the overland route to Petra and Gaza was developed. The main caravan routes to Asia depended on donkeys and mules initially, and many halts were necessary, so staging posts were developed. Camels were introduced to Arabia as beasts of burden perhaps before the end of the second millennium B.C. The pace of trade quickened, and local marauding tribes found it more profitable to levy a tax for a safe journey than to pillage the caravans. Staging

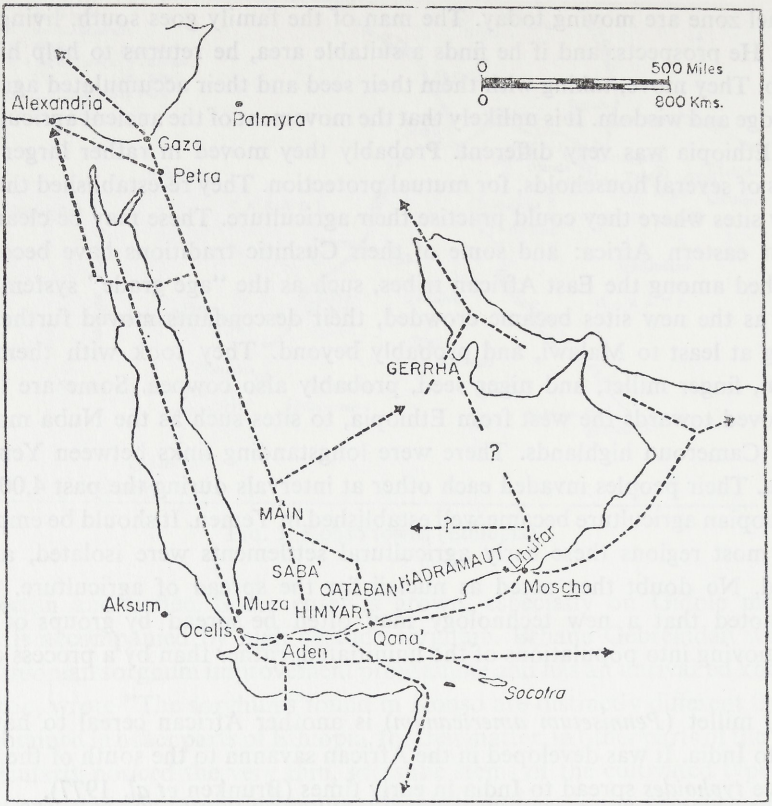

FIG. 4. Land and sea routes: South Arabia and the Horn of Africa

posts developed into towns, with water supply (often from construction of a dam). The townspeople grew food, including barley, wheat, and "millet" – which must surely often have been sorghum. Later, as bigger boats were built, sea-traffic largely replaced the overland route, especially when the monsoon wind system had been understood. Thus, there were a period of small boats trading along the coast, followed by overland caravans, which were themselves superseded by larger ships. Before the turn of the era, there was sea trade between the port of Dhufur in Saba, and India. A sketch map from Doe (1971) illustrates the trade routes in Arabia (Fig. 4). (Piggot 1950; Doe 1971; Ratnagar 1981).

Ancient agriculture in India

The first settled agricultural communities in India were established in the western Indus system, within the period 8,000 - 5,000 B.C. The Harappan civilisation developed from the numerous and widespread agricultural settlements of the Early

Indus period. The Great Indian Desert isolated Maharashtra from the Indus valley. The Banas Culture developed in the hilly country east of the Aravalli mountains around 2,500 B.C. and continued until 1,500 B.C. No Harappan sites have yet been found in this area, and Harappan influence seems to have been slight. On the Malwa plateau, sites were found at Kayatha, dating from *ca* 2,400 B.C., and at Navdatoli dating from *ca* 2,020 B.C. In Maharashtra, excavations at Daimabad revealed a chalcolithic culture, dating from *ca* 2,200 B.C. There were several similar sites in that area, including Inamgaon and Prakash, from around 2,000 B.C. These sites suggested links to the Harappan culture, but this is uncertain and requires confirmation. At another site, Jorwe 1,500 - 1,050 B.C., the huts were rectangular, as at Malwa, but at Inamgaon, 1,100 - 800 B.C., the huts were all circular.

In Karnataka, a Neolithic culture was discovered, the first phase of which was dated approximately to the period *ca* 3,000 - 2,000 B.C. From then on, more permanent settlements were discovered, often located on the crowns and slopes of granitic hills, dated between *ca* 2,100 and *ca* 1,700 B.C. Kodekal and Utnur are representative of the first period, and the people had domesticated cattle, sheep and goats. Numbers of rubbing stones and querns were found, indicating either seed collecting, or even grain cultivation. The second period occurs at Utnur, but more information has been obtained from Piklihal and Hallur, dating approximately from *ca* 2,500 and 2,200 respectively and continuing until the Early Iron Age. In period II, circular hutments of daub and wattle on a wooden frame were found, with mud floors. Tool types in the third period are reminiscent of those found in the Banas culture, Malwa and the Maharashtra sites. Grinding stones were found, with mullers, and large pots buried up to their necks probably served as storage jars. Cattle raising continued, but crops found include horse gram (*Dolichos uniflorus*), and finger millet (Allchin and Allchin 1982).

Dhavalikar (1979) underlined the problem of the chalcolithic cultures of Central India. This had already been considered by Sankalia *et al.* (1971). Sankalia has played the leading part in the excavations within reach of Pune, and has a thorough knowledge of all the evidence. He and his colleagues postulated four claimants for the development of the Malwa culture: 1. Immigrants from West Asia or Iran; 2. Aboriginal tribes who were chased up into hills by the Aryans *ca* 1,000 B.C.; 3. Unknown indigenous people who merged completely with the Sanskrit peoples; 4. A primitive indigenous people such as the Bhilo, who, coming in contact with a few immigrant people or ideas from Western Asia, developed into early farming, agricultural communities.

Dhavalikar postulated three components: a) some influences from Western Asia infiltrating through the north-western regions of the sub-continent; b) Harappan influences, especially on pottery; c) the Neolithic farmers of the southern Deccan. Somewhere in this picture might perhaps be added a small number of farmers from Ethiopia, brinding with them their crops and technology. Those crops have provided the base for arable agriculture in penninsular India ever since (supplemented by rice).

It may be fanciful to link the terraces at sites such as Kallur or Piklihal in Karnataka to transferred technology: the terraces were formed of soil behind retaining walls built of stone. We have seen that there is reason to believe that a similar movement took place from southern Ethiopia down through Eastern Africa. Communications were good to India because of the frankincense-myrrh-spice trade via South Arabia – a similar emigration of small groups to India seems quite possible.

The last event in Indian history relevant here is the Aryan invasion. In the second millennium B.C., or perhaps before the end of the third millennium, the Indo-Aryans began to enter India in several waves, the main incursion probably occurring around 1,700 B.C. There were times of violence and destruction of cities, but generally the Aryans were good colonizers, and the Sanskrit languages replaced Dravidian and Munda right across the north. The process of Aryanization had probably already begun in the Dravidian-speaking south by the opening of the first millennium B.C. If some groups of Aryans did reach the far south, they lost their original speech, and adopted the Dravidian language and customs of the people among whom they settled, indicating that rather few tried to penetrate far into the Peninsula (Allchin and Allchin 1982). Today, Karnada, Telegu, Malayalam and Tamil represent the main Dravidian languages of the Peninsula.

The African crops in India

Allchin and Allchin (1982) emphasize that the Indian sub-continent can be divided into three regions defined by hill and forest zones, as follows: 1. A western region centering on the Indus system; 2. A combined northern and eastern region, centering on the Ganges system; and 3. A southern or peninsular region. The Great Indian Desert forms a barrier between the Western region (Baluchistan and Sind in Pakistan) and the Southern region. Overland communications are easiest along a corridor to the south of the desert, linking Sind to Gujarat, Malwa, and southern Rajasthan, and thence through the lower rainfall regions of Maharashtra to the Tamil Nadu coast of the southern Peninsula. The internal movements of crops probably followed this route, although coastal trading boats are likely to have been involved also.

A second important consideration is the existence of an independent indigenous culture in the southern Deccan region of peninsular India. This dates back prior to 3,000 B.C., and so was contemporary with the urban phase of the Harappan civilisation. As recorded above, Sankalia and Dhavalikar suggested that the chalcolithic cultures of central India could have been much influenced by both this neolithic culture and the Harappan culture, with possibly a component from somewhere outside.

A third consideration is the inadequacy of the present archaeological record for crop plants. The samples are small, some of the identifications are in dispute,

some of the dates are uncertain. Even where the date of the remains of a crop has been well established, that tells us very little about the date when it arrived in the area where it was discovered.

Sorghum. Kajale recorded charred grains of sorghum from Jorwe in W. Maharashtra dating to *ca* 1,000 B.C. Another possible identification comes from Inamgaon, near Ahmadnagar in Maharashtra, dated around 1,800 - 1,500 B.C. during the Malwa period. It has also been recorded from Pirak, E.S.E. of Harappa, from around 1,350 B.C. Pirak was occupied by Harappan people during the first and second millennia B.C. Sorghum was also reported from Ahar, near Udhaipur, Rajasthan, dating to 1,500 B.C. or later.

Pearl millet. Finds at Ahar, dated *ca* 1,200 - 1,000 B.C. were thought to be pearl millet, as were some from Lothal (1,400 B.C.). Lothal was an important port in the Gulf of Bombay, controlled for a time by the Harappans, but a local culture existed alongside the Harappan culture.

Finger millet was found by Kajale at Jorwe *ca* 1,000 B.C. It has also been reported from a site in Karnataka, close to the Tungabhadra river, a tributary of the Krishna, during the Tekkalakota I period (2,100 - 1,500 B.C.). This is still a major crop among the Dravidian peoples of South India, notably in the Bangalore area. It is also an important crop for the agricultural Tribals in the Peninsula (Allchin and Allchin 1982; Kajale 1977; Vishnu-Mittre 1977).

Wheat. Harlan (1969) noted that the emma wheats in Ethiopia may be related to the Khapli wheats of south India, since both have more than two vascular bundles in the coleoptile. This could be another indication of direct links between the two areas.

Sesame is an old crop in West Asia, and has been found at Harappa II (2,500 - 2,000 B.C.). However, it is also an old crop in western Ethiopia and in the Sudan. The Tamils of south India have ancient rites involving this crop at birth, marriage, and death. Sesame seed is always placed in the mouth of a person who has just died: Bedigian and Harlan (1983) reported similar rites among the peoples of the Nuba mountains (Sudan) which are still in use. The writer mentioned this in a lecture in Nigeria, and was told afterwards by a Chadic language speaker that his people still observe these same rites. This is another crop in India, widely grown though often in small amounts. The sesame from N. India differs markedly in plant type and photoperiodic response from that in S. India. The latitudes of peninsular India and of Ethiopia are very similar, so photoperiodic responses are likely to be similar.

Niger seed (Noug, *Guizotia abyssinica*) is an important oilseed crop in Ethiopia, and also among the Tribal peoples of India practising agriculture. Many of these Tribals are the remnants of older indigenous peoples of India, displaced by later incursions.

It is interesting that there is such an association between the old crops of Ethiopia – finger millet niger seed, sorghum, sesame, perhaps also desi-chickpeas, – and the

old peoples of India, the Dravidians and the Tribals. It does not seem probable that these crops all came from or even through north India: growing conditions, especially day-length, are very different. There is scope for some interesting botanical analyses of the crop populations of Ethiopia and peninsular India, especially now that gene probes can be used. This could shed light on the history of the annual tropical seedcrops common to Ethiopia and India.

Crop movements

These crops were moved from Ethiopia to India, perhaps a long time ago. Small coastal craft could have been involved initially. Ships' provisions would have been needed, and crops such as finger millet, guinea sorghum, and niger seed store well. Agriculture would have been becoming familiar in Ethiopia, and it is probable that trading posts would have been established along the coasts, with crops from the Ethiopian region grown to provide familiar food, and to supply the boats pushing yet further along the coasts. The distribution of guinea sorghums from southern Africa to the coasts of China must surely be an illustration of this. The same must have happened when the larger dhows were operating on the monsoons, the trade winds of the Indian Ocean.

Of special interest is the period between the small boat traffic and the larger dhows, when the incense and spice trade was making the Arabian states and Abyssinia so wealthy that the overland caravan routes were worth operating right through into India and China. Doe's (1971) comment that agricultural settlements were established along the route to feed the staff at the staging posts *en route* is of much interest. There is reason to believe that settled agriculturalists were beginning to migrate out of the Ethiopian region perhaps around the second or third millennium B.C. Certainly that highly developed agriculture came across into Yemen. Conditions on the route to India may not have been so arid as they are today. Piggot (1950) noted that the climate of the Baluchistan-Sind region must have been wetter in Harappan times, and speculated about a small shift in the monsoon. The idea that agriculturalists gradually moved around the southern side of the Great Indian Desert and down to the south may not be fantastic. Sankalia *et al.* (1971) and Dhavalikar (1979) were certainly looking for an outside influence to explain their findings. The crops will be worth studying, as well as the human mitochondrial DNA of the peoples involved.

The age of the Ethiopian crops

There was a cut-off date for crop movement, probably around 525 A.D. when the Abyssinians overthrew the Himiyar. In 628 A.D. the Persian satrap embraced Islam, and the land-routes finally ceased as a factor in the international trading scene (Doe 1971). The history of sorghum shows that only the races guinea and durra reached India. The more recent caudatum and kafir races did not.

The dates for sorghum and finger-millet in India suggest that they were there by 1,000 B.C., and could have reached there by 1,500 B.C. – possibly somewhat earlier, samples are few thus far. The excavations at Kadero indicate that good progress had been made there in ennobling finger millet and sorghum by the end of the fifth millennium B.C., which fits in quite well with the dates when these crops were carried to India. We may guess that crop development in Ethiopia had begun by the beginning of the fifth millennium B.C.

End note

Seegeler (1983) made the following comment: "It is curious to note an old tradition of the region of Wolcait reported by Baldrati (1950). According to this legend an Ethiopian queen had occupied a vast region of India in the very remote past. She forced groups of Ethiopians to emigrate to India. How far this story has historical background is unknown, but it is striking that there are so many similarities between the crops of traditional agriculture in Ethiopia and in India, and that there are groups of Jaferbad in Kathiawar that consider themselves to be of Ethiopian origin".

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