

## Cucurbits depicted in Byzantine mosaics from Israel, 350–600 CE

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• **Background and Aims** Thousands of floor mosaics were produced in lands across the Roman and Byzantine empires. Some mosaics contain depictions of agricultural produce, potentially providing useful information concerning the contemporary presence and popularity of crop plants in a particular geographical region. Hundreds of floor mosaics produced in Israel during the Byzantine period have survived. The objective of the present work was to search these mosaics for Cucurbitaceae in order to obtain a more complete picture of cucurbit crop history in the eastern Mediterranean region.

• **Results and Conclusions** Twenty-three mosaics dating from 350–600 CE were found that had images positively identifiable as cucurbits. The morphological diversity of the cucurbit fruits in the mosaics of Israel is greater than that appearing in mosaics from any other Roman or Byzantine provincial area. The depicted fruits vary in shape from oblate to extremely long, and some are furrowed, others are striped and others lack definite markings. The cucurbit taxa depicted in the mosaics are *Cucumis melo* (melon), *Citrullus lanatus* (watermelon), *Luffa aegyptiaca* (sponge gourd) and *Lagenaria siceraria* (bottle gourd). *Cucumis melo* is the most frequently found taxon in the mosaics and is represented by round dessert melons and long snake melons. Fruits of at least two cultivars of snake melons and of watermelons are represented. To our knowledge, images of sponge gourds have not been found in Roman and Byzantine mosaics elsewhere. Indeed, the mosaics of Israel contain what are probably the oldest depictions of *Luffa aegyptiaca* in Mediterranean lands. Sponge gourds are depicted often, in 11 of the mosaics at eight localities, and the images include both mature fruits, which are useful for cleaning and washing, and immature fruits, which are edible. Only one mosaic has images positively identifiable as of bottle gourds, and these were round–pyriform and probably used as vessels.

**Key words:** Byzantine mosaics, crop archaeology, crop history, crop domestication, *Citrullus lanatus*, *Cucumis melo*, cucurbit history, Cucurbitaceae, *Lagenaria siceraria*, *Luffa aegyptiaca*, *Luffa cylindrica*, snake melon, sponge gourd.

### INTRODUCTION

The Cucurbitaceae contain a number of plants that have been cultivated for the use of their fruits as food and other purposes since time immemorial. Cucurbits were depicted in ancient Egyptian wall paintings and mentioned in scripture. They are also referred to in Greek, Latin and Hebrew texts dating to the time of the Roman Empire (Janick *et al.*, 2007). The cucurbit crop plant taxa that were the subjects of Roman era depictions and discussions were *Cucumis melo* L. (melons), *Citrullus lanatus* (Thunb.) Matsum. & Nakai (watermelons) and *Lagenaria siceraria* (Mol.) Standl. (bottle gourds). The most frequently depicted and discussed cucurbit was the snake melon, *Cucumis melo* Flexuosus Group (Paris, 2012).

An improved, more accurate understanding of the history of crop plant taxa can be best achieved by the collection and critical evaluation of interdisciplinary evidence (Dalby, 2003). Evidence can appear in pictorial and literary forms, and encompass various fields of study, among them agriculture, botany, culinary usage, lexicography, linguistics, medicine and pharmacology, and archaeology. Correct taxonomical identifications are dependent on the descriptive detail and accuracy of this evidence. Iconographic evidence has proved to be particularly useful for obtaining assessments

of cucurbit crop history (Eisendrath, 1961; Zeven and Brandenburg, 1986; Paris, 2000; Paris *et al.*, 2009, 2011). Often, though, it has been difficult to determine for certain the taxon of a particular cucurbit that is depicted or discussed as cucurbits are polymorphic and exhibit much parallel variation (Vavilov, 1951). *Cucumis melo*, melon, is especially polymorphic, containing more or less round-fruited as well as distinctly elongate-fruited cultigens, the former grown mostly for use of their mature fruits and the latter for use of their immature fruits. The selection of round-fruited cultigens includes, among others, the sweet cantaloupes, muskmelons and casabas as well as the insipid adana and duda'im melons; the selection of elongate-fruited cultigens includes, among others, the cucumber-like snake melons and adzhur melons (Stepansky *et al.*, 1999; Pitrat *et al.*, 2000; Goldman, 2002; Burger *et al.*, 2010; Paris *et al.*, 2012c; McCreight *et al.*, 2013).

Mosaics are surface decorations formed by the inlay of small pieces, of one or more materials and colours, that fit together side by side (Avi-Yonah, 1975; Dunbabin, 1978; Ben Dov and Rappel, 1987; Ovadia, 2002). Mosaic art has been produced for thousands of years, for the decoration of floors, walls and ceilings. During the Hellenistic period, there were marked advances in mosaic art, including colour gradation to capture the nuances of light and shade. By the third century BCE, the cutting of stones

into small square tiles, *tesserae*, was widely practised for producing mosaics. No longer were mosaics geometric images produced merely from dark- and light-coloured stones, but instead became multi-coloured depictions of people, animals and plants. The art spread across the Roman Empire, thousands of mosaic floors being produced, probably by travelling artists, in the Roman provinces of Europe, northern Africa, Asia Minor and the Middle East. As mosaics became increasingly refined and sophisticated, dynamic depictions of mythology, animals and hunting and sporting scenes were produced. Some mosaics contain depictions of agricultural produce, tools or other aspects of local day-to-day rural life.

Mosaic floors are far more durable than other works of art (Ben Dov and Rappel, 1987; Ling, 1998; Dunbabin, 1999). While it is quite likely that most of the mosaics ever produced were floors, floors are also far more likely to have survived the neglect and collapse of a building than any that might have been produced on walls or ceilings and, moreover, the fallen debris would actually protect the floor mosaics from natural and human disturbance.

The production of mosaics, the arranging and setting of thousands of small pieces into mortar or plaster, required a large investment in intensive labour of skilled artisans (Ben Dov and Rappel, 1987; Ling, 1998). Moreover, mosaics vary in the amount of detail they show, being limited in their power of resolution by the size of the component *tesserae*. Use of smaller tiles improves resolution but considerably increases the cost of producing the mosaic. The size and grandeur of the building housing the mosaic, the skill of the artisans employed to compose the mosaic, the size of the mosaic itself and its tiles, and the import of stones of special colours were limited by the size of the available budget.

Of the hundreds of mosaic floors uncovered in Israel, the vast majority date to the Byzantine Period, 324–638 CE, thus post-dating most of those from other former Roman provincial areas (Kitzinger, 1965; Avi-Yonah, 1975; Roussin, 1985; Ovadiah, 2002; Ovadiah and Ovadiah, 1987; Mucznik *et al.*, 2004; Hachlili, 2009). They vary widely in overall quality, from ‘refined mastery . . . to the crudest representation’ (Schapiro and Avi-Yonah, 1960). The Byzantine mosaics of Israel are similar to their Roman antecedents by typically having an outer frame composed of repetitive geometrical and floral patterns. Often, the mosaics are divided into scenes or panels serving to separate different subjects or a series of events. On the other hand, within these frames and panels, artists had considerable flexibility, according to the limitations of their talents, to depict real-life, biblical or mythological subjects, according to preferences of individual patrons and modified by possible bias towards particular religious or secular symbolisms, or economic or social sectors. The Roman mosaics were most often used to decorate government buildings and luxurious private villas. The overwhelming majority of Byzantine mosaics of Israel, though, decorated places of worship and the subjects include biblical events, zodiac signs, the four seasons and village life and agriculture, with images of people, animals and plants. Given the large quantity of mosaics, it appeared plausible to us that some might contain images of fruits and vegetables, thereby providing information concerning crop history and usage in Israel during the Byzantine era, contemporary with Late Antiquity and the onset of the European Dark Ages. Our objective was to collect and compare images of

Cucurbitaceae in the Byzantine mosaics of Israel, and attempt to identify these cucurbits taxonomically.

## MATERIALS AND METHODS

The first author photographed many of the extant mosaics in Israel. Some sites, though, are closed or have been covered, necessitating the use of photographs maintained by the Israel Antiquities Authority (Jerusalem) or in various publications or private collections, which usually are in black-and-white or lack fine resolution. We carefully searched and examined the photographs of the mosaics and found images of crop plants depicted in 134 of them. Of these, we found 23 that contained images clearly recognizable as portraying cucurbits. These 23 mosaics are distributed among 18 localities, ranging from Nahariyya in the north to Mamshit in the south (Fig. 1). Except for the familiar English-language names Jerusalem and Bethlehem, these localities are herein Romanized from Hebrew according to the recommendations of the Hebrew Language Academy of Israel (errant spellings and common synonyms are given in parentheses). The consonant *alef*, when pronounced, is indicated with a regular apostrophe (‘) and the pharyngeal consonant *ayin* is indicated with an inverted apostrophe (‘).

Cucurbit fruits can be round or elongate and recognized as such in the mosaics because they appear together with other agricultural produce, especially fruits. Many of the fruits are readily identifiable by their distinctive shapes, the most common being grape clusters (*Vitis* L. spp., Vitaceae), pomegranates (*Punica granatum* L., Punicaceae), figs (*Ficus* L. spp., Moraceae) and citrons (*Citrus medica* L., Rutaceae) (Fig. 2). In the mosaics, the fruits are often depicted within baskets (Fig. 2A, B), repetitive grapevine or acanthus (*Acanthus* sp., Acanthaceae) foliar designs often called ‘scrolls’ (Fig. 2C), or geometrically shaped or foliar-patterned cells called ‘medallions’ (Fig. 2D). Cucurbits also appear in corners of square panels containing a zodiac wheel, with the corners depicting the four seasons (Fig. 3). The cucurbits appear together with agricultural tools (Fig. 3A, B) or without them (Fig. 3C). In addition to their relatively large sizes in comparison with other fruits, cucurbits often exhibit peculiar traits of their own, including radial markings, a protrusion or large circular area or withered petals at the stylar end, or a depressed peduncle end. Cucurbit fruits have many diagnostic features that readily allow distinguishing among the various genera and species, but some of these features are beyond the power of resolution of the mosaic images.

The 23 mosaics containing portrayals of cucurbits were produced over a period spanning ~250 years, from 350 to 600 CE, but the majority date from ~500 to 600 (Table 1). They differ greatly in the size of their component tiles, variety of colours and state of preservation. Fruits of more than one cucurbit crop are depicted in approximately half of these 23 mosaics.

Of the round cucurbits, melons (*Cucumis melo*) and watermelons (*Citrullus lanatus*) were frequently mentioned and illustrated in Mediterranean antiquity (Janick *et al.*, 2007). There are some fruit traits that appear in mosaics that allow identification, with a high degree of confidence, of the images as depicting melons. Melons can have prominent lobes and furrows or a protruding and/or large stylar scar, and often they have a netted or warted surface. When they ripen, they usually turn yellow and can abscise from the plant, leaving a depressed peduncular scar.

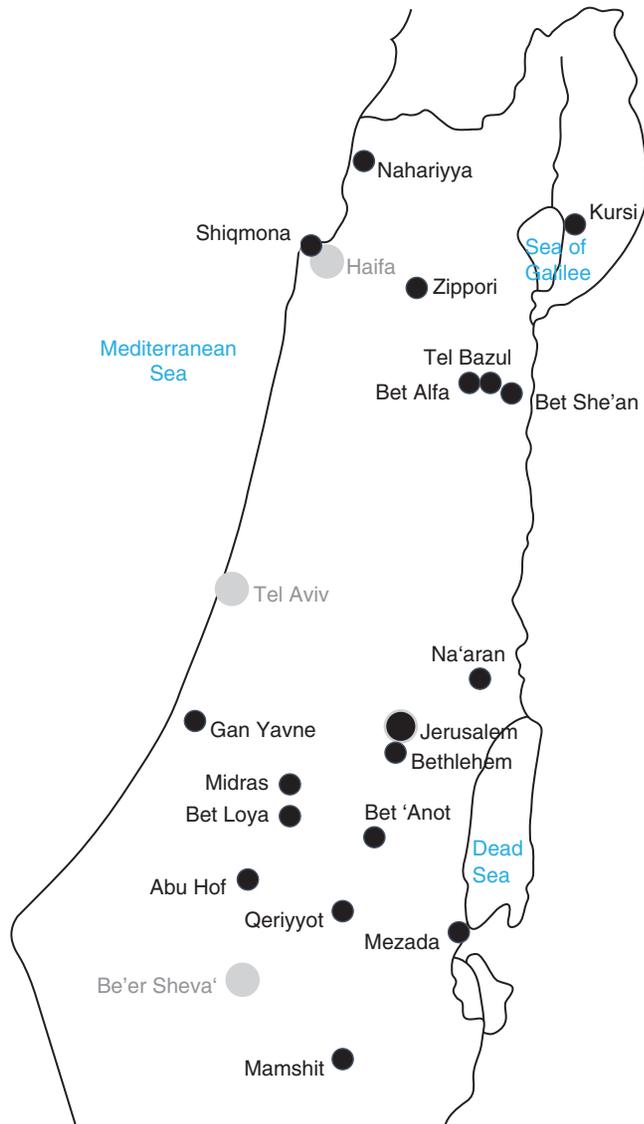


FIG. 1. Map showing most of Israel and its surroundings, with the geographical layout of the 18 localities (indicated with black circles) at which the mosaics containing images of cucurbits were found in relation to three major cities (indicated with grey circles), Haifa, Tel Aviv and Be'er Sheva', and the Mediterranean Sea, Sea of Galilee and Dead Sea.

Watermelons lack these salient topographical features and thus cannot usually be identified with the same high degree of certainty as melons in mosaic images. Ripe watermelons range in colour from light yellow–green to intense black–green, though the ground side is yellow and senescing watermelon fruits turn yellow. Watermelons are often boldly striped with intense green and the stripes have acute edges, a feature that could be reflected in mosaic images. Watermelons characteristically have a smooth, glossy surface. Although some mosaic images of round cucurbits suggest glossiness by being more lightly coloured in one portion, many objects represented in mosaic images are realistically depicted as lighter in the portion nearest the viewer, as occurs in modern photographic images, thereby depicting depth. Therefore, lightening towards the centre of cucurbit images in the mosaics must be interpreted with caution. Also, some

images of round cucurbits seem to combine features distinguishing between modern watermelons and melons and thus may be composites, reminiscent of the composite images drawn by Renaissance artists to depict variants of cucurbit species or even different taxa of cucurbits, to save time, effort and space (Paris, 2000). At present, 'melons' is often colloquially used in the USA to collectively designate watermelons and melons (Goldman, 2002) and, possibly, these two fruits were considered collectively by some Byzantine artists as well. It is quite possible, too, that the melons and watermelons of yore had features that are rare or absent in modern germplasm, having been lost over time due to advances in plant breeding and selection, thus requiring further caution in taxonomic interpretation of round cucurbit images. Significant advances in breeding of various crop plants, including melons, are known to have occurred during the medieval period (Watson, 1983; Paris *et al.*, 2012b).

Of the elongate cucurbits, melons (*Cucumis melo*) and bottle gourds (*Lagenaria siceraria*) were frequently mentioned and illustrated in Mediterranean antiquity (Janick *et al.*, 2007). Some features distinguishing among long-fruited cucurbit taxa are beyond the power of resolution of the mosaics. However, various nuances of elongated fruit shape tend to differ noticeably among taxa and can be quite useful for taxonomic identification. *Lagenaria siceraria* fruits have an extreme range of shapes (Heiser, 1979; Robinson and Decker-Walters, 1997), but the elongate bottle gourds of Mediterranean antiquity almost invariably had bulging peduncle ends (Janick *et al.*, 2007), a feature not found in long melons, *Cucumis melo*. Cucumbers (*Cucumis sativus* L.) are often broader at the peduncle end, tapering to narrow at the stylar end (Paris *et al.*, 2011), but no writings or images of cucumber have been found that date to the time of the Roman Empire (Paris *et al.*, 2012a). Other features of cucurbit fruits that appear in mosaics and can be useful for taxonomic identification are size of the stylar scar and corolla colour. Melons, but not cucumbers and bottle gourds, often have large stylar scars. The corolla is yellow in *Cucumis* and *Citrullus*, but white in *Lagenaria*. As will be shown and discussed, some mosaics in Israel contain images of elongate cucurbits that cannot be identified with any of these taxa.

## RESULTS

### Round cucurbits

Twenty mosaics at 16 localities in Israel contain portrayals of round-fruited cucurbits (Table 2). Based on their differing features, these portrayals can be grouped into six categories. We accordingly present these portrayals of round-fruited cucurbits in chronological order for each category.

*Category 1.* The most prominent features of the first category of round-fruited cucurbits are the longitudinal furrowing and the protruding or otherwise broad stylar scar. Such fruits are portrayed in six mosaics at five localities (Fig. 4). An exposed fragment of the underlying, older of two mosaics at Bet Alfa (Beth Alpha) shows a striking image of two round fruits adjacent or connected to grey stems, which themselves are connected to rounded cordate leaves of the same colour, on a white background (Fig. 4A). The larger round fruit, outlined with yellow and grey, is about three times the average area of the cordate leaves. It has narrow radial lines formed by the laying of



FIG. 2. Mosaic floors containing depictions of various fruits. (A) A cornucopia filled with fruits, Nile Festival Building, Zippori. Depicted are a round cucurbit (short arrow), two elongate cucurbits (long arrow), two grape clusters, a pomegranate, a fig and perhaps a peach. (B) A large basket filled with fruits, Midras. Depicted are a round cucurbit (short arrow), two elongate cucurbits (long arrow at top left), one very long cucurbit (long arrow at bottom right, depiction incompletely preserved), a pomegranate (left), a citron (top centre) and other fruits. (C) Acanthus scroll, Qeriyot. Depicted are a round cucurbit (arrow), elongated grapes (on both sides of the cucurbit), a pomegranate (at left) and other fruits. (D) Geometric medallions at the John the Baptist Chapel at the Russian Ascension Churchyard, Jerusalem. Depicted in the front row, left to right, are a grape cluster, a fish, pomegranates, a round cucurbit (arrow) and figs. Photographs (A) and (C) are courtesy of the Israel Parks and Nature Authority, Jerusalem, (B) and (D) are courtesy of the Israel Antiquities Authority and (D) also courtesy of the monastery mother. Photographs (A), (B) and (D) are by Anat Avital; photograph (C) is by Yehuda Guvrin.

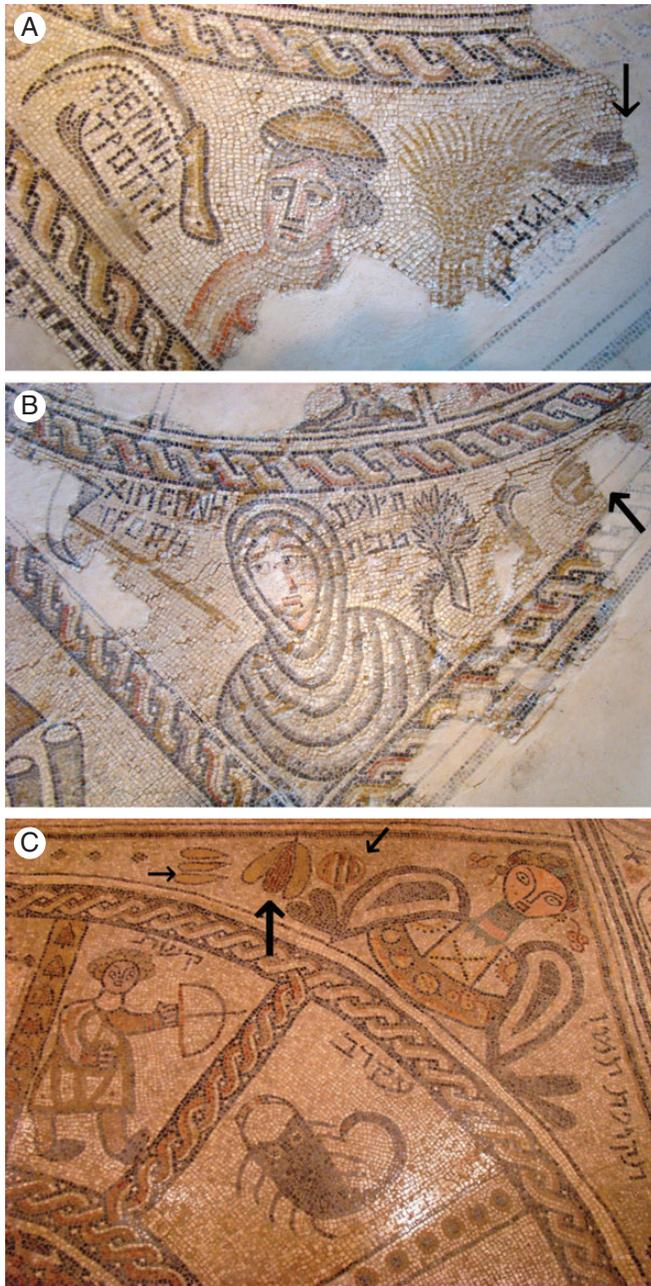


FIG. 3. Mosaic floors with a square panel containing a zodiac wheel, the four corners of the square depicting the seasons. (A) Synagogue at Zippori, corner with Hebrew inscription *Tequfat Tammuz* (summer season). Left to right: a two-pronged tool, a sickle, an image of a woman personifying the summer, a sheaf of grain and two partially preserved elongate cucurbit fruits (arrow). (B) Opposite corner of same mosaic, with Hebrew inscription *Tequfat Tevet* (winter season). Left to right: a hatchet, an image of a woman personifying the winter, a pruned branch of a tree, a billhook and an elongate cucurbit (arrow). (C) Synagogue at Bet Alfa, corner with Hebrew inscription *Tequfat Tammuz* (summer season). Image of a woman personifying the summer adjacent to three elongate cucurbits (short, thin arrow), three larger elongate cucurbits (long, thick arrow) and one round cucurbit (short, thick arrow). Courtesy of the Israel Parks and Nature Authority, Jerusalem (photographs by Anat Avital).

yellow tiles diagonally on a pale pink and white background, and a large, thickened semi-circular area at one end, at which the lines converge. The smaller round fruit, grey and less well-defined, has

darker grey narrow lines, also formed by the laying of tiles diagonally. The Church of the Nativity in Bethlehem has clear depictions of three round cucurbit fruits, each consisting of a large number of tiles (Fig. 4B–D, Table 2). The images are on a dark background inhabiting the acanthus scroll in the frame of the mosaic. The fruits are furrowed, with a narrow protrusion at one end and a broad circular protrusion or scar opposite. The narrow protrusion is easily identified as the peduncle (fruit stem) and the broad circular area would thus be the styler end of the fruit. One of the fruits is egg-shaped with deep furrowing and a broad styler protrusion (Fig. 4B), one is blocky with deep furrowing and has a broad styler protrusion (Fig. 4C), and one is globular with less distinct furrows and a large but not protruding styler scar (Fig. 4D). At Tel Bazul (Tell Basul), there is an image of a similar egg-shaped fruit with a circular styler protrusion but without the peduncle, again on a dark background within the acanthus scroll framing the mosaic (Fig. 4E). The image consists of far fewer tiles than the similar image in the Church of the Nativity. The furrows and circular area of the fruit are represented by differently coloured tiles laid side by side. The mosaic at the Martyr Church in Bet She'an (Beth Shean, Beth-Shan, Beisan, Scythopolis) contains clear, nicely detailed depictions of a variety of fruits in square and rectangular medallions. One of the fruits is large and oblate (Fig. 4F). Outlined in maroon, this fruit has radial lines of maroon that are curved, and to the left of each radial line is a row of yellow–brown tiles followed by a row of tan and/or white tiles, imparting a three-dimensional shading effect and indicating that the radial maroon lines are furrows, not stripes. One end of the fruit has a thick, circular protrusion, outlined in maroon and highlighted with a ring of grey–blue. At Kursi, various subjects are depicted as a quartet, in a row of four diamond-shaped medallions. Each medallion in one such quartet contains a large fruit that is nearly spherical, outlined and furrowed in deep grey and shadowed with light grey, with a grey peduncle and prominent circular grey area at the opposite end, on an off-white background (Fig. 4G). The central of three panels in the overlying, more familiar, recent and complete of the two mosaics at Bet Alfa is composed of a square enclosing a zodiac wheel. In the corner representing the summer season (Fig. 3C), there is a depiction of a large, round fruit, outlined in orange and filled with 13 radial lines (Fig. 4H). Each line is composed of tiles of a single colour, the lines being yellow, black, orange and white. A single black tile projects from one radial end and at the opposite end is a thick projecting area, four tiles wide.

*Category 2.* The most prominent feature of the second category of round-fruited cucurbits is the broad, circular styler scar, but without longitudinal furrowing. Such fruits are portrayed in two mosaics at Zippori (Sepphoris) (Fig. 5A, B). The Nile Festival Building has an image of a cornucopia filled with various fruits (Fig. 2A). The largest fruit, which is composed of <100 tiles, is round and yellow, except for a thick circular area that is white and outlined in brown (Fig. 5A). The synagogue mosaic at Zippori contains a much inferior copy of the contents of the cornucopia. The synagogue mosaic also has a square panel surrounding a zodiac circle. Each of the four corners of this square panel, just outside of the zodiac, is labelled with one of the four seasons and is personified by a woman attired according to the season. To either side of each woman are images of

TABLE 1. *Chronological list of localities having Byzantine mosaic floor images of cucurbits*

Locality	Geographical area	Building type or name	Date (CE)*	Size of mosaic tiles**	Cucurbit fruit shape	References
1. Shiqmona	Northern coast	Church	350	2	Round	Biran, 1964; Elgabish, 1994; Tal and Zemer, 2008
2. Zippori	Lower Galilee	Nile Festival public building	400	3	Round + elongate	Weiss and Talgam, 2002
3. Zippori	Lower Galilee	Synagogue	410	3	Round + elongate	Weiss, 2005
4. Mamshit	Eastern Negev	Church	425	1	Round + elongate	Biran, 1966; Negev, 1988
5. Bet Alfa	Jordan Valley	Synagogue	440	2	Round	Israel Antiquities Authority, Archives/Israel Scientific Inspection Files: P/Bet Alfa /Synagogue/X, Hebrew, Nehemya Zuri, 1954
6. Bethlehem	Judean Mountains	Church of the Nativity	450	3	Round	Bagatti, 1952
7. Mezada	Judean Desert	Chapel	450	1	Round	Ben-Tor, 2009
8. Tel Bazul	Jordan Valley	Chapel	475	–	Round	Zuri, 1962
9. Nahariyya	Upper Galilee Coast	Church	500	3	Round	Edelstein and Dauphine, 1975
10. Bet She'an	Jordan Valley	Martyr Church	500	1	Round + elongate	Mazour and Bar-Natan, 1996
11. Bet Loya	Judean Hills	Church	500	3	Round	Patrich and Tsafir, 1993
12. Bet 'Anot	Judean Hills	Church	500	3	Round	Magen, 1992
13. Qeriyot	Southern Judean Mountains	Church	500	3	Round + elongate	Derfler, 2003; Guvrin, 2006
14. Gan Yavne	Southern coastal plain	Barqa Church	511	1	Round	Sion <i>et al.</i> , 2010
15. Bet Alfa	Jordan Valley	Synagogue	517	3	Round + elongate	Sukenik, 1932
16. Midras	Judean Hills	Church	550	3	Round + elongate	Ganor <i>et al.</i> , 2012
17. Na'aran	Jordan Valley	Synagogue	550	–	Elongate	Vincent, 1919
18. Bet She'an	Jordan Valley	Al-Hammam Chapel	550	3	Elongate	Avi-Yonah, 1936
19. Bet She'an	Jordan Valley	Lady Mary Monastery	567	1	Round + elongate	Fitzgerald, 1939
20. Kursi	Jordan Valley	Church	586	2	Round + elongate	Tsaferis, 1983
21. Abu Hof	Northern Negev Desert	Church	600	–	Elongate	Israel Antiquities Authority, Archive Excavation Files, Ba'ikhat Abu Hidba, Abu Hof, A-986 by D. Allon and R. Cohen, 1980
22. Jerusalem	Judean Mountains	Russian Ascension Church	600	3	Round	Clermont-Ganneau, 1899
23. Jerusalem	Judean Mountains	Dominus Fleuit Oratorium	600	3	Round + elongate	Bagatti, 1955–1956

\*Most years are approximate or estimates, some differing among researchers. For brevity, time frames are given as single years; e.g. mid-5th century is given as 450 and the end of the 5th century as 500. The synagogue at Bet Alfa contains a well-preserved mosaic dated 517 CE built over the remains of a mosaic that is probably at least 75 years older and thus estimated as at 440 CE, of which only two small parts have been excavated.

\*\*Tiles per square decimetre as reported by cited sources: 1, <100; 2, 100–130; 3, >130.

TABLE 2. Localities, descriptions and probable identities of images of round cucurbits

Locality	Figure	Approximate number of tiles constituting the cucurbit image(s)	State of preservation of the cucurbit image(s)	Probable taxonomic identity (degree of certainty)*
Shiqmona	6A	200	Fine	<i>Citrullus lanatus</i> (high)
Zippori (Nile Festival)	5A	86	Fine	<i>Cucumis melo</i> (high)
Zippori (Synagogue)	5B	180	Fine	<i>Cucumis melo</i> (high)
Mamshit	7A, B	160, 160, 160	Good	<i>Citrullus lanatus</i> (medium)
Bet Alfa (Lower)	4A	250	Good	<i>Cucumis melo</i> (high)
Bethlehem	4B–D	500, 1000, 1500	Good	<i>Cucumis melo</i> (high)
Mezada	7C	110	Good	<i>Citrullus lanatus</i> (low)
Tel Bazul	4E	250	Good	<i>Cucumis melo</i> (high)
Nahariyya	6B	200	Fine	<i>Citrullus lanatus</i> (high)
Bet She'an (Martyr)	4F	350	Fine	<i>Cucumis melo</i> (high)
Bet Loya	5C	72	Fair	<i>Cucumis melo</i> (low)
Bet 'Anot	7D	1000	Fine	<i>Citrullus lanatus</i> (medium)
Qeriyot	5D–F	200, 280	Fine	<i>Cucumis melo</i> + <i>Citrullus lanatus</i> (high + high)
Gan Yavne	7E	300	Fine	<i>Citrullus lanatus</i> (low)
Bet Alfa	4H	200	Fine	<i>Cucumis melo</i> (high)
Midras	6C	87	Poor	<i>Citrullus lanatus</i> (low)
Bet She'an (Lady Mary)	6D–E	110	Fair	<i>Citrullus lanatus</i> (medium)
Kursi	4G, 7H	360 + 160	Good	<i>Cucumis melo</i> + <i>Lagenaria siceraria</i> (high + high)
Jerusalem (John the Baptist Chapel, Russian Ascension)	7F	500	Fine	<i>Citrullus lanatus</i> (medium)
Jerusalem (Dominus Flevit)	7G	500	Fine	<i>Citrullus lanatus</i> (low)

\*Taxonomic identifications vary greatly in certainty, according to the number of tiles per image, the image's state of preservation, its exactness and degree of realism, and clarity of features distinguishing among taxa. The most certain identifications are for the images at Bet Alfa (lower fragment), Bet She'an (Martyr) and two at Bethlehem (Fig. 4B, C); the least certain are for the images at Mezada, Midras and Gan Yavne.

agricultural tools and produce (Fig. 3A). In the corner of the fall season, between two red pomegranates, is a round fruit outlined in brown and filled with light brown and yellow, with a thick circular area that is grey and outlined in brown (Fig. 5B).

**Category 3.** The most prominent feature of the third category of round-fruited cucurbits is the oblate shape, rather than spherical or oval, and/or a round indentation. Such fruits are portrayed in two mosaics, at Bet Loya and Qeriyot (Kerioth) (Fig. 5C–F). Within one of its vine-scroll medallions, the mosaic at Bet Loya contains a depiction of a kylix (broad, two-handled vase) filled with various fruits. One of these fruits is large and round, greenish grey at the top, yellow toward the middle and white at the bottom, but within the grey portion there is a semi-circular depression of white; the image of this fruit consists of <100 tiles (Fig. 5C). The acanthus scroll border of the mosaic at Qeriyot (Fig. 2C) contains portrayals of a particularly rich array of fruits and vegetables. Three of the fruits are large and oblate, outlined in black and filled with light yellow and dotted with dark yellow. The most oblate of the large, yellow fruits has radially arranged darker yellow dots and a yellow peduncle (Fig. 5D). The other two are without peduncles (Fig. 5E, F), one of which has an obvious but small circular indentation (Fig. 5E).

**Category 4.** The most prominent feature of the fourth category of round-fruited cucurbits is distinct longitudinal striping. Such fruits are portrayed in five mosaics at five localities [Figs 6 and (see below) 5E, F]. At Shiqmona, in the central portion of the mosaic, centred among four grape clusters, is a depiction of a large, round, striped fruit, including its peduncle (Fig. 6A). The fruit is outlined with a dark colour and contains two

shades radially arranged within so as to depict stripes. Near the stylar end there is what at first appears to be a narrow ring but, upon closer examination, this is seen to be a crack in the mosaic. The stripes have jagged edges, achieved by the laying of the tiles in a diagonal, diamond-shaped pattern. Evidently, the jaggedness was intentional, as the portrayals of grapes and other fruits have smooth edges. The mosaic at Nahariyya contains an image of a large, globular, mostly yellow fruit marked with radially arranged grey and green tiles (Fig. 6B). Some green appears in approximately half of the grey tiles, suggesting that these and the other grey tiles were also originally green, the green becoming worn off or fading over time. The radial tiles are set diagonally, corner to corner, resulting in an overall appearance of narrow, acutely edged stripes. At the centre of the fruit and towards its top left, white tiles are concentrated, suggestive of a glossy surface. Adjacent is a kitchen knife, evidently used to slice this fruit. At Midras, various fruits are depicted on a blue–grey background in a *kalathus* (large basket) (Fig. 2B). One fairly large, round fruit is mostly yellow with a few white tiles in a suggestive radial arrangement (Fig. 6C); this image consists of <100 tiles and is poorly preserved. At the Lady Mary Monastery in Bet She'an, within medallions of various geometric shapes, there are five portrayals of large, oval, striped fruits, consisting of ~110 tiles each, depicted on an off-white background; two of these images are reproduced here (Fig. 6D, E). The fruits have a blue–grey line extending from one end, no doubt representing the peduncle. The striping is based on lines of large tiles in alternate colours. Four of the fruits have the alternately coloured tiles arranged side to side (Fig. 6D) but one has them laid corner to corner (Fig. 6E), evidently to depict broad striping and narrow striping, respectively. At Qeriyot, on both

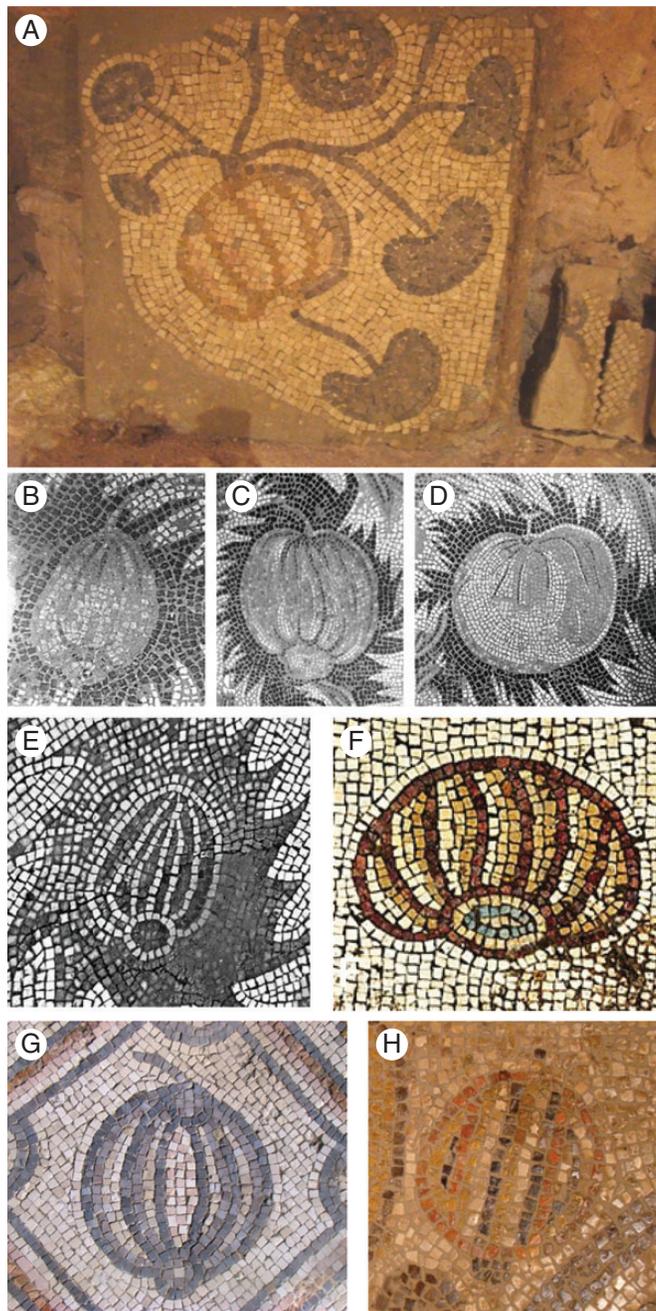


FIG. 4. Images of round cucurbits, lobed and furrowed and with protruding or broad, large stylar scar, in mosaics dated 440–586 CE. (A) With foliage and younger fruit, underlying mosaic, Bet Alfa. (B, C, D) Church of the Nativity, Bethlehem (Israel Antiquities Authority, Jerusalem, Mandate Record files 35, 36 and 37). (E) Tel Bazul (Israel Antiquities Authority, Archive file &-7/1961, N. Zuri). (F) Martyr Church, Bet She'an (Israel Antiquities Authority, Bet She'an Excavations led by R. Bar-Natan and G. Mazour). (G) One of four images of round melons, Kursi. (H) Overlying mosaic, Bet Alfa. Photographs (A) and (F–H) are courtesy of the Israel Nature and Parks Authority, Jerusalem (photographs by Anat Avital).

sides of two of the large, oblate yellow fruits are two other, smaller, round fruits (Fig. 5E, F). These four fruits are outlined in black with a black or greenish grey peduncle. The body of the fruits is greenish grey with black dots and, in two of the

fruits, the dots having a distinct radial distribution which, when viewed from a distance, is suggestive of striping.

**Category 5.** The most prominent feature of the fifth category of round-fruited cucurbits is the lack of furrows, protrusions, indentations and stripes. Such fruits are portrayed in six mosaics at five localities (Fig. 7A–G). At Mamshit (Mampsis, Memphis), within a square medallion, there is a depiction of a large, round object in intense shades of red, lighter towards the centre (Fig. 7A). Within a rectangular medallion in the same mosaic are two fairly large, round objects, both of which are outlined in grey and filled with yellow–orange, within which white tiles are interspersed in a circular fashion (Fig. 7B). One of 16 circular medallions in the centre of the mosaic at Mezada (Masada) (Fig. 7C) contains three large, round, plain yellow objects consisting of relatively few tiles. At Bet 'Anot (Beit 'Einun), a fragment of the mosaic contains, within a square medallion, a depiction of two olive branches between which is a large, round fruit, with attached peduncle, consisting of ~1000 tiles (Fig. 7D). The fruit has small acute elongate markings, perhaps signifying small cracks, scars or stripes. This large fruit is dark towards one side and light towards the other, no doubt to indicate shading. The centre is much lighter, more than would be expected to merely indicate its closeness to the viewer, suggesting that the fruit was glossy. One grapevine scroll in the mosaic at Gan Yavne is inhabited by three fruits, including one that is round, unmarked, yellow and outlined in black, and next to it is a kitchen knife (Fig. 7E). The mosaic in the Chapel of John the Baptist at the Russian Ascension Churchyard, Mount of Olives, Jerusalem (Fig. 2D), contains an image of a large, round, light-coloured object surrounded by an off-white background. It is outlined with greyish red and filled with light grey–green towards one side, mostly white near the centre, with yellow–orange towards the other side (Fig. 7F). The colour gradations suggest illumination, and the white is suggestive of reflectance of a light source on a smooth, glossy fruit. Attached to the fruit is a thin stalk, representing the peduncle, and it has the same grey–green colour as the fruit. Under close examination, there can be seen a thin, round, greyish red ring near the stilar (lower) end of the fruit. At Dominus Flevit on the Mount of Olives in Jerusalem (Fig. 7G), the subjects are presented within alternating circular and square medallions, on a white background. A large, round, glossy, yellow–orange, yellow–grey and purplish red object is depicted, perhaps an inferior copy of the one in the Chapel of St John the Baptist, but having two stalks at opposite ends, one grey and the other yellow–orange, the same colour as the fruit.

**Category 6.** The most prominent feature of the sixth category of round-fruited cucurbits is the round–pyriform shape. The mosaic at Kursi has a row of four images of a non-lobed, unmarked, grey, large, round–pyriform object shaded towards one side and one of these images is reproduced here (Fig. 7H).

#### *Elongate cucurbits*

Thirteen mosaics at ten localities contain portrayals of elongate-fruited cucurbits (Table 3). Based on their differing features, these portrayals can be grouped into four categories. We accordingly present these portrayals of elongate-fruited cucurbits in chronological order for each category.

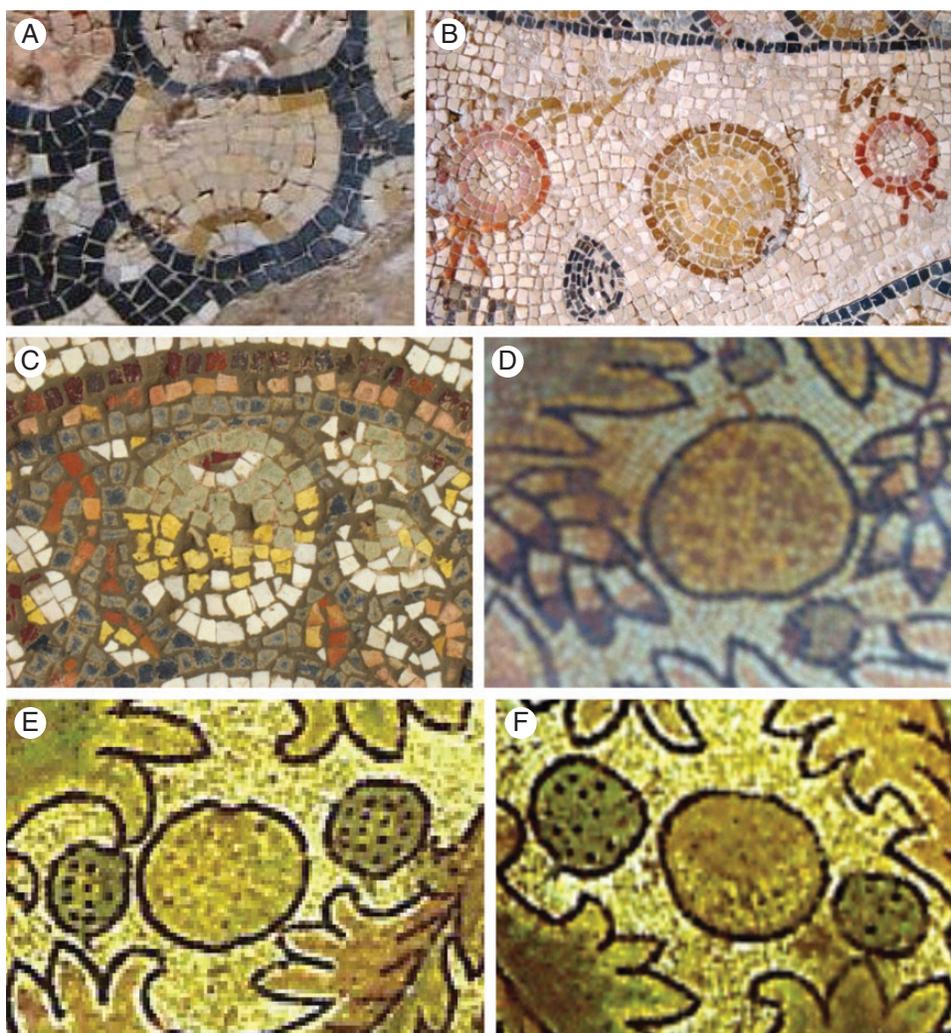


FIG. 5. Images of round cucurbits with a large, broad stylar scar, or with a peduncular depression, or oblate, in mosaics dated 400–500 CE. (A) Nile Festival Building, Zippori. (B) Synagogue, Zippori. (C) Bet Loya. (D–F) Qeriyot. Photographs (A) and (B) courtesy of the Israel Nature and Parks Authority, and (C) courtesy of the Israel Antiquities Authority (photographs by Anat Avital). (D–F) Photographs by and courtesy of Yehuda Guvrin.

*Category 1.* The first category is characterized by very long fruits with a ratio of length to broadest width of  $\geq 4:1$ . Such fruits are portrayed in seven mosaics at seven localities (Fig. 8A–G). A partially preserved image is present in the corner for the summer season, just outside the zodiac (Fig. 3A), in the synagogue mosaic at Zippori (Fig. 8A). The fruits are brown and each has orange–yellow tiles at one end to depict the withered corolla. Of the two fruits, the one that has been more completely preserved is bulbous at the preserved end and narrows towards what would have been its peduncle end. At Mamshit, within a rectangular medallion measuring  $26 \times 20$  tesserae and having a white background, are two cylindrical objects that are narrow towards one end and the broader end is acute (Fig. 8B). At Qeriyot, within the acanthus scroll, two fruits, quite long and a bit twisted, one only partially preserved, are depicted with a black outline and brown interior having a darker brown, longitudinal stripe (Fig. 8C). They are bulbous at one end and quite narrow at the other. Next to them is what appears to be a cross-cut piece, showing the same black outline and brown filling, but with black dots, perhaps to indicate hollow placental cavities. Three

fruits with their peduncles are illustrated at the Martyr Church, in a square medallion having an off-white background (Fig. 8D). The fruits are outlined in blue–grey and have an off-white fill that is shaded to grey, evidently to depict shading, on one side. The fruits are narrower towards the peduncle end. At Midras, part of a very long fruit appears, the peduncle end of which is missing (Fig. 8E). This fruit is light green, but pale yellow on one side, which perhaps was the ground-facing side of the fruit or perhaps depicts the play of light and shadow. At Dominus Flevit, the mosaic has a circular medallion within which is a very long fruit with its peduncle. The fruit is narrower towards its peduncle end and bulbous near the stylar end, consisting mostly of light blue, yellow and olive green tiles (Fig. 8F). Each of two diamond-shaped medallions at Abu Hof contains an image of a fruit that is quite long, curved and dark-coloured, mostly with brown and black, the more complete image showing obvious narrowing at the peduncle end (Fig. 8G).

*Category 2.* The second category has fruits that are less elongate, having a length-to-width ratio of approximately 3:1, and are

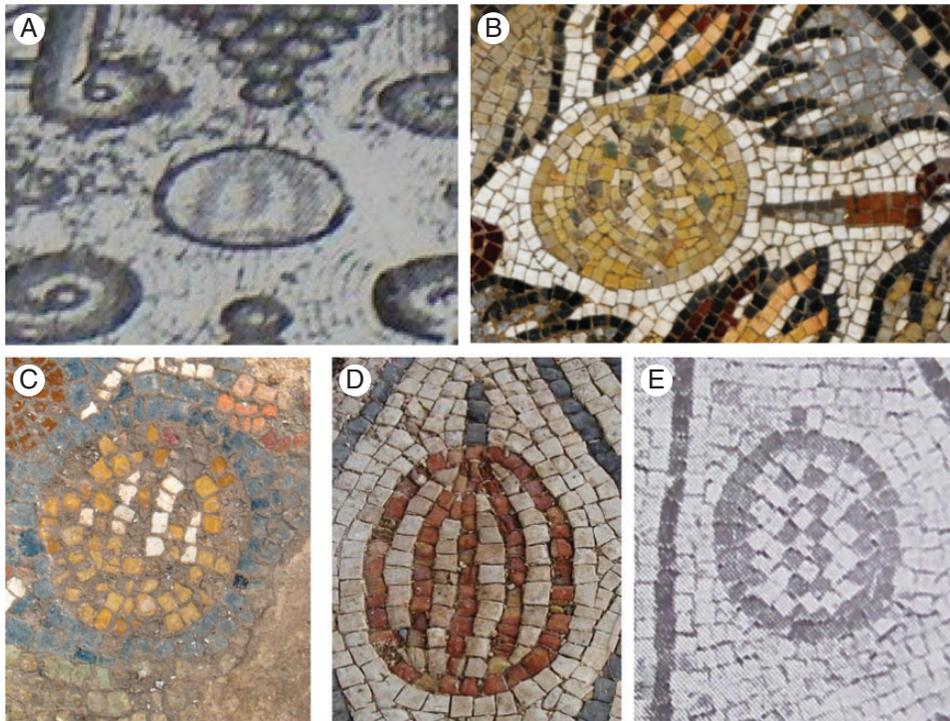


FIG. 6. Images of round cucurbits in mosaics dated 350–567 CE. (A) Centred among grape clusters, Shiqmona (Biran, 1964). (B) Adjacent to a kitchen knife, Nahariyya. (C) In a large basket, Midras. (D) Lady Mary Monastery, Bet She'an. (E) Lady Mary Monastery, Bet She'an (Fitzgerald, 1939). (B) Photograph by David Musri and courtesy of the Edge Center of Arts, Culture, and Society, Nahariyya, (C) is courtesy of the Israel Antiquities Authority and (D) is courtesy of the Israel Parks and Nature Authority. Photographs (C) and (D) are by Anat Avital.

narrow towards the peduncle and tend to bulb at the stylar end. Such fruits are portrayed, numerous times, in one mosaic, at Kursi. They appear in quartets of diamond-shaped medallions aligned in rows. Each medallion contains two or three fruits, together with their peduncles, outlined in grey and filled with grey, darker towards one side, with shrivelled grey sepals or petals still attached (Fig. 8H).

*Category 3.* The third category also has fruits of length-to-width ratio approximating 3:1, gradually narrowing from the centre to the peduncle end, but these tend to be larger and have a nearly uniform diameter from the centre to near the stylar end, which is usually capped with a differently coloured circular region. Such fruits are portrayed in nine mosaics at eight localities (Fig. 9). In the synagogue at Zippori, in the corner of the winter season within the square enclosing the zodiac (Fig. 3B), there is a partially preserved image of a tapered cylindrical object, mostly yellow–brown- and tan-coloured (Fig. 9A). The broader end is outlined and consists of alternating grey and white tiles. At Qeriyot, within the acanthus scroll are two depictions of tapered cylindrical objects. They are outlined in black with a brown body and, at the broader end, white dots are intermingled with dark brown (Fig. 9B, C). At the Martyr Church in Bet She'an, there is a clear and very well-preserved image, within a square medallion, of two tapered cylindrical objects (Fig. 9D). They appear on an off-white background and are mostly yellowish brown, with lengthwise yellow and white towards the middle, probably to indicate illumination. At the broader ends of the tapered cylinders there is a circular area

consisting of chequered black and white tiles. The frame of the mosaic at Bet Alfa encloses a grapevine scroll, in the medallions of which appear portrayals of various animals and fruits. One of the medallions contains three tapered cylindrical objects, two yellow and one light brown, without the play of light and shadow, outlined with dark grey (Fig. 9E). At the broader end of each cylindrical object is a circular area defined by dark grey but all of the tiles within are off-white. Within this same mosaic, outside the zodiac in the corner of summer (Fig. 3C), there is again an image of three tapered cylindrical fruits, two yellow and one brown, outlined with dark grey (Fig. 9F). Although these three lack the circular outline at the broader end, given their nearly identical shape and similar colours they appear to represent the same fruits as does the depiction at Midras (Fig. 2B) of two tapered cylindrical fruits, one dark brown and the other light brown (Fig. 9G). At Na'aran (Ain Douq), in a semi-circular medallion, there is a somewhat stylized image of two similar-looking fruits, with the rounded outline at the broader end of the cylinder containing alternately coloured tiles (Fig. 9H). At the Al-Hammam Chapel, Bet She'an, greater stylization, allowing identification only after comparison with the previous, is evident in an image of three conical objects within a circular medallion, each having a well-defined broad end filled with alternately coloured tiles (Fig. 9I). At Kursi, in diamond-shaped medallions, there are pairs of tapered cylindrical fruits, outlined with yellow and grey and filled with light yellow. Each of these fruits has a well-defined demarcation of the broad end that is filled with alternating yellow and white tiles (Fig. 9J). At Dominus Fleuit in Jerusalem, in a circular

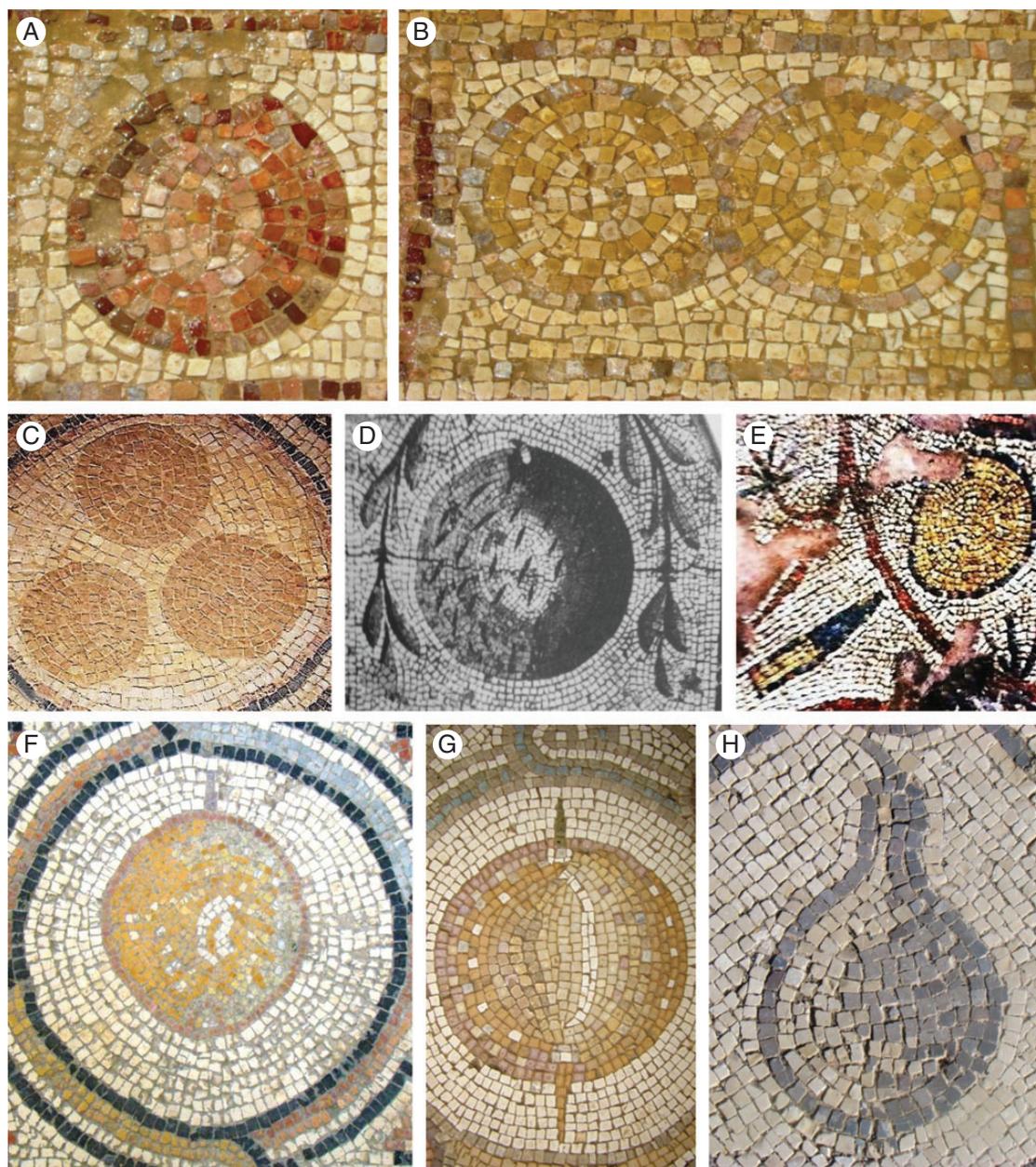


FIG. 7. Images of round cucurbits in mosaics dated 425–600 CE. (A, B) Mamshit. (C) Mezada. (D) Between two olive branches, Bet 'Anot (Magen, 1992). (E) Adjacent to a kitchen knife, Gan Yavne (Sion *et al.*, 2010). (F) John the Baptist Chapel, Jerusalem. (G) Dominus Flevit Oratorium, Jerusalem. (H) Kursi. Photographs (A–C) and (H) are courtesy of the Israel Parks and Nature Authority, (F) courtesy of the Monastery Mother and (F, G) courtesy of the Israel Antiquities Authority. Photographs (A–C) and (F–H) are by A. Avital.

medallion, there is an image of a large, tapered cylindrical fruit, consisting mostly of light yellow–orange and light purple tiles (Fig. 9K).

*Category 4.* The fourth category also has fruits of length-to-width ratio approximating 3:1, gradually narrowing from the centre to the peduncle end and having a nearly uniform diameter from the centre to near the styler end. These fruits, though, tend to be smaller. They are portrayed in four mosaics (Fig. 10). In the Nile Festival Building at Zippori, the cornucopia (Fig. 2A) contains two rather small objects of this shape, mostly yellow with a

white circular area at the broad end, outlined in brown; a cross-cut fruit, mostly white but with five evenly spaced pink tiles, is adjacent (Fig. 10A). At Bet Alfa, outside of the zodiac in the corner representing the summer season (Fig. 3C), there are three fruits, with their peduncles, which are mustard yellow, outlined with brown (Fig. 10B). At Lady Mary, Bet She'an, in a diamond-shape medallion, there is a fruit of tapered cylindrical shape, but with an orange and blue–grey outline and white interior (Fig. 10C). Two triangular blue–grey tiles extending from the broad end of the fruit indicate the adhering calyx. At Dominus Flevit, Jerusalem, in two circular medallions, there are images

TABLE 3. Localities, descriptions and probable identities of images of elongate cucurbits

Locality	Figure	Approximate number of tiles constituting cucurbit image(s)	State of preservation of cucurbit image(s)	Probable taxonomic identity (degree of certainty)*
Zippori (Nile Festival)	10A	45	Fine	<i>Luffa aegyptiaca</i> (medium)
Zippori (Synagogue)	8A, 9A	180	Fine	<i>Cucumis melo</i> + <i>Luffa aegyptiaca</i> (high + high)
Mamshit	8B	70	Good	<i>Cucumis melo</i> (high)
Bet She'an (Martyr)	8D, 9D	125 + 200	Fine	<i>Cucumis melo</i> + <i>Luffa aegyptiaca</i> (high + high)
Qeriyot	8C, 9B, C	180 + 180	Fine	<i>Cucumis melo</i> + <i>Luffa aegyptiaca</i> (high + high)
Bet Alfa	9E, F, 10B	50–250	Fine	<i>Luffa aegyptiaca</i> (high)
Midras	8E, 9G	77 + 50–75	Poor	<i>Cucumis melo</i> + <i>Luffa aegyptiaca</i> (medium + high)
Na'aran	9H	400	Fine	<i>Luffa aegyptiaca</i> (high)
Bet She'an (Al-Hammam)	9I	200	Fine	<i>Luffa aegyptiaca</i> (high)
Bet She'an (Lady Mary)	10C	70	Fair	<i>Luffa aegyptiaca</i> (low)
Kursi	8H, 9J	90–140, 160	Good	<i>Cucumis melo</i> + <i>Luffa aegyptiaca</i> (medium + high)
Abu Hof	8G	200	Fine	<i>Cucumis melo</i> (high)
Jerusalem (Dominus Flevit)	8F, 9K, 10D, E	90, 100–200	Fine	<i>Cucumis melo</i> + <i>Luffa aegyptiaca</i> (medium + medium)

\*Taxonomic identifications vary in degree of certainty, according to the number of tiles per image, the image's state of preservation, its exactness and degree of realism, and clarity of features distinguishing among taxa. The most certain identifications are for the images at Zippori (Synagogue), Bet She'an (Martyr) and Qeriyot; the least certain is for the image at Bet She'an (Lady Mary).

of fruits that are cylindrical but tapered from the centre towards the peduncle end (Fig. 10D, E). These two images consist of grey, light grey, olive green and yellow tiles.

## DISCUSSION

The mosaics of the Near East are precious historical documents that can provide information no less valuable than and complementing that which can be gleaned from contemporary literature (Bowersock, 2006). Nearly all of the floor mosaics in Israel were composed during the period ~350–600 CE, under Byzantine domination (Roussin, 1985; Ovadiah, 2002; Mucznik *et al.*, 2004), and no other iconographic medium in Israel is as evenly and widely distributed over this time frame (Kitzinger, 1965). However, the degree of confidence with which mosaic images can be interpreted is limited by factors inherent to mosaic composition itself.

Foremost, mosaics are limited in their power of resolution, which is largely dependent on the size of the tiles constituting them. The mosaics of Israel average only 100–130 tiles per square decimetre (A. Avital, PhD Thesis, in preparation). Specifically with regard to the mosaic images of cucurbits, the number of tiles used to depict each fruit largely determines the informative power of the image and the degree of confidence with which it can be interpreted and identified taxonomically. Hence the image of a round cucurbit in the Church of the Nativity that consists of ~1500 tiles (Fig. 4C) is far more easily and confidently identified than its counterpart at Bet Loya (Fig. 5C), which has <100 tiles (Table 2).

The colours used to compose a mosaic are limited to those that were readily available locally or could be imported and purchased within the available budget of its patron. The predominant colours differ among localities, e.g. reds, yellows and browns at Zippori (Figs 2A, 3A, B, 5A, B, 8A, 9A and 10A) and greys at Kursi (Figs 4G, 7H and 8H). Green must have been too scarce or expensive to use to represent large objects, as foliage is often depicted as dark brown, light brown, maroon, pink, orange, yellow, grey, blue–grey or black. As external colour is an often-used literary diagnostic for differentiating between melons (yellow) and

watermelons (green) (Amar, 2000; Paris *et al.*, 2012b), the unavailability of green needs to be taken into account in attempting to interpret and taxonomically identify mosaic images of round-fruited cucurbits.

Finally, as works of art, mosaics were intended to be decorations, not chronicles. The artists were apt to draw and colour objects 'neither quite as they were known to be nor as they are seen', the mental picture predominating over the actual physical image (Schapiro and Avi-Yonah, 1960). Often it is not possible to know with certainty what the artist had in mind or the possible symbolism the image invoked (Caneva *et al.*, 2014).

The mosaics and their contents have been subjected to intensive scrutiny by archaeologists and historians. Images of traditional crops of the Land of Israel, such as grapes, pomegranates, figs and citrons, have been recognized as such and garnered much attention. However, the cucurbit images in the mosaics of Israel have attracted little interest and often have been mistakenly identified as farm tools, household items or fruits of other plant taxa, such as carob, *Ceratonia siliqua* L. (Fabaceae). We systematically searched the mosaics of Israel for cucurbits and are able to confidently identify images in 23 mosaics at 18 localities as representing members of the Cucurbitaceae (Table 1). Thus, of the 134 Israeli mosaics containing images of agricultural plants or plant parts, 17% contain one or more images of cucurbits. To our knowledge, both this frequency as well as the variety of cucurbit portrayals in Byzantine mosaics from Israel far exceed those produced in any other province of the Roman and Byzantine Empires, be they in the form of mosaics, paintings or sculpture. Evidently, cucurbits were popular in Israel, which has a warm, sunny climate well suited for their production.

We have attempted to identify each cucurbit image to the species level (Tables 2 and 3). However, these identifications are not unequivocal for many of the images.

### Taxonomic identification of the round cucurbits

The round cucurbits of Category 1, those having prominent longitudinal lobes and furrows, and a protruding or otherwise broad styler scar of the fruit (Fig. 4), are identified as *Cucumis*



FIG. 8. Images of elongate cucurbits in mosaics dated 410–600 CE. (A) Partial image of two fruits with yellow corollas, Zippori synagogue. (B) Two fruits, Mamshit. (C) Two extremely long fruits with cross-cut piece, Qeriyot. (D) Three fruits, Martyr Church, Bet She'an. (E) Among other fruits in a large basket, partial image, Midras. (F) Dominus Fleuit Oratorium, Jerusalem. (G) Two extremely long fruits (one only partially in the photograph), Abu Hof [Israel Antiquities Authority, Archive Excavation File: Alon D, Cohen R, *Ba'ikhat Abu Hidba (Abu Hof)*, A-986/1980]. (H) Two fruits, Kursi. Photographs (A, B, D, H) are courtesy of the Israel Parks and Nature Authority, and (E–G) courtesy of the Israel Antiquities Authority (photographs by Anat Avital). (C) Photograph by and courtesy of Yehuda Guvrin.

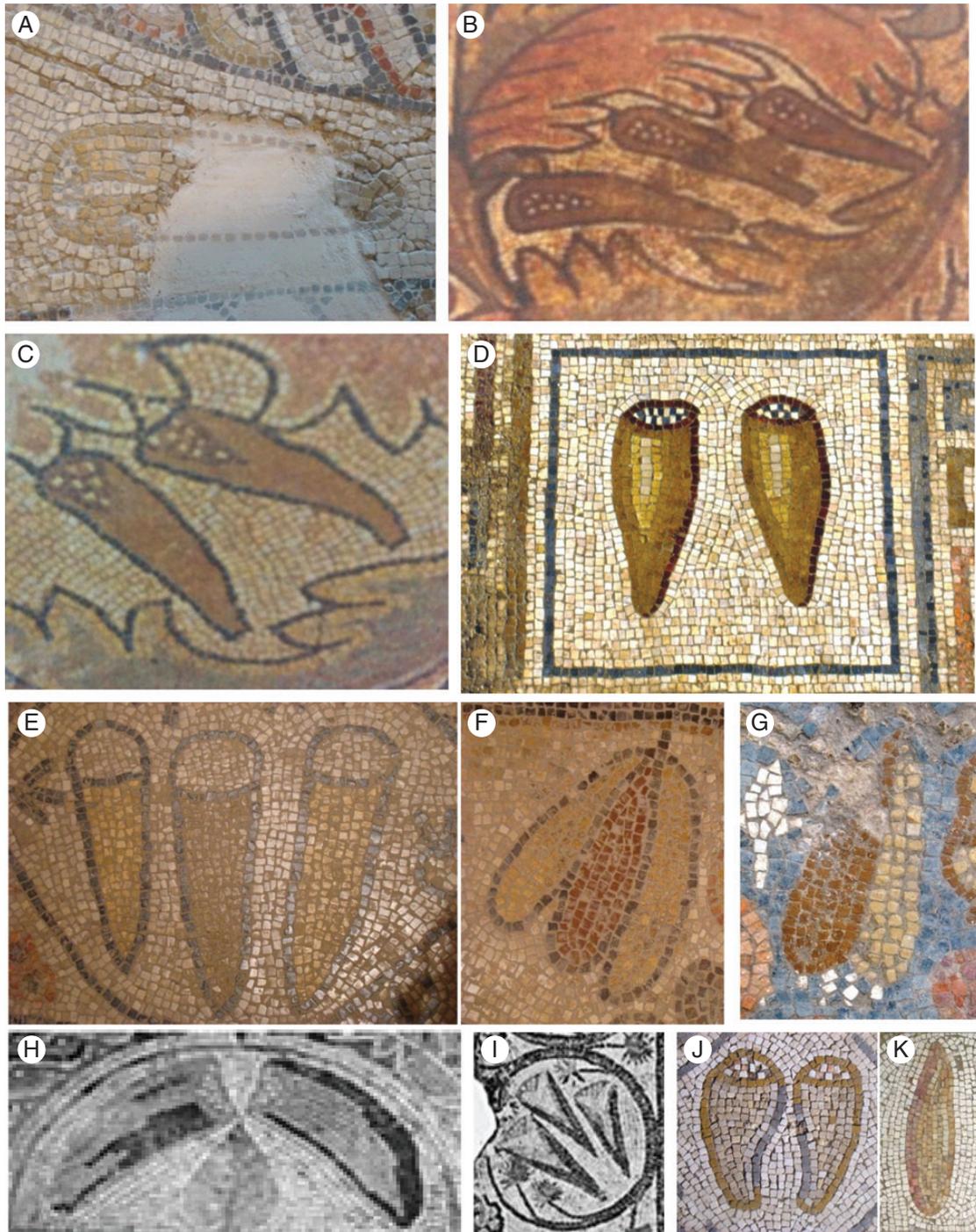


FIG. 9. Images of tapered cylindrical cucurbits, some with a bordered area encompassing alternately coloured tiles near the broader end, in mosaics dated 410–600 CE. (A) Partially preserved image of fruit, synagogue, Zippori. (B) Three fruits, Qeriyot. (C) Two fruits, Qeriyot. (D) Two fruits, Martyr Church, Bet She'an. (E) Three fruits, two yellow and one brown, in mosaic frame, Bet Alfa. (F) Outside zodiac, in corner of summer season, three fruits, two yellow and one brown, Bet Alfa. (G) Two fruits, one brown and one yellow, Midras. (H) Two fruits, Na'aran (Israel Antiquities Authority, Jerusalem, Mandate Record File no. 50, 'Ain Douq). (I) Three cone-shaped objects, Al-Hammam Chapel, Bet She'an (Israel Antiquities Authority, Mandate Record File no. 139, Mastaba). (J) Two fruits, Kursi. (K) Dominus Flevit, Jerusalem. Photographs (A, D–F, J) courtesy of the Israel Nature and Parks Authority, and (G, K) courtesy of the Israel Antiquities Authority (photographs by A. Avital). (B, C) Photographs by and courtesy of Yehuda Guvrin.

*melo* (Table 2). This trait combination, though, is extreme in comparison with extant, modern melons. Melons that are as deeply furrowed together with such prominent styler ends are

absent from the large compendia of Turkmeni (Esen, 2008) and Uzbeki (Mavlyanova *et al.*, 2005) melons, which is significant because the region of Khorasan, Central Asia, is the cradle of

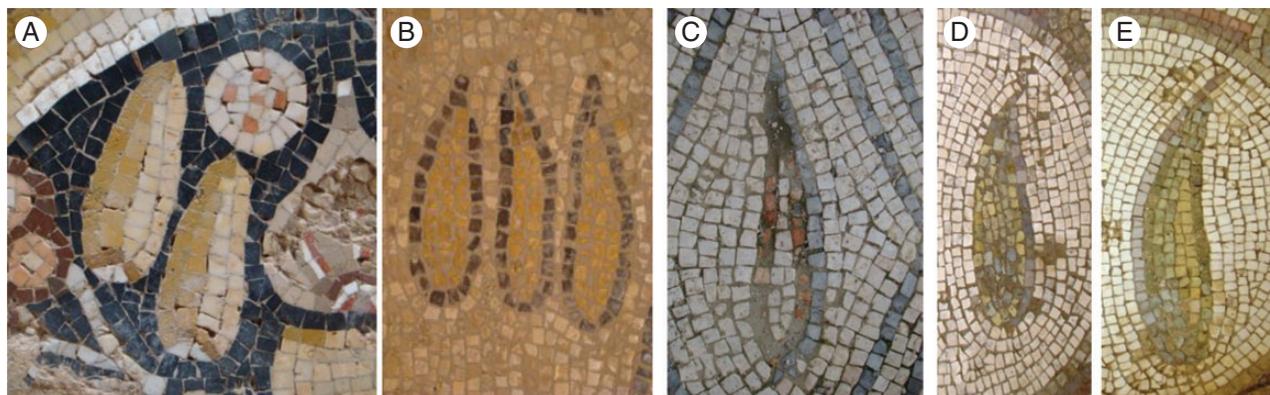


FIG. 10. Images of smaller tapered cylindrical cucurbits, in mosaics dated 400–600 CE. (A) Two fruits with cross-cut third fruit, Nile Festival Building, Zippori. (B) Outside zodiac, in corner of summer season, Bet Alfa. (C) Lady Mary, Bet She’an. (D, E) Two fruits, Dominus Flevit, Jerusalem. Photographs (A–C) courtesy of the Israel Nature and Parks Authority, and (D, E) courtesy of the Israel Antiquities Authority (photographs by Anat Avital).

dessert melon evolution (Paris *et al.*, 2012b). Some melons developed there were probably introduced through western Iran to Turkey and from there to the Mediterranean Basin as well as southeastern Europe, but no melons with a protruding styler end are depicted among traditional cultivars from Turkey and Hungary (Szamosi *et al.*, 2010). A rare heirloom melon, ‘Jenny Lind’, does strongly express these two traits (Goldman, 2002), allowing identification of these images as fruits of *Cucumis melo*. Moreover, the depiction in the underlying, fragmentary mosaic at Bet Alfa shows, in addition to the fruits, part of the plant bearing them, including a stem with leaves. The rounded cordate leaf laminae are exactly like those of plants of *Cucumis melo* (Paris *et al.*, 2012b). These melons are likely the *melopepo* that Pliny, in 77 CE, described as a new introduction resembling a quince (*Cydonia oblonga* Mill., Rosaceae) (Janick *et al.*, 2007), a fruit that typically is lobed and round but protrudes towards one end, and is yellow when ripe but not particularly sweet (see <http://theindianvegan.blogspot.co.il/2013/03/all-about-quince.html> and <http://www.fotosearch.com/photos-images/quince.html>). Pliny further described the fruit as odoriferous and tending to detach from the plant when ripe, and peduncles are absent from the fruits at Tel Bazul (Fig. 4E) and in the Martyr Church at Bet She’an (Fig. 4F). The *melopepo*, though, was not praised by Pliny or any other authors of Roman antiquity (Hedrick, 1919). The climate of Israel, particularly the rainless production season, facilitates the development of consistently higher quality in melons (Karchi, 2000), perhaps accounting for their local popularity. Apparently, the *melopepo* was a melon of the Adana Group, cultivars of which are diverse morphologically but have in common thin, mealy, rather insipid but pleasant-tasting flesh. Such melons have been grown in the environs of Adana, southern Turkey, until modern times (Cizik, 1952; Pitrat *et al.*, 2000; Jeffrey, 2001).

The round cucurbits of Category 2 and Category 3, those having a large, broad, circular styler scar (Fig. 5A, B) or a small depression (Fig. 5C, E) and/or oblate shape (Fig. 5D–F) are also identified as *Cucumis melo* (Table 2). The small depression represents the point at which the fruit was attached to the peduncle. Detachment of the fruit from the peduncle upon ripening occurs only in melons (Robinson and Decker-Walters, 1997). These images may be of the same melon cultivar as Category 1;

the images are simply not large enough to allow depiction of furrows (Fig. 5A–C) or not reproduced clearly enough to distinguish them (Fig. 5E, F). Indeed, in one of the images of a melon at Qeriyot, the darker tiles are in a radial arrangement (Fig. 5D). Protruding or otherwise large styler scars as well as oblate fruit shape are associated with cultivars having perfect (hermaphroditic) flowers rather than female (pistillate) flowers (Robinson, 1978; Noguera *et al.*, 2005; Loy, 2005–2006). Therefore, these melons must have been andromonoecious, like most extant dessert melon cultivars, with the undesirable protruding styler scar subsequently reduced by breeding. These melons of the early Byzantine era were probably not sweet by modern standards (Hedrick, 1919; Paris *et al.*, 2012b) but nonetheless were widely distributed in Israel, from Zippori to Qeriyot (Fig. 1, Table 2).

The round cucurbits of Category 4, those distinguished by the distinct longitudinal striping of the fruits (Figs 5E, F and 6), are identified, with varying degrees of confidence, as watermelon, *Citrullus lanatus* (Table 2). The stripes of the large round cucurbit depicted in the mosaic at Shiqmona have jagged edges, achieved by the diagonal laying of tiles (Fig. 6A). Unlike the melon depicted in the underlying mosaic at Bet Alfa, though, the diagonal pattern was not done to obtain a narrow width. Quite the opposite, the stripes of the fruit at Shiqmona are several tiles thick. The broad, jagged stripes mimic those of watermelons. At Qeriyot, the four round cucurbit fruits, grey and more or less radially dotted with black (Fig. 5E, F), resemble small narrowly striped watermelons. Thus, two cultivars of watermelon are definitively represented, one at Shiqmona with broad stripes and one at Qeriyot with narrow stripes. The round cucurbit at Nahariyya has single rows of radially arranged green (and grey, where the green is eroded) tiles that are set diagonally (Fig. 6B), like the darker yellow tiles of the melon in the lower mosaic at Bet Alfa (Fig. 5A). However, there is no obvious styler scar and, apparently, the special green tiles were used to mimic narrow, acutely edged, dark green stripes of a watermelon. The radially marked round cucurbit fruits at the Lady Mary Monastery, Bet She’an (Fig. 6D, E) most likely represent striped watermelons, too, but would be of two cultivars, one with broad striping (Fig. 6D) and the other with narrow striping (Fig. 6E). However, these images consist of relatively few

tiles and therefore cannot be identified as watermelons with the same confidence as the images at Shiqmona and Qeriyyot. The fruit depicted at Midras (Fig. 6C) also has few tiles and is poorly preserved. It is mostly yellow with some radially arranged white tiles set as if to represent broad stripes but, as some light green tiles are used to depict a long cucurbit adjacent (Fig. 8E), the identification of this image as watermelon is less certain.

The round cucurbits of Category 5, unmarked by furrows, protrusions, indentations or stripes (Fig. 7A–G), are also identified, but with a generally lower degree of confidence, as watermelons, *Citrullus lanatus* (Table 2). The round, red cucurbit at Mamshit (Fig. 7A) most likely represents a dark-rinded watermelon (Table 2), the red colour used due to the unavailability of green or perhaps to indicate the red colour of the fruit flesh. The image of two adjacent, grey-outlined, round objects, mostly yellow–orange with circularly distributed white tiles (Fig. 7B), has striking resemblance to an equatorially cut, yellow–orange-flesh watermelon having light-coloured seeds ([http://www.victoryseeds.com/watermelon\\_orange-flesh.html](http://www.victoryseeds.com/watermelon_orange-flesh.html)). Sweet dessert watermelons have been thought to be derived from citron watermelons (Rubatsky, 2001). Citrons, which are used for cooking and making preserves, have hard, insipid white flesh. Sweet watermelons, on the other hand, have tender, coloured flesh. If the interpretation of this image as a cut watermelon having coloured flesh and white seeds is correct, then it is highly likely that sweet watermelons were known in southern Israel in the early fifth century, contradicting the thesis by Watson (1983) that sweet watermelons were first introduced to the Mediterranean Basin from southern Asia by Islamic traders.

The round fruits of Category 5 depicted in the mosaics at Bet ‘Anot (Fig. 7D), John the Baptist Chapel (Fig. 7F) and Dominus Flevit (Fig. 7G), as well as the Category 4 fruit depicted at Nahariyya (Fig. 6B), show lightening not only at the centre, the area nearest the viewer, but also towards a side. Apparently, this nuance was used to mimic the reflection of light on a glossy surface, like that of watermelon fruits (<http://agsyst.wsu.edu/watermelonphotos.html>).

The fruit at the John the Baptist Chapel in Jerusalem (Fig. 7F) is quite glossy, like watermelon (Table 2). However, the thin circular ring near the lower end of the fruit perhaps represents a depression or a stylar scar; the latter would be suggestive of andromonoecism, which is an uncommon occurrence in modern watermelons. Possibly, this image is a composite depiction of watermelon and melon. Indeed, the yellow–orange and yellow–grey fruit depicted in the nearby, contemporary mosaic at Dominus Flevit has two peduncles, one grey and one yellow–orange (Fig. 7G), perhaps an attempt by the artist to represent, in one image, both watermelon and melon.

Other images of unmarked round fruits, Category 5, are found in the mosaics at Mezada (Fig. 7C) and Gan Yavne (Fig. 7E). These images do not depict gloss; instead they are uniformly plain yellow. Yellow is otherwise common in these two mosaics whilst green is absent, and therefore it is not possible to know with certainty whether the artists attempted to depict melon or watermelon. However, in the mosaic at Mezada there is an image of a plant that is depicted as having yellow leaves and in the image at Gan Yavne a knife is depicted next to the fruit that closely resembles the one shown with the large globular glossy fruit depicted in the mosaic at Nahariyya (Fig. 6B). Thus, these images appear to represent watermelons (Table 2).

To summarize, watermelons, *Citrullus lanatus*, are identified with a high degree of confidence in the mosaics at Shiqmona and Qeriyyot. They also appear to be represented in as many as nine other mosaics, at Mamshit, Nahariyya, Bet ‘Anot, Lady Mary, Midras, Mezada, Gan Yavne, John the Baptist Chapel and Dominus Flevit, for a total of 11 mosaics at ten localities (Table 2). Fruits of at least two cultivars of watermelons are portrayed, broad-striped (Fig. 6A, C, D) and narrow-striped (Figs 5E, F and 6B, E), as well as perhaps two others, non-striped dark (Fig. 7A,D) and non-striped light (Fig. 7C,E,F,G). In comparison with the thickness of their peduncles, the fruits depicted at Shiqmona (Fig. 6A) and Bet ‘Anot (Fig. 7D) are rather large, but most of the watermelon fruits, particularly at Lady Mary (Fig. 6D, E), appear to be relatively small, and at Qeriyyot (Fig. 5E, F) the watermelons are clearly smaller than the adjacent melons. If our interpretations of these mosaic images are correct, watermelons, in spite of their generally small size, were nonetheless widely distributed, from the northernmost locality, Nahariyya, to the southernmost, Mamshit (Fig. 1). However, some of these images might represent melons, especially the ones at Midras (Fig. 6C), Mezada (Fig. 7C) and Gan Yavne (Fig. 7E), and the images at John the Baptist (Fig. 7F) and Dominus Flevit (Fig. 7G) might be composite representations. Thus, although round melons are identified with certainty in ten mosaics (Table 2), together with the images of uncertain identity and two possible composite images, round melons might be represented in 15 or more of the 23 mosaics.

The round cucurbits of Category 6, the round–pyriform fruits at Kursi (Fig. 7H), appear to represent bottle gourds, *Lagenaria siceraria*. The large size and roundness of the fruits indicates that they were from a bottle-gourd cultivar that was not grown for culinary purposes. The flesh of bottle gourds collapses and desiccates as the fruit senesces, and then can be easily removed, together with the seeds, by hand after cutting a small hole in the top of the fruits. Round–pyriform bottle gourds were probably grown for use of the senesced fruits as vessels for transferring water or other liquids (Heiser, 1979; Janick *et al.*, 2007). Thus, the presence of such fruits at Kursi, on the shore of the freshwater Sea of Galilee (Fig. 1), would not be entirely coincidental.

#### Taxonomic identification of the elongate cucurbits

The elongate cucurbits of Category 1, those having very long fruits (length-to-broadest width ratio  $\geq 4:1$ ), portrayed in seven mosaics (Fig. 8A–G), are identified as snake melons, *faqqous*, *Cucumis melo* Flexuosus Group. Some bottle gourds can have similar relative dimensions, but these usually have bulging peduncle ends (Janick *et al.*, 2007). In five of these mosaics, the very long fruits do not have a bulging of the peduncle end (Fig. 8B–D, F,G). In the other two (Fig. 8A, E), the peduncle end of the fruit has not been preserved, but in one of these the withered petals are represented, and they are orange–yellow, not white (Fig. 8A). Therefore, six of the seven portrayals of very long fruits cannot be bottle gourds. The presence of snake melons in mosaics from the northern locality Zippori to the southern locality Abu Hof (Fig. 1) indicates that they were a widely grown crop in Israel during the fifth and sixth centuries, as they had been in earlier times (Paris, 2012). Moreover, the fruits of at least two snake melon cultivars are portrayed, those at Qeriyyot (Fig. 8C) and Abu Hof (Fig. 8G) being from a cultivar bearing

extremely long fruits, obviously longer than those at other localities (Fig. 8A, B, D, F). Interestingly, in the same summer-season corner of the synagogue at Zippori, there appears next to the snake melons a sheaf of grain (Fig. 3A). On the other side of the woman, in this same corner, is a sickle for harvesting of grain and a long, two-pronged tool that, correspondingly, appears to have been used to harvest the snake melons. This tool may have facilitated detaching the fruit from the plant at the peduncle, thereby preventing breakage of the very long, narrow fruit, as well as reducing bending of the person harvesting the fruit.

The elongate cucurbits of Category 2, bulbous and having a length-to-width ratio of  $\sim 3:1$ , are identified as ‘*ajjour*’ (adzhur) melons, also known as chate melons. They are depicted in only one mosaic, at Kursi (Fig. 8H). Evidently, these shorter melons were not as widely popular as the snake melons.

The elongate cucurbits of Category 3, differing in shape from the *faqqous* and ‘*ajjour*’ melons, appear in nine of the mosaics (Figs 9 and 10), six of which are at Jordan Valley localities (Tables 1 and 3). This cucurbit has a cylindrical shape, gradually narrowing from the centre to one end and is either non-tapered or tapering to slightly broader towards the other end, which in seven of the mosaics is marked off from the rest of the fruit. In six of these, the area at the broad end consists of tiles in a chequered arrangement of alternating colours (Fig. 9A–D, H–J). We believe that these images represent sponge gourds, *Luffa aegyptiaca* Mill. [syn. *Luffa cylindrica* (L.) M.J. Roem.].

Sponge gourds are native to the Old World tropics (Heiser, 1979; Robinson and Decker-Walters, 1997; Marr *et al.*, 2005). Fruits can grow to a length of 30 cm or more. When small and immature, sponge gourd fruits are green and succulent, and can be consumed as a vegetable after being cooked. As sponge gourd fruits mature, they desiccate, the thin rind changing from green to brown or yellow and essentially becoming an envelope enclosing an off-white spongy network of fibres, which is widely used to the present day for washing and scrubbing. At physiological maturity, the circular cap (operculum) around the styler end of the fruit often breaks off, revealing the sponge, which encloses rather large ( $\sim 1.5$  cm long), flat, black seeds (see [www.cucurbit.org](http://www.cucurbit.org); <http://www.luffa.info>). The outline encompassing the chequered area at the broader end of the fruit, which appears in seven of the mosaic images (Fig. 9A–D, H–J), would thus represent the light-coloured sponge in which are dispersed dark-coloured seeds. The image at the Martyr Church in Bet She’an (Fig. 9D) correctly depicts the mature seeds and sponge as black-and-white chequered tiles. Next to the sponge gourd portrayed in the synagogue at Zippori (Fig. 9A) is a billhook, which probably was used to harvest sponge gourds, much as the adjacent hatchet was used to prune or chop branches of trees (Fig. 3B). The image in the frame of the mosaic at Bet Alfa (Fig. 9E), with its circular outline at the broad end lacking chequering, would depict the fruit after shaking out or removal of the seeds. Other images, at Bet Alfa (Fig. 9F), Midras (Fig. 9G) and Dominus Flevit (Fig. 9K), depict the fruits without or prior to dehiscence of the operculum.

The elongate cucurbits of Category 4, tapered from the centre to narrow at one end and broad and non-tapered towards the other end but appearing to be smaller than those of Category 3, are depicted in four mosaics, two of which are in Jordan Valley localities. Apparently, these are depictions of young sponge gourds

(Table 3). The circular area at the broader end of both fruits at Zippori (Fig. 10A) probably represents the styler scar with attached, withered flower parts (<http://www.jonisare.com/recipes-demystifying-angled-luffa-and-smooth-luffa>) and the pink stones among the otherwise white area of the cross-cut fruit represent immature seeds in the white fruit flesh (<http://www.luffa.info>). The difference in fruit size of the cylindrical fruits is clearly evident at Bet Alfa (Figs 3C and 10B). In the image at Lady Mary (Bet She’an) (Fig. 10C), the adhering calyx is evident and at Dominus Flevit (Jerusalem) (Fig. 10D, E), some of the composing tiles are olive green. The images of both mature and young sponge gourds indicate that this cucurbit was grown in Israel for its sponges and as a food crop during Byzantine times, and at Zippori, Bet Alfa and Dominus Flevit it was a dual-purpose crop (Figs 9A, E, F, K and 10A, B, D, E). Sponge gourds were distributed from Kursi in the north to Qeriyyot in the south (Fig. 1).

The sponge gourd has not been found in ancient Egyptian plant remains (Vartavan and Amoros Asensi, 1997) and is not present in mosaics from other countries that were within the vast areas under Roman and Byzantine domination (Kumbaric and Caneva, 2014). Apparently, the mosaics at Zippori, dating to 400 and 410 CE, contain the oldest known portrayals of fruits of the genus *Luffa* (Tables 1 and 3).

#### Comparisons with literary evidence, Israel, 200–400 CE

In the late second-century Hebrew-language book of Jewish law, the *Mishna*, four edible-fruited cucurbit crops are named repeatedly, the *avattihim* (watermelons), *melafefonot* (round melons), *qishu’in* (inclusive of snake melons and adzhur melons) and *delu’in* (bottle gourds). Snake melons, watermelons and round melons are represented in the mosaics, but the edible, long-fruited bottle gourds appear to be absent, and only a utilitarian form is portrayed. Three kinds of *delu’in*, bottle gourds, were discussed in the *Mishna* (Feliks, 1967; Janick *et al.*, 2007). These were the Greek, which is thought to have been a long-fruited esculent, the Egyptian, also known as the Aramean, which was not an esculent and probably grown for its large, mature fruits, and the small-fruited, bitter *ramoza*. The mosaics do not have a depiction of what appears to be an elongate bottle gourd, except perhaps for the incompletely preserved image in the mosaic at Midras (Fig. 8E). The mosaic at Kursi has depictions of what would be the Egyptian bottle gourd (Fig. 7H). The mosaics at Lady Mary, Kursi and Dominus Flevit have images (not presented) of a small, more or less pyriform fruit that might represent the *ramoza*, or perhaps something else.

The sponge gourd is not mentioned in the *Mishna* and, indeed, appears to be absent as well from the literature of Greek and Roman Antiquity. The *qarmulin* or *qarumalim* of the late third-century Hebrew-language *Tosefta* was understood by Löw (1928) to refer to sponge gourds, leading Janick *et al.* (2007) to suggest that the sponge gourd was probably a then recent arrival in Israel. The so-called *Jerusalem Talmud* of the late fourth century, written in northern Israel, indicates that sponge gourd fruits were often used as an esculent (Feliks, 1979). The images of sponge gourds at Zippori (Figs 9A and 10A) confirm the presence of this cucurbit crop in northern Israel by the end of the fourth century and use of its young fruits as an esculent and its mature fruits as sponges by that time. The mosaics

of the late fifth century and of the sixth century containing images of sponge gourds are in distant localities, from Kursi (Fig. 9J) in the north to as far south as Qeriyot (Fig. 9B,C), indicating that by then the sponge gourd had become a widely planted crop in Israel.

Collectively, the five cucurbit crops, the *avattihim* (*Citrullus lanatus*), *melafefonot* (round *Cucumis melo*), *qishu'in* (long *Cucumis melo*), *delu'in* (*Lagenaria siceraria*) and *qarmulin* (*Luffa aegyptiaca*), are discussed numerous times in the *Mishna*, *Tosefta* and *Jerusalem Talmud*, especially with regard to planting, tithing and contributions (Janick et al., 2007). Likewise, cucurbits occur frequently in the mosaics of Israel that depict agricultural produce, and some mosaics display three or four cucurbit crops each. At Qeriyot, for example, round melons, watermelons, snake melons and sponge gourds are portrayed (Figs 5D–F, 8C and 9B, C). Counting only one image per crop per mosaic, the 23 mosaics display these five cucurbit crops a total of 41 times whilst in the 134 mosaics portraying agricultural produce there are a total of 404 images of crops (A. Avital, PhD Thesis, in preparation). The percentage of the five cucurbit crops among all crop images in the mosaics is therefore 10.1%. The frequent occurrence and the taxonomical and morphological diversity of cucurbits in the mosaics of Israel are stunning and greater than those reported for mosaics and all other art forms from any other provincial region of the Roman and Byzantine Empires.

Cucurbit fruits that are consumed when immature, the elongate melons and gourds, are mentioned more often in the *Mishna*, *Tosefta* and *Jerusalem Talmud* than cucurbit fruits that are consumed when ripe, the round melons and watermelons (Janick et al., 2007). Yet the round cucurbits are portrayed in more mosaics than the long-fruited ones (Tables 2 and 3). The more frequent mention of immature cucurbits in Jewish literature is attributable in part to its focus on laws of purity, for example, in regard to the removal of the hairs, *piqqus*, on the surface of immature cucurbit fruits (Paris, 2012). On the other hand, the higher frequency of the mature fruits seen in the mosaics may be due to their longer shelf life and the resulting greater availability for illustration or, more likely, a desire to depict providential blessing. Across languages and cultures, ripe cucurbit fruits symbolize abundance, fertility, sexuality and well-being (Norrman and Haarberg, 1980).

#### Comparisons with modern cucurbits

The assortment of cucurbits widely marketed in Israel today differs markedly from that portrayed in the mosaics of the Roman (Janick et al., 2007) and Byzantine empires (Tables 2 and 3). Today, snake melons, adzhur melons, bottle gourds and sponge gourds are only occasionally found at markets in Israel and other Mediterranean lands and Europe (Wright, 2001), having been replaced by relatively recent arrivals, cucumber (*Cucumis sativus*) and squash (*Cucurbita pepo* L.) (Paris, 2000; Paris et al., 2012a). The watermelons of today are, for the most part, larger than those depicted in the mosaics. Modern round melons have non-protruding and smaller styler scars (Robinson and Decker-Walters, 1997) and, moreover, are probably considerably sweeter than any that were available in Mediterranean lands and Europe during Late Antiquity and the Dark Ages (Paris et al. 2012b).

#### Conclusions

Although not of high resolving power and often misleading due to the use of false colours, mosaic images of foliage, flowers and fruits provide evidence for the contemporary presence of particular crops. The portrayals of cucurbit fruits in the mosaics of Israel do not appear to have been copied from elsewhere. Some cucurbit fruits, such as immature melons, have a shelf life of only one to several days and therefore the variations in the mosaic images of them likely reflect the actual local crop varieties that were grown at the time. The mosaics of Israel are richer in depictions of cucurbits than those in other Roman or Byzantine provincial areas. These mosaics provide a view of cucurbit diversity during a time frame corresponding to the late Roman period and early Dark Ages, for which original literary information on food and crops is scarce. The depictions of cucurbit fruits exhibit considerable variation, some of them being nearly round and others noticeably elongate, and represent four species, *Cucumis melo* (melon), *Citrullus lanatus* (watermelon), *Luffa aegyptiaca* (sponge gourd) and *Lagenaria siceraria* (bottle gourd). Of these, the most frequently encountered is melon. Round and/or elongate melons, for consumption mature and immature, respectively, are represented in at least 14 of the 23 mosaics containing portrayals of cucurbits. Watermelons are not often identified with a high degree of confidence, probably due in large part to their having few salient features that could be captured within the limited resolving power of the mosaics. Fruits of at least two cultivars each of snake melons and watermelons are portrayed. The mosaics of Israel contain the earliest known images, dating to 400 CE, of sponge gourds from Mediterranean lands. Sponge gourds are depicted in 11 of these mosaics, most of the images representing mature fruits and some representing immature fruits. Long melons, round melons, watermelons and sponge gourds are portrayed in mosaics from widely scattered localities, indicating that these cucurbits were present throughout much of the country. One mosaic has images of large, round–pyriform bottle gourds that were probably used as vessels.

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