

1 Barley History: Relationship of Humans and Barley Through the Ages

INTRODUCTION

There is considerable historical and archaeological evidence documenting the role of barley as a sustaining food source in the evolution of humankind. Indeed, it was one of the most important food grains from ancient times until about the beginning of the twentieth century. Additionally, alcoholic beverages of various types and fermented foods prepared from barley are commonly referred to in the ancient literature. As other food grains (e.g., wheat, rye, and oats) became more abundant, barley was relegated to the status of “poor man’s bread” (Zohary and Hopf 1988). However, modern consumer interest in nutrition and health may help restore barley’s status as a significant component in the human diet.

In this chapter we provide some historical perspectives on the origin, domestication, and early food uses of barley up to somewhat recent times. Our knowledge of barley’s prehistory comes in large part from archaeological studies of ancient civilizations. Along with archaeological and historical evidence, scientists have used genetics, biochemical, and morphological data to follow the evolution of barley from a wild plant to a domesticated (cultivated) crop. It is generally accepted as fact that the transformation of “wild barley” into a cultivated crop occurred over many millennia (Zohary and Hopf 1988). Fragile ears (spike), a genetic characteristic of wild barley, made it difficult to harvest seeds, as the kernels shatter at maturity. It has been postulated that natural mutations in wild barley produced plants with less fragile ears having larger and more abundant seeds that were naturally preferred and selected for food by hunter-gatherers. One may conjecture that agriculture began when seeds from these plants were planted either accidentally or intentionally, producing a “barley crop.”

The first barley foods were probably quite simple. The kernels were probably eaten raw until it was discovered that removing the hulls of hulled types followed

by soaking and/or cooking in some manner enhanced the texture and flavor. It is also logical to surmise that this may have been when early humans learned about fermentation and how to produce alcoholic beverages.

DOMESTICATION AND USE OF BARLEY FOR FOOD

The Origin of Cultivated Barley

There is some speculation, but it is believed by most authorities that the ancestor of modern barley (*Hordeum vulgare* L.) is identical in most respects to present-day *Hordeum spontaneum* C. Koch. This species is still found in abundance in many parts of Asia and North Africa (Harlan and Zohary 1966; Zohary 1969; Harlan 1978; Molina-Cano and Conde 1980; Xu 1982; Zohary and Hopf 1988; Nevo 1992). *H. vulgare* and *H. spontaneum* are interfertile and differ primarily in the attachment of the kernel to the spike; the latter having a brittle rachis that allows the kernels to shatter at maturity. Archaeologists and other scientists who have attempted to reveal more of the historical development of humankind and human attempts at barley agriculture do not conclusively agree upon the exact site(s) of where these events occurred.

The theory that barley was first domesticated in the Fertile Crescent in the Near East, which spans present-day Israel, northern Syria, southern Turkey, eastern Iraq, and western Iran (Harlan 1978), has been widely accepted but not without controversy. As in many controversies of this nature, there are opposing arguments to this theory. A noted Russian agronomist, N. I. Vavilov proposed that barley originated in two separate centers: one in the mountains of Ethiopia and the second in eastern Asia bordering to the north on present-day Tibet and Nepal and south into India in the subcontinent (Vavilov 1926). In both the Ethiopian highlands and the vast area of Asia proposed by Vavilov, there is an abundance of evidence of early barley culture (Harlan 1978; Molina-Cano et al. 2002). Vavilov's conclusion in 1926 was based on the large diversity of morphological types of cultivated barley that exist in these regions. In a later publication Vavilov indicated that barley was unlikely to have been domesticated in an area (Ethiopia) where the wild ancestor did not exist (Vavilov 1940). Although Ethiopia is widely recognized as a center of extensive genetic diversity in barley types, the area was not seriously considered as a center of origin; however, a study by Bekele (1983) indicated this as a possibility. In support of Bekele's study was the significant revelation that the World Barley Collection at Aberdeen, Idaho contains *H. spontaneum* entries from Ethiopia (Molina-Cano et al. 2002).

The suggestion of barley's possible domestication in Tibet has received support in the discovery of *H. spontaneum* in the Qinghai-Xizang plateau of Tibet (Xu 1982). This finding revived the controversy of cultivated barley's origin in the Far East. Abundant evidence as cited by Molina-Cano et al. (2002) indicates that the East Asian and Indian wild forms of barley are distinctly different from the Near Eastern forms in morphological and biochemical characteristics but have the brittle rachis characteristic of *H. spontaneum*. This evidence strongly suggests that domestication of wild barley occurred in both the Near and Far

East, although domestication in the latter may have occurred considerably more recently (Xu 1982). Furthermore, the geographical distribution of wild barley in North Africa has been extended beyond the boundaries suggested in earlier studies (Harlan 1978) with the finding of *H. spontaneum* plants in southern Morocco (Molina-Cano and Conde 1980). As with the Tibetan barley plants, those found in Morocco were different in many morphological characteristics from those found in Afghanistan, Iraq, Israel, and Libya (Molina-Cano et al. 2002). These authors also presented evidence that suggested the possible existence of wild barley populations in the Iberian Peninsula in Neolithic times. Thus, in light of the evidence, it can be surmised at this time that *H. spontaneum* was present in a vast region in ancient times, beginning in the western Mediterranean region, spanning North Africa, and extending into western, eastern, and southern Asia. The presence of wild barley in these areas indicates that it was available for use and domestication by early people.

Although Harlan (1978) felt very strongly in favor of the Fertile Crescent as the true center of the origin of cultivated barley, evidence gathered and presented over the past 20 years suggests a hypothesis for a multicentric origin for barley (Molina-Cano et al. 2002). Exactly where cultivated barley originated is probably academic, as the important fact that barley was an original food utilized by humans and was vital in the development of many civilizations. The most recent discovery site of barley remnants in a prehistoric setting is only a few thousand years old, which considering the eons of human development is a very short period, and there is so much that is truly unknown and hidden in the veil of ancient history.

The Fertile Crescent

Ancient texts from many cultures in Asia, North Africa, and Europe refer to barley as an important dietary constituent. Identifiable whole seeds and remnants of ground seeds of barley and other cereals have been found in numerous archeological sites that predate writing. Seeds of wild barley were found in a prehistoric camp recently excavated on the southwestern shore of the Sea of Galilee in Israel (Nadel et al. 2004). The age of the camp as determined by ^{14}C measurements is about 23,000 years, which makes this the oldest known site of barley use by humans. Until this discovery, the earliest remains of barley were found in archeological sites at Wadi Kubbanyia near Aswan in southern Egypt (Wendorf et al. 1979). The Egyptian sites are typical Late Paleolithic and were firmly dated between 18,000 and 17,000 years ago. Several well-preserved chemically carbonized barley grains were recovered at these sites, some of which had retained intact cell structure. Kernel sizes and shapes resembled both wild and modern-day cultivated barleys.

More recent evidence of barley use by ancient people in the Fertile Crescent was dated to approximately 10,000 years ago. This evidence was found in archeological sites from the Bus Mordeh phase of Ali Kosh, near Deh Luran in Iran and Tell Mureybat in Syria. Wild wheat was also found there, although as in other sites in Syria, Palestine, Mesopotamia, and Asia Minor, barley was

the more abundant of the two cereals. From available evidence, barley appears to have been grown on a considerable scale by 7000 to 6500 B.C. at Jarmo in the Iraqi piedmont, and large amounts of two-rowed hulled barley remnants have been unearthed at Beiha, north of Petra in southern Jordan. Six-rowed hullless types appeared at Ali Kosh and two Anatolian sites, Hacilar and Catal Huyuk, dating from 7000 to 6000 B.C. (Harlan 1978).

Archaeologists found a clay tablet from ancient Sumer in Lower Mesopotamia dating about 2700 B.C., which gave a prescription for a poultice that included dried powdered herbs and fruit blended with barley ale and oil. The Sumerian scribes also described the correct method of planting barley. Similarly, a small fragment of pottery with cuneiform script dating about 1700 B.C. was found at Nippur (Egypt) describing recommended irrigation practices for growing barley and the deleterious effect of too much moisture (Kramer 1959).

Several jars were discovered at two excavation sites near the ancient city of Kish in the Tigris and Euphrates river lowlands that contained preserved kernels of barley. These samples were dated in the early Sumerian period, and contemporary with predynastic Egypt, about 3500 B.C. (Hill 1937). Bishop (1936) cites evidence of both barley and wheat being grown in Turkestan in the third millennium B.C. The basic foods of the Sumerian diet were barley, wheat, millet, lentils, pulses, beans, onions, garlic, and leeks. Sumerians were also fond of alcoholic beverages; they developed eight kinds of ale made from barley, eight from wheat, and three from grain mixtures (Tannahill 1988). Perry (1983) relates a curious ancient recipe from the medieval Arab culture, which involves putting unleavened and unseasoned barley dough into closed containers and allowing it to “rot” (ferment) for 40 days. The dough was dried and ground into meal, then blended with salt, spices, wheat flour, and water to make a liquid condiment called *murri*; when mixed with milk, it was called *kamakh*. Other records of ancient agriculture in Turkestan show that barley was grown there at least as long ago as the third millennium B.C. (Bishop 1936). Considerable evidence indicates that agriculture and barley use spread from southwestern Asia, following Neolithic migrations west into North Africa, north to Europe and east to the valley of the Indus (Weaver 1950; Clark 1967). On the basis of historical evidence we were able to document, it would seem that it is possible that barley did evolve as a cultivated crop first in the Fertile Crescent, but as pointed out earlier, this theory has been challenged with good authority.

North Africa

There is documented evidence that barley was a mainstay food crop in North Africa for several thousand years, extending from Ethiopia and Egypt across the southern coast of the Mediterranean Sea to Morocco and southern Morocco.

Both barley and wheat foodstuffs were utilized by Egyptians during the early Neolithic period, and breads and porridges were common daily fare. In Egyptian literature, barley (*it*) is mentioned as early as the first dynasty and is often referred to as barley of “Upper Egypt” or barley of “Lower Egypt” and as white

or red barley. Crude granaries dug into the ground were discovered at a site of Egyptian Neolithic culture that contained quantities of well-preserved barley and wheat kernels. This site was thought to have been inhabited between 5000 and 6000 B.C. The prehistoric barley appeared to be very similar to barley grains grown in Egypt at the time of the discovery. Digesta from the alimentary canal of bodies exhumed in an ancient Egyptian cemetery dating about 6000 years old was confirmed to contain barley but no wheat (Jackson 1933).

Historical records from Egypt show abundant evidence of the high esteem in which barley was held. Barley heads appeared on many Egyptian coins, and written records from the fifth (ca. 2440 B.C.), seventh (ca. 1800 B.C.), and seventeenth (ca. 1680 B.C.) dynasties indicate its importance. Barley was intimately entwined in Egyptian religious rites and celebrations, being used as an offering to their gods, in funerals, and even becoming a part of Egyptian legends. Ancient Egyptian records proclaimed barley as a gift of the goddess Isis, and germinated barley kernels symbolized the resurrection of the goddess Osiris. Apart from these uses and its use as food in general, barley was used in brewing, as a medium of exchange, and in therapeutic applications (Weaver 1950). Although barley gained its favor primarily as a staple food, probably as porridge or bread, it was also used in making beer or a beverage called "barley wine." In this period an alelike beverage called *haq* was made from "red barley of the Nile" (Harlan 1978). Barley was used widely in medicinal applications in ancient Egypt and was prescribed in different forms for various maladies. Ground barley preparations, usually mixed with oil, were used as purgatives, applied to wounds to decrease the time required for healing, used as anal suppositories, used to remove phlegm from the respiratory tract, used to treat eye diseases, and most impressively, used as a diagnostic agent for pregnancy and to determine the gender of unborn children (Darby et al. 1976). The effectiveness of the latter two uses is unknown.

Ethiopia has a long history of barley cultivation and diverse agroecological and cultural practices dating back as early as 3000 B.C. The nation is renowned for its large number of landrace barleys and traditional agricultural practices. The diversity of barley types found in Ethiopia is probably not exceeded in any other region of comparable size (Harlan 1978; Bekele et al. 2005). The primary use of barley in Ethiopia continues to be for food, with most of the crop used to make the local bread (*injera*). The Oromo, an ethnic Ethiopian people, incorporate barley in their lifestyle following cultural practices that date back thousands of years, where according to Haberland (1963), barley was the only crop grown by these people in ancient times. Among the Oromo and other people in Ethiopia, barley was considered the holiest of all crops. Their songs and sayings often include reference to barley as the "king of grains." People in the highlands of Ethiopia encouraged their children to consume "lots of barley," believing that it made them brave and courageous. Raw or roasted unripe barley was a favorite food of children (Asfaw 1990), a tradition that continues to modern times (Mohammed 1983). In the Oromo society, special systems, practices, and traditions that involved barley foods and beverages have been maintained for at

least the last 400 years. Barley porridge (*merqa* and *kinche*) and fermented and unfermented barley beverages of various consistencies (*tella*, *zurbegonie*, *bequre*, *borde*, and *arequie*) are central to harvest and marriage rituals. The Oromo were originally a nomadic people, and it has been suggested that the development of barley as a crop made an immense contribution in transforming these nomads into a settled farming society, thereby making their life more secure (Mohammed 1983). As noted earlier, a large diversity of barley morphological types is found in Ethiopia, which led to the earlier conclusion that Ethiopian highlands might have been a center of origin of barley.

In Morocco, barley has played a significant role in providing food security throughout the history of that country. Since the beginning of the second millennium B.C., the ruling dynasties in Morocco ensured the security of the populace by maintaining large grain storage facilities, which in effect increased their popularity and secured their positions as rulers. Barley was stored by the rural population, whereas wheat was stored by the urban populations, creating two separate but important systems in safeguarding against famine. Barley and durum wheat were the predominant grains consumed in ancient times (Saidi et al. 2005).

Southern Europe

With movement of civilizations from the Fertile Crescent and the initiation of agricultural trade routes, barley use and cultivation spread throughout the European continent. Evidence of the transfer of barley use from Egypt to southern Europe appears in references made to Egyptian barley use by famous Greeks. Herodotus described barley beer as an important drink among the Egyptians. In one of his visits to Egypt, Pliny the Elder witnessed the use of barley in medical treatments and brought the knowledge to Greece. He is quoted as saying that consuming barley would heal stomach ulcers. Hippocrates is also quoted as saying that Egyptians believed that drinking barley water gave them strength and health (Weaver 1950).

Pliny described recipes for barley *puls*, an oily, highly seasoned paste mixture that was a popular food in Greece (Tannahill 1988). Barley was a common constituent of unleavened bread and porridge eaten by the ancient Greeks. A breadroll claimed by Archestratus in the fifth century B.C. to be the “best barley” was prepared in Lesbos and Thebes by “rounding the dough in a circle and pounding” (by hand) prior to baking. This bread was called *krinnitas* or *chondrinos*, which are terms describing coarsely milled barley (Davidson 1999). A twice-baked barley biscuit called *paximadia*, a favorite Greek food item, was then soaked in broth prior to eating (Kremezi 1997). In more recent times in Greece, a combination of barley and wheat flour was used to produce lighter, crunchier biscuits that did not require soaking before eating. Barley was not fully accepted by all Greeks, however. Aristotle, as well as bakers in the more cosmopolitan communities such as Athens, thought it to be less healthy than wheat (Davidson 1999).

Barley was highly regarded and widely grown by the Romans in many countries which they conquered. The ancient Romans held festivals at planting and

harvest times in honor of the goddess Ceres, whom they worshiped as giver of the grain. Offerings of wheat and barley were made to the goddess, “the Cerealia munera,” or gifts of Ceres, from which the English word *cereal* is derived (Hill 1937). Barley was the general food of the Roman gladiators, who were called *Hordearii* or “barley men.” They believed that barley bread gave them greater strength and increased stamina compared with other foods (Percival 1921). Romans are credited with pioneer advances in dryland farming techniques in North Africa during their occupation of those territories (Hendry 1919). Barley was the grain of choice because of its tolerance to low rainfall in arid lands.

Although barley was considered a respectable, even desirable food in parts of ancient Greece and Italy, Roman soldiers came to look on barley as “punishment rations,” even though barley malt was used routinely by the armies for making alcoholic beverages (Davidson 1999). In ancient Rome, bread made from wheat was considered to be more nourishing, more digestible, and in every way superior to barley bread. As in later cultures, barley bread (*panus hordeaceus*) was consumed predominantly by slaves and poor people. After the fall of the Roman Empire, barley bread was considered inferior to rye and wheat breads. However, rich citizens used barley bread as “trenchers” or plates that were edible.

Cultivation of crops, including barley, expanded in a northern and easterly direction from the Aegean area, reaching the Caucasus and Transcaucasus regions during the fifth millennium. Fossilized barley plants that appeared to be hullless types were found in ancient settlements near the village of Ghiljar in the eastern part of the region. In the Caucasus mountain districts above 1700 m, barley was the only grain crop cultivated especially for food by the ancient inhabitants. Most of the barley grown was hullless and was used to make flat cakes and soup. A product capable of being stored, called *ini*, was made by frying hullless barley kernels on a special brazier, then grinding and storing in a large earthenware vessel. *Ini* could be stored for many months, requiring only the addition of water and salt for preparation of dough, which was then rolled into a ball and was ready to eat or could be baked or grilled. Although not necessary and only if available, butter and/or cheese were added to the mixture prior to eating. As in many ancient societies, barley drinks were common among people living in the Caucasus mountain area. One such beverage, *buza*, containing about 4% alcohol, was a traditional drink made from fermented hullless barley cakes and malt (Lisitsina 1984; Omarov 1992).

Southwestern, Central, and Northern Europe

Barley is thought by some historians to have reached Spain in the fourth or fifth millennium B.C., spreading north from there through what is now Switzerland, France, and Germany. However, Molina-Cano et al. (1999; 2002) hypothesized that ancient domestication of barley could have occurred on the Iberian Peninsula and southern France in Neolithic times, independent of genome sources from the Fertile Crescent. Identification of *H. spontaneum* in Morocco and the Iberian Peninsula suggest the possibility that landrace cultivars may have developed in the

western Mediterranean area prior to movement of barleys through the trade routes from the Fertile Crescent. There are records of barley's place among Neolithic cultures in many parts of Europe, including Stone Age people in Switzerland (Bishop 1936). According to Davidson (1999), a type of ancient barley bread survives in Jura, a mountainous region of France. This bread, called *bolon* or *boulon*, is prepared in small loaves that are very hard and require soaking in milk or water prior to eating.

Agriculture and cultivated barley reached central and northern Europe during the third millennium B.C. (Körber-Grohme 1987, cited by Fischbeck 2002). It was suggested by Fischbeck that expansion of agriculture also originated from the Aegean region, moving up the river valleys through the Balkans and north into what is now Germany, Poland, and the Baltic countries. Land areas where barley was grown were considered to be less desirable for other crops, yet barley was reported to have thrived under such conditions. Hulless, six-rowed barleys were introduced to the British Isles from the European mainland in about 3000 B.C. (Clark 1967). Coins of early Britons carried pictures of barley bearing the Anglo-Saxon name *barlych* or *baerlic*. Roman records during their occupation of northern Europe indicated that barley was a staple food of the population (Weaver 1950). Bread made from barley and rye flour formed the staple diet of peasants and poorer people in England in the fifteenth century (Kent and Evers 1994). Beyond the Roman period and through the Dark Ages, barley was a dominant food grain throughout Western Europe. It is said to have been the chief bread plant of continental Europe as late as the sixteenth century (Hunt 1904). Oats have long been thought of as the chief element of the Scots' diet, but in fact, at the beginning of the eighteenth century a mixture of barley, peas, and beans was a common food, especially among the poor. Oats were a "rent-paying" crop in Scotland; thus, barley was the cereal eaten by most rural Scots (Gauldie 1981). It was said in the early literature that Scottish land tenants "eat nothing better than barley meal and a few greens boiled together at midday and barley meal porridge at evening and morning."

In the Orkney and Shetland islands off the northern coast of Scotland, a variety of food barley called *Bere* was very popular for milling into flour in Europe for more than 2000 years. Bere is a six-rowed landrace variety adapted to growing on acid soils and to short growing seasons. It is thought to have been introduced to the islands by Norse or Danish invaders in the eighth century A.D. (Jarman 1996), although carbonized barley kernels of hulled and hulless types recently excavated in Shetland have been dated to about 1560 B.C. According to Sturtevant (1919), Bere barley, also known as "big barley," was "one of the varieties formerly cultivated in Greece" but once grew wild in the region between the Euphrates and Tigris rivers. The word *Bere* occurred in written form around the thirteenth century and was probably an earlier form or stem of the word for barley and not a proper name (Hannu Ahokas, personal communication). Oats, along with barley, were first grown on the Orkney Islands during the Iron Age. These two grains remained the standard grain crops for many years and were cultivated by the Vikings on many of the Scottish islands (Fenton 1978). Flour milled from Bere

barley was traditionally used for making bannocks and similar baked products. Scottish mills were adapted not only for oats but also to grinding of Bere and the pulses, either separately or as a mixture. The resulting mixed meal was made into coarse bread, flat and unleavened, or into porridge. Bere that had been “knockit” (roughly pearled) and left whole was used to make barley broth. Scotch broth or barley broth, a well-known traditional soup, was prepared by boiling beef or lamb with barley, adding a variety of vegetables and a little sugar. The Scottish *mashlum*, a mixture of peas, beans, and Bere barley or oats, was still eaten by all classes until the end of the eighteenth century and by workers after that in some lowland areas. A mixture of peas and barley meal known as “bread meal”, was sold by a grain mill at Perth as late as 1837. The popular scones served at tea throughout the United Kingdom were made originally from Bere barley meal or a mixture of Bere barley meal and oat meal. *Scone*, a Scottish word, is perhaps derived from *schoonbrot* or *sconbrot*, meaning white bread (Gauldie 1981). A water-powered mill near Kirkland in the Orkneys produces Bere barley meal in the traditional way today.

According to Mikelsen (1979), hullless barley and einkorn were introduced into Norway between 2000 and 1700 B.C. Of the two grains, barley was far more commonly grown, probably because it was more winter hardy. On the island of Senja in Troms in the far northern part of Norway, a porridge called *vassgraut* (“water porridge”) was a common food made by adding ground barley to boiling water. In the Viking era, “ash bread” was prepared by baking barley dough in hot ashes. In addition, it was common to bake barley flatbread on a type of griddle over fires.

Barley was grown extensively in Scandinavia during the Bronze Age (around 2000 B.C.), as wheat of that era was more difficult to grow in the prevailing cold climate. During the Bronze Age, barley became the major cereal for food in Scandinavia, a tradition that continued until early in the twentieth century in many parts of northern Europe. A common diet at the beginning of the twentieth century in Lunnede (Denmark) on the island of Fyn included porridge of barley grits cooked in milk or beer in the morning; meat broth with abraded barley at noon; and barley grits cooked in sufficient amounts to provide for next day’s breakfast as well in the evening (Munck 1977).

Perhaps the first clinical trial with barley was reported by L. M. Hindhede in his book *Fuldkommen Sundhed og Vejen Dertil*, in which two adult men were fed a diet based on barley grits, margarine, and sugar for 180- and 120-day periods, respectively. The first subject was involved in heavy manual labor and lost 3.5 kg of weight during the first 36 days of the 180-day period but was otherwise in good health at the end of the study. The second subject, who was in poor health initially, complaining of chronic stomach problems, gained 9 kg in the 120-day period and made the following proclamation: “I have now lived on barley porridge for the last four months. As well as having completely recovered my health, I have gained 9 kilos” (Munck 1977).

Flatbreads made from barley meal were common in Sweden, and the loaves were dried and kept up to six months as a staple food. In the Faroe Islands,

dough balls made with milled barley were first placed on an open fire to form a crust, and the baking was completed by placing the crusted barley dough balls in warm ashes. This ancient type of bread, called *drylur*, is not unlike the “ash bread” made from barley flour and water in ancient Norway. Abraded barley kernels and barley grits were used in many ways, including in soups, porridges, meat blends, sausages, and blood mixtures, and in many instances were blended with legumes and other cereals. In Dalarne, Sweden, pea meal and oats were commonly blended with barley meal for baking. Sour beer was often used in food preparation, especially in baking barley or mixed-grain bread (Munck 1977).

East Asia

As was the case with the spread and/or development of barley into North Africa, the Mediterranean region, and Europe, barley cultivation is thought to have moved rapidly eastward from the Fertile Crescent through the trade routes into many parts of Asia, reaching Tibet, China, Japan, and India in the second and third millennia B.C. (Davidson 1999). However, on the basis of genetic and biochemical data presented and summarized by Molina-Cano et al. (2002), it is possible that barley was also domesticated in parts of eastern Asia, particularly in Tibet.

Regardless of barley’s origin in Asia, barley has been and continues to be a mainstay in the diet of the Tibetan people. Nyima Tashi, a faculty member at the Tibet Academy of Science in Lhasa, described the long history of the use of hulless barley in food products in Tibet, including various types of cakes, porridges, soups, and snack foods. These products are still prepared using various combinations of roasted hulless barley flour, butter, cheese, sugar, milk, fruits, and meats of different kinds (Tashi 2005). Tashi used the word *tsangpa* to describe roasted grain flour that is prepared by adding cleaned kernels of grain to fine sand previously heated to 100 to 150°C for 2 to 3 minutes and then sieving out the sand. The roasted kernels, called *yue*, are ground into fine flour called *tsangpa*. Shelton (1921) and Ames et al. (2006) described a flour product made from hulless barley roasted and ground in a similar manner as *tsampa*. (We surmise that this is a different English spelling for the same product, due to the similarities in the descriptions of preparation.) Both Shelton and Ames were privileged to have spent time in Tibet, allowing them personally to witness the preparation and use of *tsampa*.

For several thousand years the Tibetan diet consisted mainly of two food items, *tsampa* and yak *butter tea*. Shelton (1921) described *tsampa* preparation as follows: Hulless barley was parched, ground into very fine flour, and made into flat cakes. Butter tea was made from a strong Chinese tea that was strained into a churn to which varying amounts of “more or less stale” yak butter and salt were added. The mixture was then churned into an emulsion. After drinking some of the tea emulsion, the *tsampa* flour was added, kneaded into doughlike balls called *ba*, and eaten. As one would expect, alternative procedures of making *tsampa* have been reported as well, but the basic components are not different. The roasted barley flour was sometimes placed in a bowl or other container first

and tea added along with the yak butter. A portion of the tea was drunk, and then the mixture was kneaded with fingers into a doughy paste, formed into small rolls or balls. *Tsampa* could be taken on journeys and eaten dry or with some type of liquid, such as water or milk (Shelton 1921). It is interesting to note the similarity of Tibetan *tsampa* and *ini* made by people who lived in the Caucasus mountain region. *Tsampa*, prepared in much the same way as in early times using native hullless barley, still makes up a substantial part of the Tibetan diet (Tashi 2005; Ames et al. 2006). *Tsampa* is considered a convenience food and is often used by Sherpas, nomads, and other travelers, as in the past. *Tsampa* is used in ways other than food, including as a remedy for toothaches and sore areas. *Tsampa* is traditionally incorporated in certain religious occasions, wedding and birthday celebrations, and the New Year festival. Tossing *tsampa* foods such as the doughlike balls into the air is a symbolic gesture commonly done at various religious and family celebrations in Tibet (Tashi 2005; Wikipedia 2007).

An important and early center of agriculture in the subcontinent of India was in the Indus Valley, now mainly Pakistan. Wheat and barley were staple foods of the Harappan civilization, which flourished in this general area from about 3200 to 2200 B.C. Ajgaonker (1972) described how ancient Indian physicians effectively stabilized type 2 diabetes some 2400 years ago. The treatment was remarkably simple and not really different from recommendations that are given to people with diabetes today (i.e., lose weight, change diet, and increase exercise). In the case of diet, the major changes were reduced caloric intake and substitution of barley for white rice.

Barley has been grown in Korea for many years and in the southern part of the peninsula as a rotation crop with rice, the latter planted in the summer season, with barley planted in the winter season. It is believed that barley was first cultivated as a crop in Korea around 100 B.C (Bae 1979). Although rice is the favorite cereal of Koreans, barley was used as an extender in many rice recipes, especially during periods when rice was in short supply. Various milling procedures have been used in the past, such as splitting the kernel at the crease to decrease cooking time and making the barley kernel closer in size to a grain of rice. In the Korean language, cooked cereal, which is usually rice, is called *bob* and mixed *bob* is prepared by cooking rice and adding precooked barley. *Bori* is the Korean word for barley, and when 100% of barley is used for *bob*, the dish is called *kkong bori-bob*. Barley malt has been used to prepare a traditional sweet drink, and in some instances barley has been used in the preparation of fermented soybean paste as well as hot pepper paste in Asia (B.K. Baik, personal communication).

Barley tea has a long history in Asia and is still a popular drink in many parts of the continent, including Korea, China, Japan, India, and especially, Tibet. Barley tea is prepared from roasted barley kernels that are steeped, making a mild nonalcoholic drink that is consumed both hot and cold, with and without meals, in place of water. In the past, kernels were roasted at home for use in tea. Today, however, roasted kernels for making barley tea are available in many food stores in modern cities and towns. There are many anecdotal references to the medicinal value of barley tea for young and old throughout the barley literature.

In a section titled “Recipes for the Sick” in *The Rumsford Complete Cookbook* (Wallace 1930), a recipe for barley water for the sick is given as follows: 2 Tbsp pearl barley, 1 qt cold water $\frac{1}{3}$ tsp salt, juice of one-half a lemon, and a little sugar; soak the washed barley, add salt, and cook for about 3 hours; strain through cheesecloth, flavor with the lemon juice and sugar as desired.

North and South America

The story of barley in the New World is a recent and brief fragment of the history of the use of this grain by humankind (Weaver 1950). Columbus brought barley to the North American continent on his second voyage, in 1494 (Thacher 1903). The original introduction site was not conducive to barley culture and there were no further reports of production in that area, although there are records of barley crops in Mexico in the sixteenth century (Capettini 2005). Later, there were two additional pathways through which barley was introduced more successfully into North America. Barley was brought to the east coast colonies from England at the turn of the seventeenth century and into the southwest during the Spanish mission movement (Weaver 1950; Wiebe 1978). Barley was probably planted for the first time on Martha’s Vineyard and Elizabeth Island off the coast of present-day Massachusetts in 1602. Four years later, barley was planted at Port Royal, Nova Scotia and in Champlain’s garden in Quebec as early as 1610. Barley was also grown by Dutch colonists in “New Netherland,” and samples were shipped to Holland in 1626. Colonists of the London Company grew barley in Virginia in 1611, and it became an important crop by the middle of the seventeenth century. In the colonial days, barley was grown principally for beer production, and the varieties cultivated were those common to the home region of the colonist. Although barley production flourished and spread westward, the early varieties introduced from northern Europe were not well adapted to the soil and climate of the eastern United States and Canada. As barley moved west in North America, production was centered close to populated areas to provide raw material for breweries (Weaver 1950). One of several such enterprises, the Manhattan Malting Company, was established by Henry Altenbrand and Jacob Rupert in 1891 in the Rocky Mountain region of western Montana, near the present town of Manhattan. Henry Altenbrand was president of the New York and Brooklyn Malting Company, and Jacob Rupert was the owner of the New York Yankees baseball team. In celebration of the newly founded brewery and barley-growing company, Altenbrand had the town name officially changed from Moreland to Manhattan. This operation was highly successful, contributing to the financial support and population growth of the area. The Manhattan Malting Company, as well as many similar enterprises in the western United States, was doomed by Prohibition in 1916. However, the initial start of barley production in the Manhattan, Montana area continued as demand for barley for animal feed grew and farmers diversified into other crops (Strahn 2006). Thus, the popularity of barley beverages played a significant role in settling many parts of the Old West of the North American continent. Barley spread north as well as west from

the original east coast introductions. There is a report of barley cultivation as far north as Fort Yukon, Alaska in the late nineteenth century (Dall 1897).

The early history of barley's establishment in North America is not confined to the east coast colonies. The Spanish brought barley into the area that is now Mexico, resulting in eventual distribution to South America, the American southwest, and California in the sixteenth and seventeenth centuries. In most instances, barley in these areas was used primarily for animal feed and secondly for beer production. Barleys that were introduced to this part of North America by the Spanish explorers were very well adapted to the soil and climate, having been developed under similar ecological conditions in North Africa and in regions of southern Europe. Thus, barley was established on both sides of the North American continent, moving from the coastal areas into the interior as the population grew and moved into new territories (Weaver 1950). Barleys that were adapted to the high mountains of Africa prospered in similar environments of the New World, and those adapted to the hot, dry coastal areas of the Mediterranean Sea prospered in Mexico, the southwestern desert country of the United States, and California (Harlan 1957).

Simultaneous to the introduction of barley into Mexico, there are records of barley crops in the sixteenth century in Argentina (1583), Peru (1531), Chile (1556), and Brazil (1583). In 1914, two German scientists, Alberto Boerger and Enrique Klein, initiated the first formal barley program in Latin America at the La Estanzuela Experiment Station in western Uruguay. Local landrace barleys were used as gene sources for developing new, adapted, and improved feed and malting lines. Klein later moved to Argentina, where he continued his barley breeding programs using germplasm he brought from Uruguay (Capettini 2005). Harlan (1957) described barley grown in Peru at the beginning of the twentieth century as very much like the "coarse" barley that was introduced into South America by Spaniards. He suggested that these barleys originated from high mountain regions of southern Europe or North Africa, as they were being produced at elevations up to 4000 m in Peru. Although the native people of Peru had proven very adept at breeding other food plants, Harlan (1957) observed that there was very little evidence of improvements made in barley.

There is little or no conclusive historical evidence that barley was used for food to any great extent other than as a beverage during these early years in North or South America. It can be deduced with some accuracy that most of the barley crop produced during the settling of the New World by people of European origin was used primarily for malt production and animal feed. The same pattern continues somewhat today in the United States and the southern cone of South America, although there are local areas in parts of South America, especially Ecuador, where barley represents a major food source in rural areas (Villacéres and Rivadeneira 2005).

Contacts initiated in 1492 between the Old and New Worlds brought profound and lasting change in human populations and plant life to the entire planet. Barley was only one of many biological entities introduced into the Americas with the migration of Europeans. The westward movement of barley and other crops to

the New World was accompanied by the introduction of crops such as maize and potatoes into European and African agriculture (Crosby 2003).

SUMMARY

In this chapter we have attempted to present a logical progression and development of barley as a food along with developing civilizations through the ages. Cereal grains have long been noted for their essential contributions to human survival throughout history. Barley, in particular, was a dietary mainstay of ancient civilizations and continued to be an important dietary constituent of working-class people in Europe until the end of the nineteenth century. On the basis of archaeological evidence, it can be speculated that the evolution of barley foods and beverages paralleled the early development of the human race. Locating the origin of cultivated barley has not been without controversy. The most prominent and accepted theory of origin is in the Fertile Crescent. There is, however, compelling evidence of the possibilities of multicenters of origin of barley, initiating in the Iberian Peninsula, extending across North Africa, southwestern Asia, and into eastern and southern Asia. Throughout historical and archaeological reports, barley is referred to as a source of health, strength, and stamina for athletes and persons involved in hard manual labor. The health benefits and medical aspects of barley foods are stressed in ancient Arabian, Chinese, Egyptian, Ethiopian, and Greek literature. These same beneficial properties of barley foods that were recognized by the ancients were also touted by more recent civilizations, extending from Asia to Europe. In almost every culture through past ages, barley foods are described as having almost mystical properties. Barley cultivation moved with advancing civilizations through Europe and into the New World. In many instances barley was grown in areas and under conditions that were not suitable for other crops, providing a source of nutrients to the less fortunate section of the population. Barley lost favor as a food grain due primarily to improved conditions of the farming classes and the growth and development of the wheat industry. Wheat bread and wheat-based breakfast cereal products have replaced many of the bakery markets for rye, oats, and barley because of texture, taste, appearance, and increased availability.

REFERENCES

- Ajgaonker, S. S. 1972. Diabetes mellitus as seen in the ancient Ayurvedic medicine. Pages 13–20 in: *Insulin and Metabolism*, J. S. Bajaj, ed. Association of India, Bombay; India.
- Ames, N., Rhymer, C., Rossnagel, B., Therrien, M., Ryland, D., Dua, S., and Ross, K. 2006. Utilization of diverse hulless barley properties to maximize food product quality. *Cereal Foods World* 51:23–26.
- Asfaw, Z. 1990. An ethnobotanical study of barley in the central highlands of Ethiopia. *Biol. Zentbl.* 109:51–62.

- Bae, S. H. 1979. Barley breeding in Korea. Pages 26–43 in: *Proc. Joint Barley Utilization Seminar*. Korea Science and Engineering Foundation, Suweon, Korea.
- Bekele, E. 1983. A differential rate of regional distribution of barley flavonoid patterns in Ethiopia, and a view on the center of origin of barley. *Hereditas* 98:269–280.
- Bekele, B, Alemayehu, F., and Lakew, B. 2005. Food barley in Ethiopia. Pages 53–82 in: *Food Barley—Importance, Uses and Local Knowledge: Proc. International Workshop on Food Barley Improvement, Jan. 2002*. S. Grando and H. G. Macpherson, eds. ICARDA, Aleppo, Syria.
- Bishop, C. W. 1936. Origin and early diffusion of the traction-plough. *Antiquity* 10: 261–278.
- Capettini, F. 2005. Barley in Latin America. Pages 121–126 in: *Food Barley—Importance, Uses and Local Knowledge: Proc. International Workshop on Food Barley Improvement, Jan. 2002*. S. Grando and H. G. Macpherson, eds. ICARDA, Aleppo, Syria.
- Clark, H. H. 1967. The origin and early history of the cultivated barleys. Pages 1–18 in: *The Agricultural History Review*. British Agricultural History Society, London.
- Crosby, A. W. 2003. *The Columbian Exchange: Biological and Cultural Consequences of 1492*. Praeger Publishers, Westport, CT.
- Dall, W. H. 1897. *Alaska and Its Resources*. Lee and Shepard, Boston.
- Darby, W. J., Ghalioungui, H., and Grivetti, L. 1976. *Food: The Gift of Osiris*. Academic Press, New York.
- Davidson, A. 1999. *The Oxford Companion to Food*. Oxford University Press, Oxford.
- Fenton, A. 1978. Grain types and trade. Pages 332–336 in: *The Northern Isles: Orkney and Shetland*. Tuckwell Press, East Lothian, Scotland, UK.
- Fischbeck, G. 2002. Contribution of barley to agriculture: a brief overview. Pages 1–14 in: *Barley Science: Recent Advances from Molecular Biology to Agronomy of Yield and Quality*. G. A. Slafer, J. L. Molina-Cano, R. Savin, J. L. Araus, and I. Romagosa, eds. Haworth Press, Binghamton, NY.
- Gauldie, E. 1981. Diet: the product of the mill. Pages 1–21 in: *The Scottish Country Miller 1700–1900: A History of Water-Powered Meal Milling in Scotland*. John Donald Publishers, London.
- Haberland, E. 1963. *Völker Süd-Aethiopiens*, vol. 3; *Gala Süd-Aethiopiens*. Kohlhammer, Stuttgart, Germany.
- Harlan, H. V. 1957. *One Man's Life with Barley: The Memories and Observations of Harry V. Harlan*. Exposition Press, New York.
- Harlan, J. R. 1978. On the origin of barley. Pages 10–36 in: *Barley: Origin, Botany Culture, Winter Hardiness, Genetics, Utilization, Pests*. Agriculture Handbook 338. U.S. Department of Agriculture, Washington, DC.
- Harlan, J. R., and Zohary, D. 1966. Distribution of wild wheats and barley. *Science* 153:1074–1080.
- Hendry, G. W. 1919. Mariout barley, with a discussion of barley culture in California. *Calif. Agric. Exp. Sta. Bull.* 312. University of California, Berkley, CA. (Cited by Weaver, 1950.)
- Hill, A. F. 1937. *Economic Botany: A Textbook of Useful Plants and Plant Products*. McGraw-Hill, New York.
- Hunt, T. F. 1904. *The Cereals in America*. Orange Judd Company, New York.

- Jackson, A. 1933. Egyptian Neolithic barley. *Nature* 131:652.
- Jarman, R. J. 1996. Bere barley: a living link with the 8th century. *Plant Var. Seeds* 9:191–196.
- Kent, N. L., and Evers, A. D. 1994. *Kent's Technology of Cereals*, 4th ed. Elsevier Science, Oxford.
- Köber-Grohne, U. 1987. *Nutzpflanzen in Deutschland*. K. Theiss, Stuttgart, Germany.
- Kramer, S. N. 1959. *History Begins at Sumer*. Doubleday Anchor Books, Doubleday and Co., New York.
- Kremezi, A. 1997. Paximadia (barley biscuits). In: *Foods on the Move: Oxford Symposium on Food History*, 1996, Totnes, UK. Prospect Books, London.
- Lisitsian, G. N. 1984. The Caucasus: a centre of ancient farming in Eurasia. Pages 285–292 in: *Plants and Ancient Man*. W. van Zeist and W. A. Casparie, eds. Balkema, Rotterdam, The Netherlands.
- Mikelsen, E. 1979. *Korn er liv*. Statens Kornforretning, Oslo, Norway.
- Mohammed, H. 1983. The Oromo of Ethiopia 1500–1850 with special emphasis on the Gibe region. Ph.D. dissertation. University of London, London.
- Molina-Cano, J. L., and Conde, J. 1980. *Hordeum spontaneum* C. Koch em. Bacht. collected in southern Morocco. *Barley Genet. Newsl.* 10:44–47.
- Molina-Cano, J. L., Moralejo, M., Igartua, E., and Romagosa, I. 1999. Further evidence supporting Morocco as a centre of origin of barley. *Theor. Appl. Genet.* 73:531–536.
- Molina-Cano, J. L., Igartua, E., Casas, A-M., and Moralejo, M. 2002. New views on the origin of cultivated barley. Pages 15–29 in: *Barley Science: Recent Advances from Molecular Biology to Agronomy of Yield and Quality*. G. A. Slafer, J. L. Molina-Cano, R. Savin, J. L. Araus, and I. Romagosa, eds. Haworth Press, Binghamton, NY.
- Munck, L. 1977. Barley as food in Old Scandinavia especially Denmark. Pages 386–393 in: *Proc. 4th Regional Winter Cereal Workshop: Barley*, vol. II, Amman, Jordan.
- Nadel, D, Weiss, E., Simchoni, O., Tsatskin, A., Danin, A., and Kislev, M. 2004. Stone Age hut in Israel yields world's oldest evidence of bedding. *Proc. Natl. Acad. Sci. U.S.A* 101:6821–6826.
- Nevo, E. 1992. Origin, evolution, population genetics and resources for breeding of wild barley, *Hordeum spontaneum*, in the Fertile Crescent. Pages 19–43 in: *Barley: Genetics, Biochemistry, Molecular Biology and Biotechnology*. P. R. Shewry, ed. C.A.B. International, Wallingford, UK.
- Omarov, D. S. 1992. Barley for food in mountainous Caucasus. Pages 192–200 in: *Barley for Food and Malt: ICC/SCF International Symposium*. Swedish University of Agricultural Sciences, Uppsala, Sweden.
- Percival, J. 1921. *The Wheat Plant*. Duckworth, London.
- Perry, C. 1983. A nuanced apology to rotted barley. In: *Petits Propos Culinaires*. Prospect Books, London.
- Saidi, S., Lemtouni, A., Amri, A., and Moudden, M. 2005. Use of barley grain for food in Morocco. Pages 17–21 in: *Food Barley—Importance, Uses and Local Knowledge: Proc. International Workshop on Food Barley Improvement*, Jan. 2002. S. Grando and H. G. Macpherson, eds. ICARDA, Aleppo, Syria.
- Shelton, A. L. 1921. Life among the people of eastern Tibet. *National Geographic*. 295–326.

- Strahn, B. D. 2006. Manhattan: the heart of the Gallatin Valley. Pages 11–13 in: *At Home, Bozeman Daily Chronicle*, Aug. 8.
- Sturtevant, E. L. 1919. *Sturtevant's Notes on Edible Plants*. N.Y. Department of Agriculture, 27th Annual Report. U. P. Hedrick, ed. Dover Publications, New York.
- Tannahill, R. 1988. *Food in History*, rev. ed. Penguin, London.
- Tashi, N. 2005. Food preparation from hull-less barley in Tibet. Pages 115–120 in: *Food Barley—Importance, Uses and Local Knowledge: Proc. International Workshop on Food Barley Improvement*, Jan. 2002. S. Grando and H. G. Macpherson, eds. ICARDA, Aleppo, Syria.
- Thacher, J. B. 1903. *Christopher Columbus: His Life, His Work, His Remains*, vol. 2. G. P. Putnam's Sons, New York.
- Vavilov, N. I. 1926. *Studies on the Origin of Cultivated Plants*. Institute de Bontanique Appliqué et d'Amelioration des Plants, Leningrad, Russia. (Cited by Weaver 1950; Harlan 1978.)
- Vavilov, N. I. 1940. The new systematics of cultivated plants. Pages 549–566 in: *The New Systematics*. Oxford University Press, Oxford, UK.
- Villacéres, E., and Rivadeneira, M. 2005. Barley in Ecuador: production, grain quality for consumption and perspectives for improvement. Pages 127–137 in: *Food Barley—Importance Uses and Local Knowledge: Proc. International Workshop on Food Barley Improvement*, Jan. 2002. S. Grando and H. G. Macpherson, eds. ICARDA, Aleppo, Syria.
- Wallace, L. H. 1930. Barley water. Page 222 in: *The Rumford Complete Cookbook*. Rumford Co., Rumford, RI.
- Weaver, J. C. 1950. *American Barley Production*. Burgess Publishing, Minneapolis, MN.
- Wendorf, F., Schild, R., El Hadidi, N., Close, A. E., Kobusiewicz, M., Wieckowska, H., Issawi, B., and Haas, H. 1979. Use of barley in the Egyptian Late Paleolithic. *Science* 28:1341–1347.
- Wiebe, G. A. 1978. Introduction of barley into the New World. Pages 1–9 in: *Barley: Origin, Botany, Culture, Winter Hardiness, Genetics, Utilization, Pests*. Agriculture Handbook 338. U.S. Department of Agriculture, Washington, DC.
- Wikipedia. 2007. Published online at <http://www.wikipedia.org/wiki/Tsampa>.
- Xu, T. W. 1982. Origin and evolution of cultivated barley in China. *Acta Genet. Sci.* 9:440–446.
- Zohary, D. 1969. The progenitors of wheat and barley in relation to domestication and agricultural dispersal in the Old World. Pages 47–66 in: *The Domestication and Exploitation of Plants and Animals*. P. J. Vekov and G. W. Dimbleby, eds. Duckworth, London.
- Zohary, D., and Hopf, M. 1988. *Domestication of Plants in the Old World: The Origin and Spread of Cultivated Plants in West Asia, Europe and the Nile Valley*. Clarendon Press, Oxford, UK.