

On the Origin of the Edible Apple

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It is generally believed that the edible apple originated somewhere in Central Asia. It is a member of the *Rosaceae* (rose) Family, and is designated by the scientific name *Malus domestica*. There are many other wild species of *Malus*, and it is generally assumed that *M. domestica* evolved from chance hybridization among these wild species.

A recent article in *The Garden*, a publication of the Royal Horticultural Society, London, England (Volume 126 (6), June, 2001) paints an interesting new picture of the apple's origin. Over the past four years Dr. Barrie Juniper, Emeritus Fellow in the Department of Plant Sciences at Oxford University, has been pursuing this question using the new power of DNA analysis. He believes that the hybridization theory is almost certainly false and that the true origin of the apples we eat today is a small population of a single species still growing in the Ili Valley on the northern slopes of the Tien Shan ("Heavenly Mountains") mountains at the border of northeast China and the former Soviet Republic of Kazakhstan. (The name of Kazakhstan's capital, Almaty, means "father of apples.") He believes that this isolated species has evolved over the past 4.5 million years to become larger and sweeter, and was carried into the Western World by travelers on the ancient "silk roads."

In 1997, Dr. Juniper and a small research group discovered a "malian wonderland" of wild fruit trees in Kazakhstan at an altitude of 5,000 feet on a mountainside overlooking China. The apple trees there grow 30 feet in height and bear fruits ranging in color from yellow to red, and in size from that of crabapples to that of large, commercial cultivars. Leaves were taken from each tree and later analyzed for DNA composition. This showed them all to belong to the species *M. sieversii*, but with some genetic sequences common to *M. domestica*. Subsequent travels to the site and further research have created the following hypothesis on the evolution of today's

edible apple.

Dr. Juniper believes that the original *Malus* species evolved in central and southern China ten to twenty million years ago and bore a small fruit with hard but edible seeds. It was spread by birds throughout the northern hemisphere. A key small group of wild apples spread northwest from their central China origin during the time the Tien Shan mountain range was rising from the collision of the Indian and Asian land plates. Birds carried seeds into today's Kazakhstan. As the mountains created the Gobi and Taklimakan deserts to their east, these prevented seed transport back to the east. The result was that a population of *Malus* became isolated geographically among the towering Tien Shan mountains and slowly evolved in seclusion for geological periods of time.

As early as seven million years ago, this area was populated by forest deer, wild pigs, and bears in the woodlands, and by wild horses and donkeys on the Steppes further west. All of these herbivores would have gorged themselves on the apple fruits, selecting those trees producing larger, sweeter, and juicier fruit. They therefore selectively spread seeds from better tasting fruit aiding the evolution of these features. Selected in this way, gradually the apple changed from a bird's food with edible seeds to a larger mammal's food with poisonous (cyanide-containing) seeds. The seed coat became smooth, black, and hard, and the seed itself became tear-shaped, allowing it to pass easily through the animals' guts.

Much later, after the end of the last ice age (about 10,000 years ago), humans began to travel the animal migratory routes east and west (the "silk roads") and they too began consuming these new fruits, and began carrying them westward. The trees began to be cultivated in progressively more sophisticated ways in Mesopotamia and then in the Mediterranean area. The early trees all would have been grown from seeds, thus

producing a diverse population similar to that Dr. Juniper discovered in Kazakhstan. When the art of grafting was discovered and developed, clones of select types were capable of being cultivated and deliberate selections to be made. This process continues today.

Whether or not his hypothesis on the origin of apples is correct is debatable, but Dr. Juniper has

opened the door to interesting new thinking about evolution of today's fruits. He himself is returning to the ancient fruit forest he discovered to repeat his apple studies on the pears, apricots, plums, and cherries also growing there. "We've started with the apple. Hopefully, we will go on to establish the genetic history of other fruits, too," says Dr. Juniper.

