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The Cucurbits of Mediterranean Antiquity: Identification of Taxa from Ancient Images and Descriptions

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• *Background* A critical analysis was made of cucurbit descriptions in Dioscorides' *De Materia Medica*, Columella's *De Re Rustica* and Pliny's *Historia Naturalis*, works on medicine, agriculture and natural science of the 1st century CE, as well as the *Mishna* and *Tosefta*, compilations of rabbinic law derived from the same time period together with cucurbit images dating from antiquity including paintings, mosaics and sculpture. The goal was to identify taxonomically the Mediterranean cucurbits at the time of the Roman Empire.
• *Findings* By ancient times, long-fruited forms of *Cucumis melo* (melon) and *Lagenaria siceraria* (bottle gourd) were selected, cultivated and used as vegetables around the Mediterranean and, in addition, bottle-shaped fruits of *L. siceraria* were employed as vessels. *Citrullus lanatus* (watermelons) and round-fruited forms of *Cucumis melo* (melons) were also consumed, but less commonly. A number of cucurbit species, including *Bryonia alba*, *B. dioica*, *Citrullus colocynthis* and *Ecballium elaterium*, were employed for medicinal purposes. No unequivocal evidence was found to suggest the presence of *Cucumis sativus* (cucumber) in the Mediterranean area during this era. The *cucumis* of Columella and Pliny was not cucumber, as commonly translated, but *Cucumis melo* subsp. *melo* Flexuosus Group (snake melon or vegetable melon).

Key words: Columella, *De Re Rustica*, Dioscorides, *De Materia Medica*, Pliny, *Historia Naturalis*, *Mishna*, *Tosefta*, plant iconography, *Bryonia alba*, *Bryonia dioica*, *Citrullus colocynthis*, *Citrullus lanatus*, *Cucumis melo*, *Cucumis sativus*, *Ecballium elaterium*, *Lagenaria siceraria*, *Luffa cylindrica.*

INTRODUCTION

Various species of the Cucurbitaceae originating in Europe, Asia and Africa have been collected or cultivated since antiquity for a number of uses including food, medicinals, culinary vessels, utensils, fishing floats, musical instruments, masks and articles of clothing (Heiser, 1979; Robinson and Decker-Walters, 1997; Jeffrey, 2001). References to cucurbits are scattered in ancient literature, notably in three 1st century CE texts by Dioscorides, Columella and Pliny, which, remarkably, were written within 18 years of each other, and in compilations of Jewish laws, known as the *Mishna* and *Tosefta*, which are derived from rabbinical statements of the 1st century BCE through the 2nd century CE. A number of ancient paintings, mosaics and sculpture depicting cucurbits from around the Mediterranean region pre- and post-date these writings.

Pedanius Dioscorides (20–70 CE), a Roman army physician born in Anazarbus, Cilicia, in what is now south-eastern Turkey, was the author of a great herbal, *Peri Ylis Iatrikis* (latinized as *De Materia Medica*, *On Medical Matters*), which was written in Greek about 65 CE. Due to fortuitous events, a compilation of this text listing plants alphabetically and dating from 512 CE (*Juliana Anicia Codex* or *Codex Vindobonensis*), accompanied by hundreds of colour illustrations, has survived and can be accessed in a two-volume facsimile edition, *Der Wiener Dioskurides* (1998, 1999). Focusing on the medicinal properties of nearly 500 plant taxa, *De Materia Medica* was the most influential herbal for nearly 1500 years. A translation into English made from a Dioscorides manuscript dating to medieval times was made by Goodyear in 1655 (Gunther, 1959). A superior English translation, based on the reconstruction of the original non-alphabetic Dioscoridean manuscript into German by Wellman (1906–1914), was recently published (Beck, 2005).

Lucius Junius Moderatus Columella, born near the beginning of the 1st century in what is now southern Spain, near Cadiz, is best remembered today for his comprehensive treatise on agricultural affairs, *De Re Rustica* (*On Agriculture*), published between 61 and 64 CE. *De Re Rustica* consists of three volumes, each of which consists of three to five books numbered consecutively. A Latin text with an authoritative side-by-side English translation is available in the Loeb Series, Harvard University Classical Library. Cucurbits are described in Book 2, translated by Ash (1941), and Books 10 and 11, translated by Forster and Heffner (1955).

Gaius Plinius Secundus, better known as Pliny the Elder, was born in the year 23 or 24 CE and, as reported by his nephew Pliny the Younger, died in 79 CE while observing the eruption of Vesuvius and aiding survivors. A soldier and prolific author, Pliny is best known for his great work, *Historia Naturalis* (*Natural History*),

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completed in the year 77 CE, a sourcebook of classical information on a wide range of topics including agriculture, art, astrology, astronomy, botany, chemistry, geography, medicine, mineralogy and zoology. Pliny was a compiler and the work is a monumental collection of science, technology and superstition. Although Pliny appears overly credulous, his encyclopaedic compilation is the best-known and most widely cited sourcebook of 'classical' natural history and a rich source of information on agriculture and horticulture. A side-by-side Latin–English version is found in the ten-volume Loeb Series, Harvard University Classical Library. Cucurbits are described in Book 19, which is in volume 5, and Book 20, which is in volume 6, with translations by Rackham (1950) and Jones (1951), respectively.

The *Mishna* is the codex of Jewish oral law compiled during the 2nd century CE in Israel under Roman rule. Organized by a chief rabbi, Yehuda HaNasi (Judah the President), it consists of six 'orders' or volumes, each of which consists of 7–12 tractates for a total of 63. Each tractate or *massekhet* concentrates on a particular subject of Jewish law, citing mostly the expoundings of 1st and 2nd century rabbis, known as the *Tanna'im*, on these subjects. As Jewish society was primarily agricultural in the Roman period, one of the six orders of the *Mishna*, named *Zera'im* (Seeds), deals primarily with Jewish laws of agriculture. Another compilation of Jewish oral law as expounded by these same rabbis is the *Tosefta* (Supplement), which is organized similarly to the *Mishna*, but has traditional statements in a more expanded, often significantly varying form, supplemented with explanatory notes. Much of it was written down at the same time as the *Mishna*, but the *Tosefta* is generally believed to have been compiled in the century after the completion of the *Mishna*. Both the *Mishna* and the *Tosefta* can be browsed and searched online at http://www.mechon-mamre.org (Mechon Mamre, 2007).

Plant iconography is often the most unequivocal tool for assessing the historical presence of botanical taxa in a particular region, and this has proven to be especially true for the Cucurbitaceae (Eisendrath, 1961). Images often are not entirely realistic, however, and interpretations and identifications of plant taxa based on them should take into account the contemporary cultural context and possible symbolism (Sillasoo, 2006). Although some of these images are familiar to art historians, they have not been widely circulated among students of crop evolution.

The objectives here are to review and analyse the cucurbit descriptions of the Roman authors, Dioscorides, Columella, and Pliny, and the descriptions from Israel of near-contemporary rabbinic sages, the *Tanna'im*, and to compare them. Moreover, we escort, integrate, and attempt to reconcile these 1st and 2nd century writings with images of cucurbits, including paintings, mosaics and sculpture, from various Mediterranean cultures, from the time of the Old Kingdom of ancient Egypt (approx. 3100–2180 BCE) through the 6th century CE. Based on these diverse sources, the traditional identification of these cucurbits is reconsidered in relation to their origin, usage and development.

TEXTUAL REFERENCES FROM DIOSCORIDES, COLUMELLA AND PLINY

The cucurbits of Dioscorides with images from the Juliana Anicia Codex

In the translation of Dioscorides by Beck (2005), there are six epithets which can be identified as cucurbits: *ampelos leuke*, *ampelos melaine*, *kolokyntha*, *sikyos agrios*, *sikyos hemeros* and *pepon*. As the text of Dioscorides is almost all confined to medicinal properties it is often difficult to determine the precise species by the text, but in some cases the names are indicative. The illustrations in the *Juliana Anicia Codex* of 512 CE facilitate the identification of *ampelos leuke*, *ampelos melaine*, *kolokyntha* and *sikyos agrios*. It needs to be stressed that the original Dioscorides manuscript was not illustrated, although Singer (1958) has suggested that some of the illustrations in the 512 codex may have been derived from Krataeus, author of a lost herbal and physician to the King of Pontus, Mithridates VI Eupater, in the 1st century BCE.

Ampelos leuke, literally 'white vine', was described by Dioscorides as having tendrils similar to the cultivated grape and red fruit bunches. Beck (2005) identified it as *Bryonia dioica*. In the facsimile edition of the *Juliana Anicia Codex* (Fig. 1A), an illustration annotated by a later hand as *bryonia leuke* shows a plant consisting of a large yellow root and four branches bearing leaves with cleft margins, long tendrils and 13 clusters of small bluish fruits resembling berries. Overall, this image appears to represent *Bryonia alba* L.

Ampelos melaine, literally 'black vine', was described by Dioscorides as having a root that is black externally but the colour of boxwood internally, leaves resembling those of ivy, tendrils clinging to trees and pale green fruit that become black upon ripening. In the facsimile edition of the *Juliana Anicia Codex* (Fig. 1B), an illustration labelled *bryonia melaine* shows a thick yellow root and two branches with leaves consisting of long petioles with deeply five-lobed, serrated laminae, without tendrils, one flower bud and no fruit, suggestive of a staminate plant. Although it is difficult to make a positive identification, the description and illustration are suggestive of *Bryonia dioica* Jacq., but Beck (2005) identified *ampelos melaine* from the Dioscoridean text as *Tamus communis* L. (Dioscoreaceae).

Kolokyntha, for which Dioscorides considered the epithets *sikya pikra* and *kolokynthis* as synonyms (Beck, 2005), was described as sending out twigs and leaves that are strewn on the ground, similar to that of cultivated *sikyos*. The stunning image labelled *kolokynthis* in the *Juliana Anicia Codex* (Fig. 1C, 100v) shows a plant clearly identifiable as *Citrullus colocynthis* (L.) Schrader consisting of a large root from which four trailing stems emerge (curiously, without tendrils), bearing leaves having pinnatifid laminae, 16 yellow flowers each with four petals (rather than the usual five), and eight round fruits of various sizes that are dark green with darker stripes.

Sikyos agrios (wild *sikyos*) was described by Dioscorides (Beck, 2005) as having a large, white root, leaves and stems similar to cultivated *sikyos* but smaller fruits resembling

FIG. 1. Four images of cucurbits from the *Juliana Anicia Codex* in the facsimile edition, *Die Wiener Dioskurides* (1998, 1999), of Dioscorides (512 CE): (A) *Bryonia alba* (labelled *bryonia leuke*), fol. 79r; (B) *Bryonia dioica* (labelled *bryonios melainos*), fol. 82r; (C) *Citrullus colocynthis* (labelled *kolokynthis*), fol. 190v; (D) *Ecballium elaterium* (labelled *sikyos agrios*), fol. 298v.

longish acorns, typically growing in building lots and sandy places, the entire plant being bitter. Dioscorides indicated that this plant was the source of the medicinal product elaterium, which was extracted from the fruit that 'springs back' when squeezed. On this basis, it can be concluded that Dioscorides was referring to *Ecballium elaterium* (L.) Rich., as the ripe fruits of this plant, when touched, vigorously squirt their seeds, hence the common name for this plant in English, squirting cucumber. The illustration labelled *sikyos agrios* in contemporary red letters in the *Juliana Anicia Codex* (Fig. 1D) shows a plant with a thick orange root, two stems bearing sagittate leaves with seven yellow flowers, both pistillate and staminate, emerging from leaf axils, and four small fruits. This plant, an inedible wild species, is common in the Mediterranean basin and bears bristly, oval fruits that are 2–3 cm long.

Sikyos hemeros (cultivated *sikyos*) was briefly mentioned in two sections of Beck's translation, immediately after wild *sikyos*, suggesting that in both cases it is an interpolation. Although the medicinal uses of *sikyos hemeros*

are mentioned, no description of it is provided. Beck (2005) identified *sikyos hemeros* as cucumber.

Pepon was mentioned in the same section as *sikyos hemeros*. The *pepon* was described as having a rind which can be applied to the top of a child's head. This suggests a large fruit with a firm exocarp. The word *pepon* has the connotation of 'ripe' or 'cooked', particularly in reference to a cucurbit that is not eaten until ripe. *Pepon* appears to have been applied to watermelon as, according to Stol (1987), the Greek physician Galen (129–200 CE) specifically used the term *sikyopepon* (literally 'ripe cucurbit') for watermelon.

The *sikyos hemeros* (cultivated *sikyos*) of Dioscorides has almost universally been identified as cucumber since the Renaissance (e.g. Gerard, 1597; de Candolle, 1886; Sturtevant in Hedrick, 1919). Over 300 years earlier than Dioscorides, Theophrastus (371–287 BCE), in *Historia Plantarum* (Enquiry into Plants), referred to four cucurbits: *sikya*, *sikyos*, *sikyos agrios* and *kolokynthe* (Hort, 1916). *Sikya* (the feminine form of *sikyos*) was translated as bottle gourd [*Lagenaria sicernaria* (Molina) Standley] by Hort (1916), Liddell *et al.* (1968) and Dalby (2003), and indeed has a secondary medical meaning of 'cupping instrument', probably because the instrument was reminiscent of the bottle gourd. Used in an ancient medical treatment, the heated cup (flaming of cotton wad soaked in alcohol was one method) applied to the skin would form a partial vacuum when cooled, drawing blood to the surface (Stol, 1987) (see Fig. 4A). Interestingly, and certainly not coincidentally, the Latin word for this instrument was *cucurbitula*, which is derived from *cucurbita*, Latin for the bottle gourd.

The cucurbits of Columella

The focus of *De Re Rustica* is agriculture. For cucurbits, the subject matter includes descriptions of management systems for climate control, specifically the use of a *specularium* (an ancient greenhouse using mirrorstone or mica) for out-of-season production, training of plants, propagation and use of extracts of wild plants for pest control. In contrast to the work by Dioscorides, the focus is food, not medicine. The citations from Columella, Books 2 and 11, below, will be given by book number, chapter and line. Book 10, written in verse, will be referred to by line number only.

The two cucurbits most repeatedly mentioned by Columella are *cucumis* and *cucurbita*. The most descriptive passage is in verse form, as follows:

and the twisted cucumber [cucumis]
And swelling gourd [cucurbita]*, sometimes from arbours hang*,
Sometimes, like snakes beneath the summer sun,
Through the cool shadow of the grass do creep.
Nor have they all one form: now, if you desire
The longer shape which hangs from slender top,
Then from the narrow neck select your seed;
But if a gourd of globelike form you seek,
Which vastly swells with ample maw, then choose
A seed from the mid-belly, bearing fruit
Which makes a vessel for Narycian pitch
Or Attic honey from Hymettus' mount,
Or handy water-pail or flask for wine;
'Twill also teach the boys in pools to swim.
But bluish [lividus] *cucumber* [cucumis] *with swollen womb*,
Hairy [hirtus] *and like a snake with knotted grass*
Covered, which on its curving belly lies
Forever coiled, is dangerous and makes
Still worse the cruel summer's maladies;
Foul is its juice and with fat seeds 'tis stuffed.
The white cucumber 'neath the arbour's shade
Creeps towards running water and pursues
Its course—by such devotion worn and thin—
More quivering than the udder of a sow
Lately delivered, softer than the milk
Just thickened and into the cheese-vat poured;
Sweet will it be, and when it ripened is
And yellow grows upon well-watered ground
Oft to sick mortals sure relief will bring.
(Book 10, beginning on line 380).

The Latin *cucumis* was translated as 'cucumber' by Forster and Heffner (1955), the modern English word which most closely resembles it. Cucumber, *Cucumis sativus* L., is a tuberculate, spiny and otherwise glabrous fruit. However, in this passage, the *cucumis* fruit did not have any of these characteristics, but instead was hairy, twisted or coiled, and snake-like (Book 10, lines 389–393). The young fruits of the melon, *Cucumis melo* L. subsp. *melo*, are pilose or lanate (Kirkbride, 1993; Robinson and Decker-Walters, 1997). Moreover, to the present day, melons with very long, typically curved fruits, known as snake melons and formally referred to as *Cucumis melo* subsp. *melo* Flexuosus Group (Pitrat *et al.*, 2000) are commonly grown in Asia Minor, North Africa and the Middle East, where they are called *faqqous*. The long, bluish *cucumis* had seeds which became plump (fat), which would have occurred when the fruit was physiologically ripe. The *faqqous* or snake melons, when mature, have a sour taste and tend to rot quickly, hence the description of the foulness of its 'juice'. On the other hand, Columella described another *cucumis*, a whitish one, which softened and turned yellow when ripe, at which time, and unlike its long-fruited counterpart, had a pleasant flavour.

The *cucumis* was forced for out-of-season production for the Emperor Tiberius, who took great delight in them (Book 11, 3: 52–53). They were planted in large containers on wheels that were covered with *specularibus* ('talc or mica windows'), so that they could be brought outdoors on warm or sunny days and wheeled inside at night or during cold, rainy weather. This appears to be the first mention and description of a greenhouse.

Columella's use of the term *cucurbita*, translated as 'gourd', indicates that at least two cultigens were being grown at the time. One was long-fruited and for eating, and hence *this certainly commands a better price than any other* (Book 11, 3:50). The fruit of the other was broader and used when dried for making various kinds of vessels and instruments: *for the fruits are quite suitable*

for use as vessels, *like the Alexandrian gourds, when they have been thoroughly dried* (Book 11, 3 : 49). In addition, of the broad bottle gourd: *which makes a vessel for Narycian pitch*, *or attic honey from Hymettus' mount*, *or handy water-pail or flask for wine; 'twill also teach the boys in pools to swim* (Book 10, lines 385–388). Clearly, it was difficult to maintain the cultivars separately. Columella offered advice as to how overcome the problem: *if you desire the longer shape which hangs from slender top*, *then from the narrow neck select your seed* (Book 10, 381–383) and *if you are growing them to sell for eating*, *the seed will have to be taken from the neck of the gourd* (Book 11, 3:50). Or *if a gourd of globelike form you seek*, *which vastly swells with ample maw*, *then choose a seed from the mid-belly* (Book 10, lines 383–384) and *You should take the seed from the middle of a gourd* (cucurbitae) (Book 11:3, 49). The *cucurbita* cultigen having rounder, more voluminous fruits was grown for the use of its mature fruits as vessels for carrying liquids. The *cucurbita* cultigen having longer and narrower fruits was a valuable vegetable grown for consumption of the immature fruit. The description fits the calabash or bottle gourd, *Lagenaria siceraria*. This species is especially variable for fruit shape. The mature, dried, round and bottle-shaped fruits have thick, woody rinds and are still employed as vessels and have a myriad of other uses (Heiser, 1979). By contrast, the long, narrow, immature green *cocuzzi* are still a popular vegetable in Sicily and elsewhere.

Columella indicated that the *cucumis* and the *cucurbita* had similar horticultural requirements and appearance. For example, he noted (Book 11, 3:48): *The* cucumis *and* cucurbita *require less care when there is plenty of water; for they take a very great delight in moisture*.

Columella recommended using extracts of a wild cucurbit, which he referred to as *cucumeris anguinei*, to control underground pests (Book 2, 9:10). *Ecballium elaterium* is a common, wild-growing Mediterranean cucurbit. However, it would not fit the epithet *anguinei* (snake-like) as the plants of this species are not viney nor can its fruits be described as serpentine.

The cucurbits of Pliny

Pliny's work on natural history contains more descriptions of the plants and fruits as well as the geographical origins of the cultivated cucurbits than does Columella.

Pliny described the *cucumis* and *cucurbita* plants as normally prostrate on the ground but they could also climb. Pliny clearly differentiated *cucumis* and *cucurbita* as follows: *cucumis* was a generic term for fruit composed of 'cartilage (pliable skin) and flesh' whilst *cucurbita* was for fruit composed of 'rind and cartilage'; it was the only fruit whose rind becomes like wood (*lignum*) as it ripens (Book 19, 22: 61–62). Thus, both cucumber, *Cucumis sativus*, and melon, *C. melo*, would fit the definition of *cucumis*. Bottle gourds, *Lagenaria siceraria*, would fit the definition of *cucurbita*, as lignification develops in the rind of these fruits as they approach maturity.

Pliny described considerable variation among *cucumis* grown in various regions: *They grow in any shape they are forced to take; in Italy green ones of the smallest possible size are popular*, *but the provinces like the largest ones possible*, *and of the colour of wax or else dark* (Book 19, 23: 65). He described the African ones as being the most prolific and those of Moesia as the largest. Those that were exceptionally large were referred to as *pepones*. The variation in fruit size and colour observed by Pliny may reflect in part regional preferences for stage of growth as well as differences among varieties. Nonetheless, the variation described is more suggestive of the highly polymorphic *Cucumis melo* than it is of *C. sativus*.

Pliny (Book 19, 24: 69–70) wrote that the *cucumis* and the *cucurbita* were similar in plant growth habit and had similar cultural requirements, adversely affected by cold but thriving when well irrigated on fertilized soil. He observed that their seeds were often sown during the spring or early summer. Although he considered 21 April to be the most suitable date, he noted that some preferred to plant the *cucurbita* on 1 March and the *cucumis* on 7 March. He wrote: *These two plants both climb upward with shoots creeping over the rough surface of walls right up to the roof*, *as their nature is very fond of height. They have not the strength to stand without supports*, *but they shoot up at a rapid pace*, *covering vaulted roofs and trellises with a light shade. Owing to this they fall into these two primary classes*, *the roof-gourd and the common gourd which grows on the ground; in the former class a remarkably thin stalk has hanging from it a heavy fruit which a breeze cannot move. The gourd as well as the cucumber is made to grow in all sorts of long shapes*, *mostly by means of sheathes of plaited wicker*, *in which it is enclosed after it has shed its blossom*, *and it grows in any shape it is compelled to take*, *usually in the form of a coiled serpent. But if allowed to hang free it has before now been seen three yards long.* Then there is a most telling description of the cucumis by Pliny: *particulatim cucumis floret*, *sibi ipse superflorescens*, *et sicciores locos patitur*, *candida lanugine obductus*, *magisque dum crescit* [*The cucumber makes blossoms one by one*, *one flowering on the top of the other*, *and it can do with rather dry situations; it is covered with white down* (lanugine), *especially when it is growing*]. Although both melons (*Cucumis melo*) and cucumbers (*C. sativus*) produce more than one flower per node, which usually do not reach anthesis at once, only the young fruits of *Cucumis melo* are densely covered with soft, white hairs, i.e. are downy. The young fruits of *Cucumis sativus* are glabrous except for tubercles and spines. Likewise, extraordinary length of the fruit can be achieved in *C. melo* but not *C. sativus*. Clearly, Pliny was describing snake-like melons, *C. melo* subsp. *melo* Flexuosus Group.

Pliny, like Columella, refers to out-of-season production of this crop, as *cucumis was a delicacy for which the emperor Tiberius had a remarkable partiality; in fact there was never a day on which he was not supplied with it*, *as his kitchen-gardeners had cucumber* [cucumis] *beds mounted on wheels which they moved out into the sun and then on wintry days withdrew under the cover of frames glazed with transparent stone* (Book 19, 23: 64).

Although it would appear that the young fruits of *cucumis* were preferred to those of *cucurbita* by the

Emperor Tiberius and presumably by the general population, Pliny noted that *cucurbita* was more utilitarian. He stated that the long-fruited gourds were the ones used for culinary purposes: *There are a larger number of ways of using gourds [cucurbitarum]. To begin with, the stalk is an article of food. The part after the stalk is of an entirely different nature; gourds have recently come to be used instead of jugs in bath-rooms, and they have long been actually employed as jars for storing wine. The rind of gourd while it is green is thin, but all the same it is scraped off when they are served as food . . . The longer and thinner gourds are, the more agreeable they are for food, and consequently those which have been left to grow hanging are more wholesome; and this kind contain fewest seeds, the hardness of which limits their agreeableness as an article of diet* (Book 19, 24 : 71).

Pliny mentioned that it was possible to preserve the fruits of both *cucumis* and *cucurbita* in edible condition for a considerable length of time: *A plan has been invented by which they are preserved for food also—and the same in the case of cucumbers—to last almost until the next crops are available. This method employs brine; but it is reported that gourds can also be kept green in a trench dug in a shady place and floored with sand and covered over with dry hay and then with earth* (Book 19, 24: 74).

Pliny gave instructions for seed propagation, quite similar to the instructions given by Columella concerning the determination of fruit shape in the following generation of plants: *semina quae proxima a collo fuerunt proceras pariunt* (Book 19, 24: 72–73) [*The seeds that were nearest the neck of the plant produce long gourds*]. (Pliny was clearly referring to the neck of the fruit.) As for propagation, Pliny gave clear instructions: *The seeds are dried in the shade, and when they are wanted for sowing they are steeped in water . . . Gourds kept for seed are not usually cut before winter; after cutting they are dried in smoke for storing seeds of garden plants—the farm's stock in store*.

Besides the commonly known *cucumis* and *cucurbita*, there was, according to Pliny, an epithet for another cucurbit, and this he defined clearly: *Curious to say, just recently a new form of cucumber has been produced in Campania, shaped like a quince. I am told that first one grew in this shape by accident, and that later a variety was established grown from seed obtained from this one; it is called apple pumpkin* [*melopepo*]. *Cucumbers of this kind do not hang from the plant but grow of a round shape lying on the ground; they have a golden colour. A remarkable thing about them, beside their shape, colour and smell, is that when they have ripened, although they are not hanging down they at once separate from the stalk when ripe, although they do not hang from the stem, they separate from it at the stalk* (Book 19, 23:67). Separation of the ripened fruit from the peduncle is a common characteristic of melon, *Cucumis melo*, not cucumber, *C. sativus*. Clearly, *melopepo* was a form of *C. melo*. It also differed distinctly from the long-fruited melons commonly grown and consumed by his contemporaries by its being grown only on the ground (never climbing), by its round shape and its being harvested upon attaining full maturity, when it changed colour. It can also be inferred that upon ripening and separating from the peduncle, the fruit was aromatic, a further characteristic distinguishing melons from other cucurbits.

Another epithet used by Pliny probably to indicate a cucurbit was *pepones*. He used it twice, once apparently in reference to large melons: . . . *those of Moesia the largest. When they are exceptionally big they are called pumpkins* [pepones] (Book 19, 23: 65). In the other instance (Book 20, 6: 11), the *pepones* were described as such: *Qui pepones vocantur refrigerant maxime in cibo et emolliunt alvum*. [*The gourds called pepones make a very refreshing food, and are also laxative*.] The description as *very refreshing* suggests watermelon, *Citrullus lanatus* (Thunb.) Matsum. & Nakai. Pliny followed this statement with medicinal applications of the fruit and root of this plant.

Pliny described a wild-type *cucumin* as a source of the drug elaterium with medicinal properties (Book 20, 2: 3). *We have said that there is a wild cucumber much smaller than the cultivated kind. From it is made the drug called elaterium by pressing the juice out of the seed. Unless, to prepare it, the cucumber be cut open before it is ripe, the seed spurts out, even endangering the eyes*. This description perfectly matches *Ecballium elaterium*. Pliny then described *cucumin* (Book 20, 3: 7) from several localities that reportedly had superior qualities, but these may be references to other wild cucurbit taxa.

Pliny described yet another wild cucurbit: *Colocynthis vocatur alia, ipsa plena semine, sed minor quam sativa. utilior pallida quam herbacea* (Book 20, 8: 14) [*Another kind of wild gourd is called colocynthis. The fruit is smaller than the cultivated, and full of seed. The pale variety is more useful than the grass-green*]. Pliny was referring to the colocynth, *Citrullus colocynthis* L., but we understand the Latin *utilior pallida quam herbacea* as not to compare the medical usefulness of different varieties but rather the mature, pale-coloured fruit with the immature green fruit. Another wild cucurbit mentioned briefly (Book 20, 7: 13) was *somfos*, described as found growing only in rocky soils and having hollow fruits. This meagre description is insufficient for taxonomic identification.

SCRIPTURE AND JEWISH COMMENTARY

The three cucurbits mentioned in the Hebrew Bible, the *qishu'im*, the *avattihim*, and the *paqqu'ot sade*, as well as several other cucurbits, are the subject of rabbinical commentary in the *Mishna* and the *Tosefta*. The citations from the *Mishna* and *Tosefta* below will be given according to the name of the *massekhet* (tractate), chapter number and statement number. Most significant is that the first four cucurbits described below were mentioned along with edible fruits of various other plant families on the subject of tithing (*Mishna*, *Ma'asrot* 1:4) and therefore must have been food sources growing in Israel in the 2nd century.

The *qishu'im* were known to the Children of Israel from Egypt, who longed for them during their wanderings in the Sinai Desert (*Numbers* 11:5). No later than by the time of the first temple in Jerusalem, their cultivation in Judea

must have been common, as there was a special word in Hebrew for a field of them, *miqsha* (*Isaiah* 1:8). Moreover, these *qishu'im* or *qishu'in*, or in the singular form, *qishut*, are the most frequently mentioned cucurbit in the Jewish commentary, reflecting their relative importance and widespread culture in the Israel of Roman times. The possibility of growing the plants in a pot or receptacle (*Mishna*, '*Oqazin* 2 : 10) is reminiscent of Pliny's description of out-of-season production of *cucumis*. Indeed, Rabbi Yehuda HaNasi was said to have had *qishu'in* on his table throughout the year, according to the 7th century compilation of Jewish law derived from the *Mishna*, the *Babylonian Talmud* (*Berakhot* 57b) (Mechon Mamre, 2007, http://www.mechon-mamre.org); this is reminiscent of Columella's and Pliny's description of the year-round availability of *cucumis* for Emperor Tiberius. The *qishu'im* had a very short shelf life and were deemed fit as contributions until only a day after harvest (*Tosefta*, *Terumot* 4 : 5). The *qishut* was so obviously and densely hairy that, in a play on words, the hairs collectively were referred to as *keshut shel qishut* (down of *qishut*) (*Mishna*, '*Oqazin* 2 : 1). The Greek *pekos* is the likely source for the special Hebrew word for the removal of the hairs prior to the use of the fruits in culinary preparation, *piqqus* (*Mishna*, *Ma'asrot* 1 : 5) (Feliks, 1968; Lieberman, 1993). This *piqqus* was probably accomplished by vigorously rubbing the fruit or perhaps by dipping the fruits in boiling water (Feliks, 2005), apparently with the purpose of removing the dirt and grit that tended to accumulate on the surface of the fruits because of the hairs. Growers near the town of Zippori in northern Israel habitually wiped the fruits with a sponge upon harvest until rabbis deemed this practice unacceptable (*Tosefta*, *Makhshirin* 3 : 3). The Hebrew *qishut* is the linguistic equivalent of the Arabic *qitha* or *qatta*, and both appear to be linked to the Greek *sikyos* by an ancient, common root epithet of the Mediterranean region (Stol, 1987), of which the French *courge* and the Italian *cocuzza* and *zucca* are derivatives. Vesling (1640), in his supplement to Alpini's *De plantis Aegypti liber*, presented an illustration, labelled *Chate*, which was clearly based on a plant of *Cucumis melo* having rather elongate, nearly rhomboidal fruits. The epithet 'chate', a blundered rendition of *qatta* (Loret, 1892), is used at present to designate a cultivar-group of *C. melo* that is distinguished by fruits having a length-to-broadest-width ratio of around 2 : 1 or 3 : 1 and that are not sweet, but are used when young, like cucumbers, raw, pickled or cooked (Pitrat *et al.*, 2000). Feliks (1967, 1968) and Zohary (1982) concurred that the *qishu'im* of Biblical times were chate melons. The Arabic *faqqous*, used to designate the long-fruited snake melons, *C. melo* Flexuosus Group, is obviously linked linguistically to the Hebrew *piqqus*. Although it seems that the *qishu'im* of Biblical times were mostly chate melons, the *qishu'im* of the *Mishna* and *Tosefta* appear to have referred mostly to snake melons (Kislev, 2000*b*).

A second edible cucurbit from the *Mishna* and *Tosefta* is the *delu'im* or *delu'in*, or the singular form *dela'at*. The name of a Biblical town, *Dil'an* (*Joshua* 15 : 37–38), may be derived from this. By the time of the *Mishna* and *Tosefta*, the *delu'im* must have been commonly grown, as a field of them had a specific name in Hebrew, *midla'* (*Mishna*, *Shevi'it* 2 : 1, 2; *Tosefta*, *Oholot* 17 : 11). The *delu'im* are most often mentioned in connection with the *qishu'im*, and it was permissible to plant the two together in the same garden or field on the condition that they were trained to grow in separate directions (*Mishna*, *Kil'ayim* 3 : 5), which suggests that both of these crops were viney plants. They could also be grown in the same field with other vegetables but had to be given adequate spacing so as not to interfere or intermingle with them (*Mishna*, *Kil'ayim* 3 : 4, 6–7). The *delu'im* were hairy fruits and, as with the *qishu'im*, they had to undergo *piqqus* prior to the use of the fruits in culinary preparation (*Mishna*, *Ma'asrot* 1 : 5), and wiping them with a sponge was unacceptable (*Tosefta*, *Makhshirin* 3 : 3). The shelf life of the *delu'im* was as short as that of the *qishu'im*, just 1 d (*Tosefta*, *Terumot* 4 : 5). Löw (1928), Feliks (1967, 1968, 2005) and Zohary (1982) identified the *delu'im* as bottle gourds, *Lagenaria siceraria.* Three distinct varieties of *delu'im* were grown, the Greek, the Egyptian and the *ramoza* (*Mishna*, *Kil'ayim* 1 : 5). There is also reference to the Aramean *dela'at* (*Tosefta*, *Kil'ayim* 1 : 4), but it is regarded as synonymous with the Egyptian (Feliks, 1967). The *ramoza* differed from the others by the bitterness of its fruits, which could be eliminated by roasting them in hot embers. The Greek cultigen was not to be intermingled with the others together in the field (*Mishna*, *Kil'ayim* 1 : 5) or at least not with the *ramoza* (*Tosefta*, *Kil'ayim* 1 : 4) (Kislev, 2000*a*). Given the genetic bitterness of the *ramoza*, it certainly would have been ill advised to save seeds from edible-fruited *L. siceraria* growing next to it. For a person who vowed to abstain from *delu'in*, the prohibition applied to the Greek cultigen only (*Tosefta*, *Kil'ayim* 1 : 4), suggesting that its fruits were used for culinary purposes. This could also account for the observation that the Greek cultigen required more space in the field than the others (Feliks, 1979). Maturing fruits and seeds slow vegetative growth but continual removal of immature fruits for use as food allows cucurbit plants to sustain rampant growth.

A third cucurbit, the *melafefonot*, or in the singular form, *melafefon*, was also an article of food and thus subject to tithing. These fruits could be used when young. They would be tithed after removal of the hairs by dipping in boiling water (*Tosefta*, *Ma'asrot* 1 : 3–5), which would have tended to clean, disinfect and preserve the fruit. One of the *Tanna'im*, Rabbi Yishma'el, is on record, however, as exempting the immature fruits from tithing, prior to their becoming 'bald', an indication of the strong preference for consuming these fruits after they became glabrous, close to or at their maturity (Lieberman, 1993). As more mature fruits, the *melafefonot* would be expected to have had a longer shelf life than the *qishu'im*, and indeed they were considered as being fit for contribution for as much as 3 d after harvest (*Tosefta*, *Terumot* 4 : 5). They also must have been rounder than the *qishu'im*, the linguistic origin of the Hebrew *melafefonot* obviously being from the Greek *melopepones*, the name Pliny used in describing a quince-shaped fruit. For the purpose of tithing, most of

the *Tanna'im* considered the *melafefon* and *qishut* as one and interchangeable (*Mishna*, *Terumot* 2 : 6) and most agreed that it was permissible to plant them close to one another (*Mishna*, *Kil'ayim* 1 : 2). Feliks (1967, 1968, 2005) and Kislev (2000*a*) identified the *melafefonot* as melons, *Cucumis melo*.

The *avattihim* of Egypt were longed for by the Children of Israel in the Sinai Desert (*Numbers* 11 : 5). As edible produce, in Israel the *avattihim* were subject to tithing (*Mishna*, *Ma'asrot* 1 : 4). However, along with figs, table grapes and pomegranates, they were exempt if purchased directly from the field (*Mishna*, *Ma'asrot* 2 : 6). The association with those fruit crops suggests that the *avattihim*, like them, were indeed juicy fruits. The *avattihim* along with the other three edible cucurbits were mentioned again together with figs and grapes with regard to contributions (*Mishna*, *Terumot* 8 : 6). The *avattihim* have been identified by Feliks (1967) and Zohary (1982) as watermelons, *Citrullus lanatus*. Like the *melafefonot*, the watermelons were also to be tithed and marketed after being dipped in boiling water (*Mishna*, *Ma'asrot* 1 : 5), and probably for the same reasons or to blanch the exocarp (Lieberman, 1993; Feliks, 2005). In contrast to the *qishu'im* and *delu'im*, which could be piled in the field in preparation for sale or transport to market, mature watermelon fruits had to be laid out one by one (*Mishna*, *Ma'asrot* 1 : 5). Apparently, the watermelons of the time differed from those familiar today by being considerably smaller and by having more fragile rinds (Feliks, 2005), characteristics that can still be found in a number of east Asian cultivars.

The *paqqu'ot sade* were not luscious; instead they were poisonous and extremely bitter (2 *Kings* 4 : 39–40). Although the *paqqu'ot* fruits were inedible, the young shoots of the plants were palatable (*Mishna*, '*Oqazin* 3 : 4), and they were consumed after pickling in brine or vinegar (Feliks, 1968). An entirely different use of the *paqqu'ot* is also revealed in the *Mishna*. Oil was pressed from the seeds, and used for illumination (*Mishna*, *Shabbat* 2 : 2). Feliks (1968) identified the *paqqu'ot* as colocynth, *Citrullus colocynthis*. Colocynth oil was a familiar commodity in ancient Egypt (Darby *et al.*, 1977). Dried colocynth rinds could also be employed as vessels (*Mishna*, *Kelim* 17 : 17) (Feliks, 1968). As attested to by Arabic writers, colocynth fruits continued to be used for medicinal and other purposes around the Mediterranean throughout the Middle Ages until modern times (Amar and Hazot, 2003). *Citrullus colocynthis* was to become a source of contention in early Christianity. In the Hebrew Bible (*Jonah* 4 : 6–7), the fast-growing plant called *qiqayon*, castor (*Ricinus communis* L., Euphorbiaceae), provided shade to Jonah at Nineveh, but in the Septuagint (the Greek translation of the Hebrew Bible in the 2nd and 1st century BCE), the plant was incorrectly translated with the similar-sounding word *kolokynthis*, and thus has been often translated into English as 'gourd'. This mistranslation serves as the basis for images of Jonah under a 'gourd' plant (typically *Lagenaria siceraria*) in early and medieval Christian mosaics, a textual error that continued to be repeated for over 1500 years, through the King James Version of the Bible and beyond (Janick and Paris, 2006).

The *qarmulin* or *qarumalim* (*Tosefta*, *Shevi'it* 4 : 12) were suggested by Löw (1928) to be *Luffa*, and Feliks (1979) concurred, citing a comment referring to its dark green colour (*Tosefta*, *Nega'im* 1 : 3). Smooth luffa, *L. cylindrica* (L.) Roemer (syn. *L. aegyptica* Mill.), is grown mainly for use of the dried mature fruit flesh as a sponge, but its young fruits are edible and of an intense green colour. As the long, narrow fruits of smooth luffa resemble those of *Lagenaria siceraria* except in external colour, they are referred to as *delu'in*, subject to tithing as a vegetable, in the *Jerusalem Talmud* (Feliks, 1979). *Luffa* may have been a recent arrival in Israel at the time the *Tosefta* was redacted or compiled.

The *yaroqet hamor* (*Mishna*, *Oholot* 8 : 1) was mentioned in regard to laws of purity and separation of the pure from the impure. It was identified by Löw (1928) as *Ecballium elaterium*, squirting cucumber. This is a common wild plant in Israel and other Mediterranean countries to the present day.

IMAGES FROM ANTIQUITY

We have located cucurbit images from ancient Egyptian, imperial Roman and early Byzantine sources. The cucurbit illustrations from the 6th-century Byzantine manuscript *Juliana Anicia Codex* have already been discussed above and here are presented various images from ancient Egypt and from the Roman empire and early Byzantine empire.

Ancient Egypt

A wealth of cucurbit images has been discovered among archaeological finds of ancient Egypt although the taxonomic attribution of the images has been subject to error among various writers. Most frequently found among the images are representations of *Cucumis melo*, especially of the Chate Group (Loret, 1892). Keimer (1924) presented over 20 tracings of images from ancient Egypt of fruits of *C. melo*, mostly of this group as well as some noticeably longer, almost serpentine forms, thus of the Flexuosus Group. Keimer also presented an image of a *Citrullus lanatus* fruit attached to a stem with two highly divided leaves, a *Lagenaria siceraria* fruit, and leaves and branches of *Ecballium elaterium*.

Six cucurbit images from ancient Egypt dating from the 16th to the 12th century BCE are presented in Fig. 2. The oldest is a wall painting (Fig. 2A) of a large, oblong striped watermelon, *Citrullus lanatus*, from a tomb at Meir dating to the Old Kingdom, 3100–2180 BCE (Manniche, 1989). A crude wall painting (Fig. 2B) from a Theban tomb of the 18th dynasty in the New Kingdom (approx. 1500 BCE) showing a basket containing ten elongate cucurbit fruits, narrower near their peduncular than stylar ends, appears to be *Cucumis melo* but *Lagenaria siceraria* cannot be ruled out. A wall painting from the same epoch (Fig. 2C) depicts an elongate fruit, together with attached peduncle and clinging corolla, having longitudinal striations which appear to represent shallow furrows, a common feature of *Cucumis melo* fruits but not of either *C. sativus* or *L. siceraria*. Another

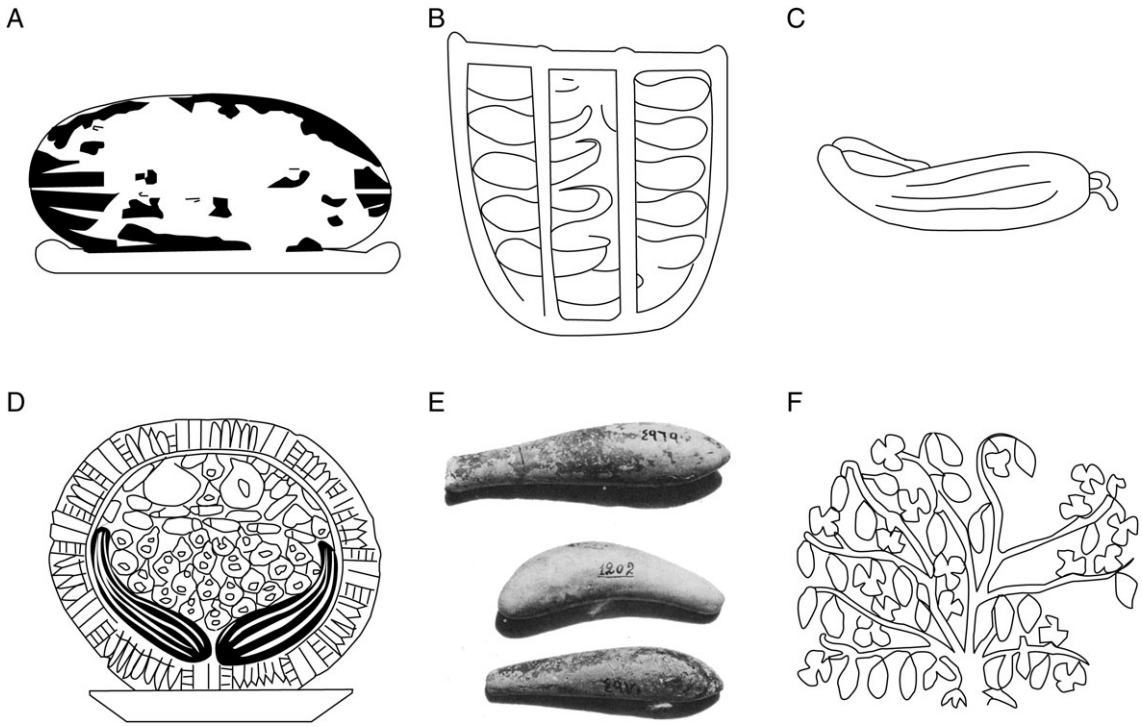

FIG. 2. Six images of cucurbits from ancient Egypt: (A) watermelon, *Citrullus lanatus*, from a wall painting in a tomb at Meir, Old Kingdom (Manniche, 1989); (B) basket of melons, *Cucumis melo*, from tombs from the 18th Dynasty, 1550–1300 BCE (Manniche, 1989; Pitrat and Foury 2003); (C) melon, *Cucumis melo*, from a wall painting in a Theban tomb with attached peduncle and corolla, 18th Dynasty (Manniche, 1989); (D) basket of melons, *Cucumis melo*, figs and dates from a wall painting of a Theban Tomb, 18th Dynasty (Manniche, 1989; Pitrat and Foury, 2003); (E) wooden models of melon, *Cucumis melo*, from the New Kingdom, 1517–1192 BCE (Darby *et al.*, 1977); and (F) carving of plant identified as a cucurbit by Singer (1958) suggestive of squirting cucumber, *Ecballium elaterium*, from an early botanical collection on the walls of the temple of Karnak brought back by Thothmes II, approx. 1450 BCE.

painting (Fig. 2D) shows two large, elongate, striped fruits of *Cucumis melo* in a basket together with figs and dates. Wooden models (Fig. 2E) from the New Kingdom (1517–1192 BCE) have been identified as fruits of *Cucumis melo* (Darby *et al.*, 1977). These cucurbit images and those presented by Keimer (1924), although far from forming a comprehensive collection, indicate that chate and snake melons, *Cucumis melo*, were a familiar vegetable crop in ancient Egypt. Finally, a crude carving on the walls of the Temple of Amun in Karnak (Fig. 2F) of plants brought back from Syria (approx. 1450 BCE) by Thothmes III was identified as a gourd by Singer (1958) and appears to be *Ecballium elaterium*, as evidenced by the thick root, bushy growth habit and small oval fruit.

Roman and Early Byzantine empires

A number of cucurbits were found in mosaics and sculpture from various regions of the Roman and Byzantine empires from the 2nd to the 6th centuries CE. Mosaics by their nature often have limited resolution for species identification, and in some cases it was difficult to distinguish among long-fruited *Cucumis melo* and *Lagenaria siceraria* or among round-fruited *C. melo*, *Citrullus lanatus* and *Citrullus colocynthis*. Therefore, the long-fruited cucurbit images are considered separately from the round-fruited ones. Furthermore, the long-fruited cucurbit images assumed to be *Cucumis melo* subsp. *melo* Flexuosus Group (snake melons) are considered first, followed by *L. siceraria* (gourds). Images will be considered chronologically within each group.

The images of long-fruited cucurbits identified here as *Cucumis melo* are displayed in Fig. 3A–G. A 2nd-century mosaic from Tunisia (Fig. 3A) depicts two fruits with small yellow–orange corollas clinging to the acute stylar ends. Two other 2nd-century Tunisian mosaics (Fig. 3B, C) each depict two similar long fruits although the fruits depicted in Fig. 3C might represent *Lagenaria siceraria*. Three elongated fruits in a tomb painting from Thessaloniki, Greece (Fig. 3D), dated to the second half of the 3rd century and now located in the Museum of Byzantine Culture in that city, were thought to be eggplant *Solanum melongena* L. (Solanaceae) (Pazaras, 1981). Quite the contrary, this image appears to us to be of three cucurbit fruits, the yellow–orange flower colour of the fruit on the right indicating *C. melo*, but the bulbous peduncular ends and the rather thick-appearing peduncles resemble *L. siceraria*. A 3rd-century Tunisian mosaic (Fig. 3E) depicts one large, maturing, elongate melon split longitudinally and four younger ones; the longitudinal split is characteristic of *C. melo* rather than *L. siceraria*. A 3rd-century Tunisian mosaic (Fig. 3F) illustrates two rather small thin melons with acute stylar ends typical of some snake melons. A 4th-century bas relief from Spain

FIG. 3. Eight images of long-fruited cucurbits, identified here as *Cucumis melo* Flexuosus Group: (A) 2nd-century Tunisian mosaic (Blanchard-Lemée *et al.*, 1995); (B,C) late 2nd-century Tunisian mosaics (Balmelle *et al.*, 1990); (D) second half of 3rd-century, Thessaloniki, Greece, tomb painting displayed at Museum of Byzantine Culture (Pazaras, 1981); (E) 3rd century, Tunisia, mosaic (Blanchard-Lemée *et al.*, 1995); (F) 3rd century, Tunisia, oval mosaic panel (Yacoub, 1995); (G) approx. 4th century, Mérida, Spain, marble relief referring to summer, probably derived from a mantel panel in a reception room of a private house (Álvarez Martinez *et al.*, 2000); (H) 6th century, Lebanon, mosaic (Baratte, 1978; Balmelle *et al.*, 1990).

(Fig. 3G) depicts an erect plant with two striated fruits and dentated leaves below a sheaf of wheat; the striations are characteristic of snake melons and not bottle gourds. A late 6th-century Lebanese mosaic (Fig. 3H) shows tangent round medallions, each containing two small, crossed melons with narrow peduncular ends, resembling fruits of the extant 'Green Snake' and 'Striped Snake' cultivars of the Flexuosus Group of *C. melo* (Goldman, 2002, figs. 66 and 67, respectively).

The images of long-fruited cucurbits identified here as *Lagenaria siceraria* are displayed in Fig. 4A–G. The 1st century bronze cupping vessel (Fig. 4A) from the House of the Surgeon, Pompeii, resembles a gourd in which the neck has been cut off. Known as *sikya* in Greek or *cucurbitula* in Latin, it is modelled after a bottle- or flask-shaped fruit of *L. siceraria*, which has been reported to be the original source of the cup (Einarson and Link, 1976, p. 76 footnote d.; Liddell and Scott, 1925–1940). A 3rd-century mosaic from Tunisia (Fig. 4B) shows elongated fruits with prominent knob-like swelling of the peduncular end often characteristic of *L. siceraria*. Depictions of Jonah at Nineveh (Fig. 4C–E) reclining under the shade of a plant bearing long gourds are common early Christian images (Janick and Paris, 2006a). The 3rd-century statue (Fig. 4C) from central Turkey shows a *Lagenaria* gourd; the identification is based on the rounded stylar base and unduly long and narrow proximal end. The fruits hanging on a trellis from both a 3rd-century Tunisian mosaic (Fig. 4D) and a 4th-century Italian mosaic (Fig. 4E), obviously related in style, show the clear peduncular enlargement characteristic of long-fruited *L. siceraria*. A simplified 4th-century mosaic from Carthage (Fig. 4F) shows three elongated curved fruits that could be *L. siceraria*. Finally, images of bottle

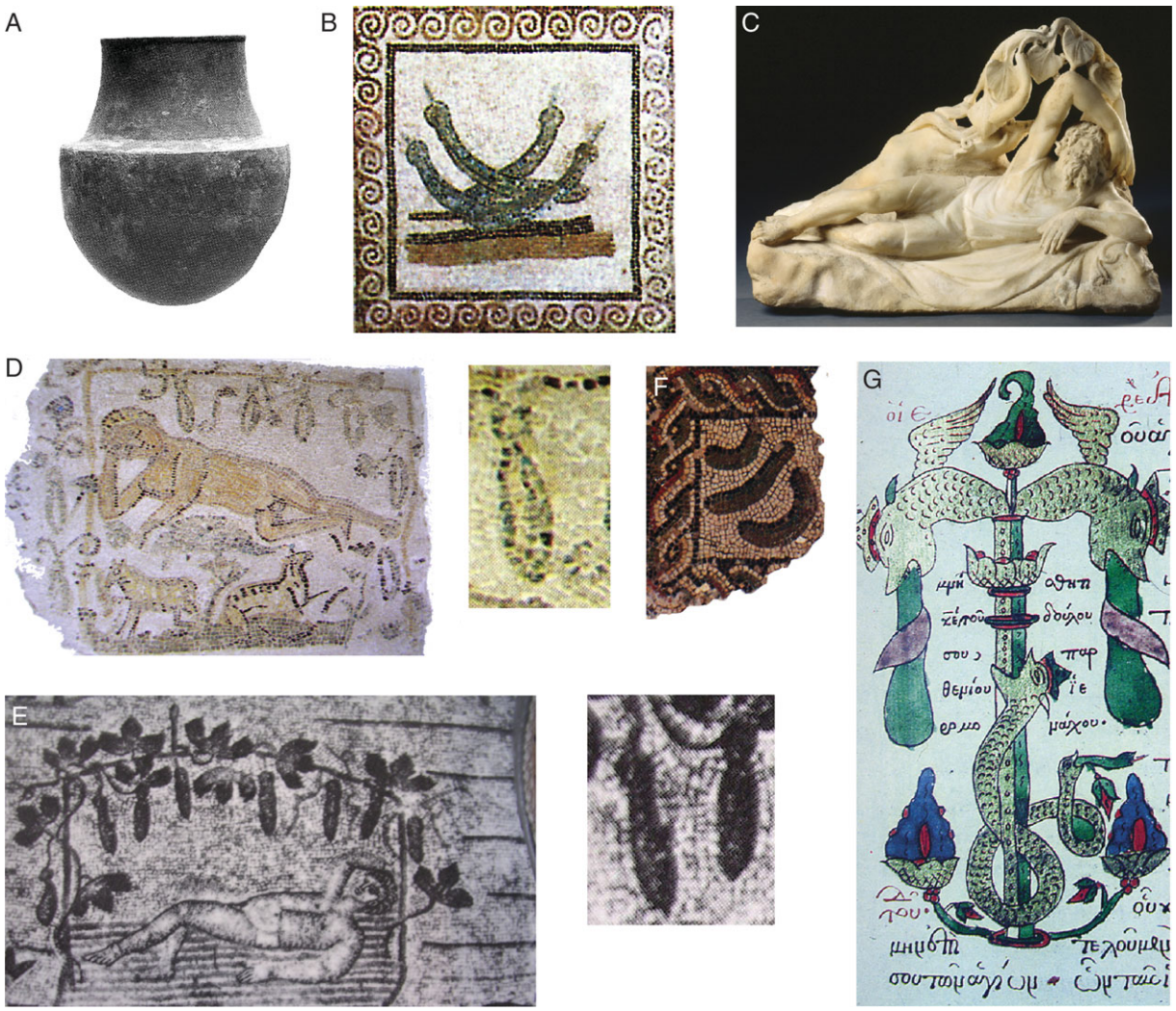

FIG. 4. Images of long-fruited gourds identified here as *Lagenaria siceraria*: (A) 1st century, Pompeii, bronze cupping vessel from House of the Surgeon (Bliquez, 1994); (B) late 2nd century, Tunisia, mosaic (Balmelle *et al.*, 1990); (C) 270–280 CE, central Turkey, Jonah under gourd in Nineveh, courtesy Cleveland Museum of Art; (D) end of 3rd or beginning of 4th century, Tunisia, mosaic of Jonah, with inset to show detail (Baggio *et al.*, 1995); (E) 4th century, Aquileia, Italy, mosaic of Jonah, with inset to show detail (Rossi, 1968); (F) 4th century, Carthage, mosaic (Balmelle *et al.*, 1990); (G) manuscript 531(μ), of hieromonk Parthenios, Koutloumousiou monastery, Mount Athos, Greece [T. Provatakis (undated) and D. Nalpantis, pers. comm.].

gourds (Fig. 4G) were found in calligraphic decorations of the letter T observed in a guidebook to Mount Athos, Greece (Provatakis, undated), the home of a number of monasteries with collections of Byzantine manuscripts. This image has been identified as an illustration from a handwritten manuscript entitled *The Three Services* by the heiromonk Parthenios of the Koutloumousiou monastery, dated 1677. Five gourds are illustrated: two long smooth fruits emanating from the mouths of snakes and three shorter fruits with red warts with a prominent calyx growing from a vine. The snake provides an obvious erotic overtone to the image. The two fruit types resemble two forms of *L. siceraria*, serpentine and flask-shaped, that are well illustrated in the Renaissance ceiling of the loggia of Cupid and Psyche in the Villa Farnesina (Janick and Paris, 2006b). Fruit wartiness has been observed in *L. siceraria* (Heiser, 1979). Since *Lagenaria* occurs in a myriad of shapes, in our judgement it would not be a stretch that this image helps to explain the fact that as the Greek *sikya*, the feminine form of the word, refers to bottle- or flask-shaped (breast-shaped) gourds, therefore *sikyos*, the male form, refers to long-fruited (phallic) gourds or melons (*see* Dalby, 2003 p. 215).

Five images of round-fruited cucurbits from mosaics (Fig. 5A–E) could represent watermelon (*Citrullus lanatus*), melon (*Cucumis melo*) or colocynth (*Citrullus colocynthis*). A 4th-century mosaic from Carthage, Tunisia (Fig. 5A), depicts two round, striped fruits, probably watermelon. Round-fruited melons appeared in other 4th-century mosaics: an image from Torre de' Schiavi, Italy (Fig. 5B), displays one oval and two oblate melons; and an image from Thuburbo Majus, Tunisia (Fig. 5C), shows five oblate fruits differing from one another in colour pattern. Three of these are partly yellow, indicating that they are mature or nearly so while the green fruits are either immature or differ genetically from the yellow ones

FIG. 5. Five images of round-fruited cucurbits: (A) 4th century, Carthage, mosaic with watermelon, *Citrullus lanatus* (Balmelle *et al.*, 1990); (B) 4th century, Torre de' Schiavi, Rome, mosaic, melon, *Cucumis melo* (Balmelle *et al.*, 1990); (C) 4th century, Tunisia, mosaic of melon, *Cucumis melo* (Balmelle *et al.*, 1990); (D) late 4th to 5th century, Tegea-Episkopi, Peloponnese, Greece, mosaic, 'August', with watermelon, *Citrullus lanatus*, in left hand and two fruits of bottle gourd, *Lagenaria siceraria*, in right hand (Åkerstrom-Hougen, 1974); (E) early 6th century, Argos, the Peloponnese, Greece, mosaic, 'July and August', with watermelon, *Citrullus lanatus*, in right hand (Åkerstöm-Hougen 1974).

by retaining their green colour at maturity. The differences in colour suggest that these fruits were derived from separate plants in a segregating population. In a late 4th- or early 5th-century mosaic from Greece (Fig. 5D), the left hand of the young man holds a round, striped fruit that could be a small watermelon rather than a large colocynth because the green striping pattern on the detached fruits is intact, whilst, according to Dioscorides, Book 4, 176 : 1 (Beck, 2005) and Pliny, 20, 8 : 14 (Jones, 1951), colocynths were usually harvested when the colour fades. The large, round, striped fruit held in the right hand by a young man in an early 6th-century image from Greece (Fig. 5E) is more easily identified as watermelon. Based on the size of the hands the diameter of the fruits can be estimated as 12 cm (Fig. 5D) and 17 cm (Fig. 5E). The pair of long cucurbit fruits in the right hand of the young man in Fig. 5D suggests *Lagenaria siceraria* rather more than *C. melo*, although lack of resolution makes this identification uncertain. Judging from the size of his hand, the length of the fruits, through the axis, is estimated to have been 20 cm.

DISCUSSION: INTEGRATING TEXTS AND IMAGES TO IDENTIFY TAXONOMICALLY THE CUCURBITS OF ANTIQUITY

An accurate understanding of the history and development of food plants requires critical evaluation and comparison of widely interdisciplinary evidence from horticulture, botany, archaeology, history and philology (Dalby, 2003). This understanding is dependent upon the degree of descriptive detail and accuracy of the original sources as

well as the accuracy of the translations of these sources. As eruditely discussed by Dalby (2003), misleading translations, such as 'ripe cucumber' for *sikyos pepon*, have made their way into standard reference books and scientific literature, becoming self-perpetuating and difficult to redress, but independent translations as well as interpretations by specialists in particular plant taxa can provide enlightening reassessments. For a historical example, some writers, including de Candolle (1886), asserted that a species of squash and pumpkins, *Cucurbita maxima* Duchesne, was known in the classical world and this view had persisted in the scientific literature for quite some time. Iconographic, archaeological, historical and philological evidence has refuted this view (Gray and Trumbull, 1883; Whitaker, 1947), and it is universally accepted that the genus *Cucurbita* was unknown to the ancient Greeks or Romans.

The Cucurbitaceae, an extremely polymorphic family, encompass a number of economically important food plants and exhibit much parallel variation among species and genera (Chester, 1951). This has resulted in much overlapping and juxtaposition of cucurbit names in various languages. Often, epithets for cucurbits have changed over time to designate different taxa, and from the distant past to the present can designate various taxa in different localities (Andrews, 1958). There may be no other family of plants in which the misuse of names has been so widespread. Inaccurate and confusing use of names for various cucurbits has continued to the present, some noteworthy examples being the use of 'melon' for watermelon and 'cantaloupe' for muskmelon in the USA, the oxymorons 'round zucchini' and 'round courgette', and the misnomer 'Armenian Yard Long Cucumber' for the snake melon of *Cucumis melo*. Hence, artistic detail and literary accuracy are of the utmost importance for enabling the correct identification of cucurbit taxa.

Plant iconography has played the most important role in the accurate identification of cucurbit taxa in Europe since the Renaissance (Eisendrath, 1961), especially with regard to the American genus *Cucurbita* (Paris, 2001). However, for historical periods prior to the Renaissance, both detailed depictions and accurate descriptions of cucurbit plants are much more scarce. Ancient images vary in their quality. Moreover, the mosaic images, though impressive works of art, are of limited resolution, sometimes not even enough to allow definite identification of plant species. The major treatises of the 1st century describing cucurbits are those of Dioscorides, Columella and Pliny, but Dioscorides focused on medicinal properties. Although the descriptions by Columella and Pliny are brief, some of the traits mentioned are of the utmost importance for correct identification of cucurbit taxa. In addition, Jewish texts of the 1st and 2nd centuries, while devoted to religious issues and affairs, refer to cucurbits because these were food plants, and a number inferences can be made concerning their taxonomic identity. We are aware that the images and literary accounts of ancient cucurbits presented here are not fully comprehensive and we hope this paper will encourage others to provide examples which have escaped our attention. Nonetheless, we have derived a number of conclusions concerning cucurbit crop history and development based on the materials that we accumulated and carefully considered.

Our interest in the taxonomic identity of ancient Mediterranean cucurbits was instigated by the writings of Columella and Pliny, particularly with regard to the predilection of the emperor Tiberius Caesar (42 BCE to 37 CE) for *cucumis*, leading to the invention of the greenhouse. *Cucumis*, according to Pliny, was a fruit of pliable cartilage and flesh, and this word is the source from which the English word cucumber is ultimately derived (Gove, 1967). The Latin *cucumis* was translated into English as cucumber by the translators of Columella and Pliny, even though young melon fruits fit the definition of *cucumis* by Pliny at least as well. This led to statements that cucumbers were appreciated by the Greeks and Romans in authoritative monographs on cucurbits (Whitaker and Davis, 1962; Kirkbride, 1993; Robinson and Decker-Walters, 1997; Jeffrey, 2001). Traditionally, the Biblical Hebrew word *qishu'im*, for a well-appreciated esculent known to the ancient Israelites from the Land of Egypt, has also been translated as cucumbers, and this has persisted even in modern, improved translations, such as that of Fisch (1992). Despite this apparent consensus, we found nothing in the writings of Columella and Pliny, nor in the rabbinical texts, to indicate that the *cucumis* or the *qishu'im* were *Cucumis sativus*. Certainly, if the *cucumis* and the *qishu'im* were of that species, we would expect to encounter a comment alluding to the warty or spiny surface of the fruits. Instead, both the Roman and the Jewish writers indicated that the *cucumis* and the *qishu'im* were downy, softly hairy, which is characteristic of the young fruits of *C. melo* (Robinson and Decker-Walters, 1997). Moreover, a more-or-less round-fruited *cucumis*, known as the *melopepo*, was said by Pliny to detach from the stem when ripened. This is a common characteristic of *Cucumis melo* but has not, to our knowledge, ever been described for *Cucumis sativus*. Depictions of both long and round *C. melo* fruits are found in ancient images from the Mediterranean basin but we have yet to encounter a single image that can definitely be ascribed to *C. sativus*. The textual and iconographic evidence, in our opinion, makes it doubtful that Tiberius grew cucumbers (*Cucumis sativus*) as indicated by the translators of Columella and Pliny and as assumed by Darby *et al.* (1977), Stol (1987) and many others, and we propose that snake melon (*Cucumis melo* Flexuosus Group) is the correct identification.

Columella and Pliny used the epithet *cucurbita* for those cucurbits that produce a woody rind when mature. Most translators use 'gourd' for *cucurbita*, but as this word is generic and can be synonymous with cucurbit, it offers little help as to the specific identity. Moreover, cucumbers and elongated forms of *Cucumis melo*, as well as elongated forms of *Lagenaria siceraria*, do resemble one another superficially, but can often be readily distinguished in accurate depictions. *C. melo* and *L. siceraria* fruits are smoother than those of *C. sativus* and are hirsute when young and often have enlarged stylar ends. *C. melo* fruits can be striped and/or lobed, characteristics absent from those of *L. siceraria*. Elongate *L. siceraria* fruits can often be distinguished by their rounded, swollen peduncular ends.

A number of the images are clear enough to allow the conclusion that both elongate *C. melo* and elongate *L. siceraria* were grown as food around the Mediterranean during the first centuries CE.

Melons have been found growing wild in eastern tropical Africa, including parts of Sudan (Keimer, 1924; Mohamed and Yousif, 2004). There the fruits of primitive indigenous melon cultigens, known locally as *tibish*, are harvested when they are immature and usually are eaten fresh in salads, but also are pickled or added to cooked foods (Mohamed and Yousif, 2004). The fruits of Tibish Group melons have been described as medium small, lacking furrowing but having longitudinal dark and light green stripes, with fruit shape varying from oblate to oval, the latter being the more common (Pitrat *et al.*, 2000). Sympatric wild melons are usually smaller than the *tibish* but they also are striped and vary in shape as well as taste (Mohamed and Yousif, 2004). Of the species of cucurbits, *Cucumis melo* was probably the most widely grown and perhaps the most ancient in cultivation around the Mediterranean Sea (Zohary and Hopf, 1993). This is not surprising, given the greater proximity of the geographical origin of this species to the Mediterranean than other edible-fruited cucurbits. Most of the melons depicted in ancient Egypt show a length-to-broadest-width ratio of approximately 2 : 1 or 3 : 1 (Keimer, 1924), typical of chate melons and typically longer and narrower than the wild melons and primitive *tibish* melons of Sudan. Some other ancient Egyptian depictions show melons that were considerably longer and narrower than the chate melons. On one, the elongate fruits are clearly striped (Fig. 2D), a common characteristic of melon that has not been described in cucumber, *C. sativus*. On another one, the fruit has striations reflecting the topography of the fruit, indicating longitudinal furrows (Fig. 2C). Had this been a cucumber, tubercules and not furrows would have been depicted. Moreover, the wooden models from ancient Egypt (Fig. 2E) also are suggestive of melons as none of them shows the tubercules typical of cucumber. These paintings and models show *Cucumis melo* fruits with a length-to-broadest-width ratio that was considerably higher than that of chate melons, attaining and even exceeding 4 : 1. An even higher proportion of the melons depicted in the first centuries CE were quite long. These long melons, similar to most present-day melons referred to as *faqqous*, are best considered as snake melons, Flexuosus Group. People had already begun selecting for long-fruitedness in *Cucumis melo* in ancient Egypt more than 3000 years ago, and this selection was continued in the Mediterranean area through Roman times.

The *qishu'im* of Jewish commentary and the *cucumis* of Pliny were both described as softly hairy fruits, and were esteemed in both Israel and Rome. The soft hairiness attributed to these fruits indicates that they could not have been of *Cucumis sativus*, as fruits of that species are glabrous except for tubercules and spines. Flexuosus Group melons are softly hairy, fitting this description. Moreover, snake melons are illustrated in nearly contemporary mosaics. We have not found a single depiction indicative of *C. sativus*. However, another form of melon was already cultivated in Israel and Rome by this time. This was the *melafefon* or *melopepo*. Thought by Pliny to be a mutant, it had nearly round fruits that detached from the plant at maturity. Possibly, its roundness as compared with the other melons may have been due to the recessive, pleiotropic gene for andromonoecy (Wall, 1967). Perhaps, due to its lesser importance, the *melopepo* was not a sport but instead was not common and Pliny was unaware of it. Certainly, it was familiar in Israel by the 2nd century, where, in contrast to the *qishu'im*, it was usually eaten when the fruits were close to or at maturity. Although Zohary and Hopf (1993) believed that the *melopepo* was sweet, both de Candolle (1886) and Sturtevant (Hedrick, 1919) eloquently expressed a different opinion. de Candolle: *It was probably of an indifferent quality, to judge from the silence or the faint praise of writers in a country where* gourmets *were not wanting*. Sturtevant: *... the admiration of the authors of the sixteenth century for the perfume and exquisite taste of the melon, as contrasted with the silence of the Romans, who were not less epicurean, is assuredly a proof that the melon had not at that time, even if known, attained its present luscious and perfumed properties ...* Apparently, the *melopepo* of the Romans was palatable with some degree of sweetness, as is characteristic of melons of the Adana Group (Pitrat *et al.*, 2000), but they did not possess the high degree of sweetness of melons that is familiar today. The *faqqous* melons, the modern equivalents of the *qishu'im*, become sour in taste as they mature, a characteristic conferred by a single dominant gene, *So*. The *melopepo* may have been a selection for non-sour, *so/so*, which would have made the mature fruits distinctly more palatable and, following Burger *et al.* (2002), it is tempting to suggest that this *melopepo* represents an important step in the eventual development of sweet melons. Truly sweet melons appear to have been described in the first half of the 14th century in southwestern Asia (Pitrat and Foury, 2003). When they arrived in Europe prior to the close of the 15th century (Naudin, 1859; Goldman, 2002), they caused a sensation, and their surge of popularity has continued to the present.

The geographical origin of *Lagenaria siceraria* was long a mystery, but recently this plant was found growing wild in Zimbabwe (Wilkins-Ellert, 2003). The wild plants were observed to have small, round, thin-rinded fruits. Cultivated *L. siceraria* must have reached northern Africa in ancient times, and by Roman times the bottle-shaped forms were grown for the use of the mature, dry, thick-rinded fruits and the elongate forms were grown for the use of the young fruits as a vegetable. Both are depicted later, in the Middle Ages, and can frequently be found in Renaissance illustrations. Young, elongate fruits of *L. siceraria* or *cocuzzi* are still a part of Sicilian cuisine even though they have been replaced in part by the post-Columbian, more diminutive *cocozelle*, the young, elongate fruits of *Cucurbita pepo* L.

Watermelons, *Citrullus lanatus*, originated in southwestern Africa (Bates and Robinson, 1995) and were anciently cultivated in Egypt, given the age of at least one depiction (Fig. 2A) and the longing of the Children of Israel for the *avattihim* they knew from Egypt

(*Numbers* 11 : 5). Nonetheless, there are relatively few images of watermelons from ancient Egypt (Andrews, 1958). Even from the time of the Roman Empire, there are few depictions of watermelons, and they are not mentioned nearly as much as the fruits of *Cucumis melo* or *Lagenaria siceraria* in Roman and Jewish writings, apparently reflecting lesser appreciation for these fruits. This might seem odd, at first, because watermelons had the advantage over the others of being sweet. On the other hand, watermelons can cross spontaneously with non-sweet watermelons, known as citrons, that are used for pickling and preserves. Worse, watermelons can hybridize with the naturally occurring bitter colocynth, and it was almost unavoidable that these two often grew in near proximity to one another. Hybridizations with the citron and with the colocynth would have resulted in the frequent occurrence of non-sweet or bitter watermelons, and thus limited their popularity.

Many of the Renaissance botanists identified the cultivated *sikyos* of the Greeks as cucumber. Observers of more recent times, including de Candolle (1886), Sturtevant (Hedrick, 1919) and Hyams (1971), have concurred. However, as de Candolle (1886) admitted, the origin of cucumbers is the foothills of the Himalayas. Although Roberts (2001) identified two ancient mosaic images as depicting cucumber (see Figs 3E and 4B) the former is clearly *Cucumis melo*, as evidenced by the longitudinal split in the fruit, and the latter is *Lagenaria siceraria*, as evidenced by the obviously swollen peduncular ends of the fruits. Archaeobotanical records include findings of several seeds purportedly of cucumber, but it is extremely difficult, even for experts, to differentiate between the seeds of *C. sativus* and *C. melo* (Bates and Robinson, 1995). Possibly, an identification of the species of these seeds could be accomplished by analysis of ancient DNA (Gyulai *et al.*, 2006). In this survey of Mediterranean iconography and verbal sources of Roman times, we have found no hard evidence of the presence of cucumbers. There is some linguistic evidence that they became known in the region during the early Middle Ages (Amar, 2000) but the earliest European image known to us of what can be unquestionably identified as cucumber is from approx. 1335, post-dating the Mongol invasions. Renaissance depictions of cucumbers, although very common, show much less variation than do those of melons, which is suggestive of their being more recently introduced or of their lesser culinary appreciation or economic importance.

The results of this survey of ancient iconography and writings contribute toward a better understanding of cucurbit crop evolution. Wild cucurbits bear fruits which are almost always round or nearly so. From the images and written accounts, it is clear that at least two cultivars or market types of both *Cucumis melo* and *Lagenaria siceraria* were grown around the Mediterranean, certainly by Roman times. By that early time, long-fruited types of both taxa had already been selected by people, from ancestral round-fruited progenitors, for the culinary use of the immature fruits while non-elongate types of both taxa were grown for the use of the mature fruits, either for consumption (melon) or for utilitarian purposes (bottle gourd). A similar history and relationship between fruit shape and maturity occurs in the ancient domesticate of North America, *Cucurbita pepo* (squash), and seems to be generally characteristic of cucurbits (Paris, 1989). Unlike these three species, *Citrullus lanatus* (watermelon) does not have what could be described as elongate-fruited market types or cultivar-groups and, not surprisingly, its fruits are almost always consumed when mature. The opposite situation occurs for *Cucumis sativus* (cucumber), the fruits of which are almost always rather long to elongate and are almost always consumed when immature. Long-fruitedness is also associated with culinary use of the young fruits in cucurbit taxa derived from a wide variety of geographical origins, including *Luffa acutangula* (L.) Roxb. (ribbed luffa, ridged gourd), *Trichosanthes cucumerina* L. (snake gourd) and *Sicana odorifera* (Vell.) Naudin (casabanana). It has been suggested that the culinary use of the mature cucurbit fruit preceded that of the young fruit (Hammer *et al.*, 1986). Quite to the contrary, among cucurbit crops, culinary use of the immature fruits is an ancient practice, preceding the culinary use of the mature fruits and, due to the desire for a smaller, narrower seed cavity, led to the early development of long-fruited cultigens (Paris, 1989).

One problem remains: the ancients presumably grew their long-fruited and round-fruited melons in near proximity of one another, and their long-fruited and bottle-shaped bottle gourds in near proximity of one another. Intercrossing within each respective species certainly occurred. Hybrid progeny would have appeared in the following growing season, which was problematic because such plants would have borne fruits of intermediate characteristics, which were less desirable than those of both of the parents for any given purpose, e.g. eating as a vegetable or for use as a vessel. Columella (Book 11, 3 : 49–50) and Pliny (Book 19, 24 : 72) suggested a solution, taking seeds from different parts of the bottle gourd fruit. Those taken from the stylar end would produce rounder fruits and those from the peduncle end the more desirable, longer fruits. This seemingly bizarre suggestion has received experimental support. Wilson and Payne (1994) grew two accessions of *Cucurbita pepo*, one a zucchini (uniformly cylindrical fruits) and the other a gourd (oval fruits) and applied measured proportions of zucchini and gourd pollen to the stigmas of each. The results showed that the pollen of the pistillate parent was favoured in both, indicating that microgametophytes are adapted for maximal performance within the context of their respective gynoecia. That is, the pollen of long-fruited cultivars is more fit to fertilizing ovules of such cultivars than those of cultivars having nearly round fruits, and *vice versa*. Moreover, there was greater fertilizing success of zucchini pollen at the peduncular end of the fruit than at the stylar end. Apparently the male gametes from the zucchini had greater ability to travel the greater distance required to reach the ovules near the peduncle than did those from the gourd, but the gametes of the gourd were better adapted to reaching the nearer ovules. Although the nature of gametophyte competition is unclear, the results seem to suggest that interactions of microgametophyte growth rate and gynoecium shape and size play a critical role.

CONCLUSIONS

The descriptions of Columella and Pliny, the Jewish writings, and the artistic legacy from around the Mediterranean Sea are consistent with the growing and food use of several cucurbit crops in this area during Roman times. We identify these taxonomically, in order of importance, as *Cucumis melo* (melon), *Lagenaria siceraria* (bottle gourd) and *Citrullus lanatus* (watermelon). The long-fruited vegetable forms of *Cucumis melo* were the most widely grown cucurbit from ancient times and through the Roman period, and round-fruited melons were of lesser importance. *L. siceraria* was also widely grown, for use of long-fruited forms as a vegetable and of the round and bottle-shaped forms as vessels or utensils. The text of Dioscorides indicates that several other species of the Cucurbitaceae were collected or grown mainly for medicinal purposes, but not for human consumption of the fruits. These included *Bryonia* species (bryony), *Ecballium elaterium* (squirting cucumber) and *Citrullus colocynthis* (colocynth). There is no compelling evidence for the existence of *Cucumis sativus* (cucumber) around the Mediterranean in this time period.

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