Study of Plant Remains from the Embalming Cache KV63 at Luxor, Egypt

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Abstract. Plant remains from tomb KV63 dating to the XVIIIth dynasty of ancient Egypt (c. 16th–13th BC) have been analyzed using morphological characters. A total of 17 species were identified, and among these ten were used in the production of floral collars, including leaves of pomegranate (*Punica granatum*), olive (*Olea europaea*) and willow (*Salix subserrata*); flowers of low cornflower (*Centaurea depressa*), safflower (*Carthamus tinctorius*) and blue lotus (*Nymphaea caerulea*); fruits of ashwagandha (*Withania somnifera*), date palm (*Phoenix dactylifera*), and papyrus (*Cyperus papyrus*). Linen strings (*Linum usitatissimum*) were used for binding together the various components of the collars. Additional plant fragments identified included barley chaff (*Hordeum vulgare*), pine (*Pinus* sp.), juniper (*Juniperus* sp.) and edible fruits of persea (*Mimusops laurifolia*), doum palm (*Hyphaene thebaica*), Christ's thorn (*Ziziphus spina-christi*), grape (*Vitis vinifera*), olive (*Olea europaea*) and date palm (*Phoenix dactylifera*). The leaves of the latter two trees were observed to be present in all recovered collars. There is a great similarity between the species used in making the collar of the third coffin of Tutankhamun (buried in KV62) and those found in KV63 as well as KV54, which represents an embalming cache associated with KV62. A gilded collar (E4) and many safflower heads were recorded for the first time in KV63. The large number and variety of collars and associated plant remains found in the tomb supports the theory that KV63 was used as an embalming cache.

Keywords: Archaeobotany · Egypt · Embalming cache · Fruits
Flowers · Gilded collar · Leaves · Seeds · Safflower · Tutankhamun

Introduction

The tomb known as KV63 (XVIIIth dynasty, Kings' Valley) was accidentally discovered in 2005 by the University of Memphis Amenmesse Tomb Project, led by Dr. Otto Schaden, in the Valley of the Kings, Luxor (Fig. 1). The archaeological team found KV63 while excavating the remains of workmen's quarters at the entrance to KV10, which was constructed during the reign of Amenmeses of the XIXth dynasty (who was buried elsewhere). Both Theodore Davis and Howard Carter excavated in the area in the early 20th century without removing these particular structures. While exploring a layer of dark rock, excavators suddenly came across chips of white stone, which represented the last level excavated by Carter. Further exploration revealed a

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straight edge of cut stone, which formed the upper lip of a vertical shaft leading to the tomb KV63. The tomb had been concealed beneath workers' quarters that were built on the site a short time after KV63 was sealed.

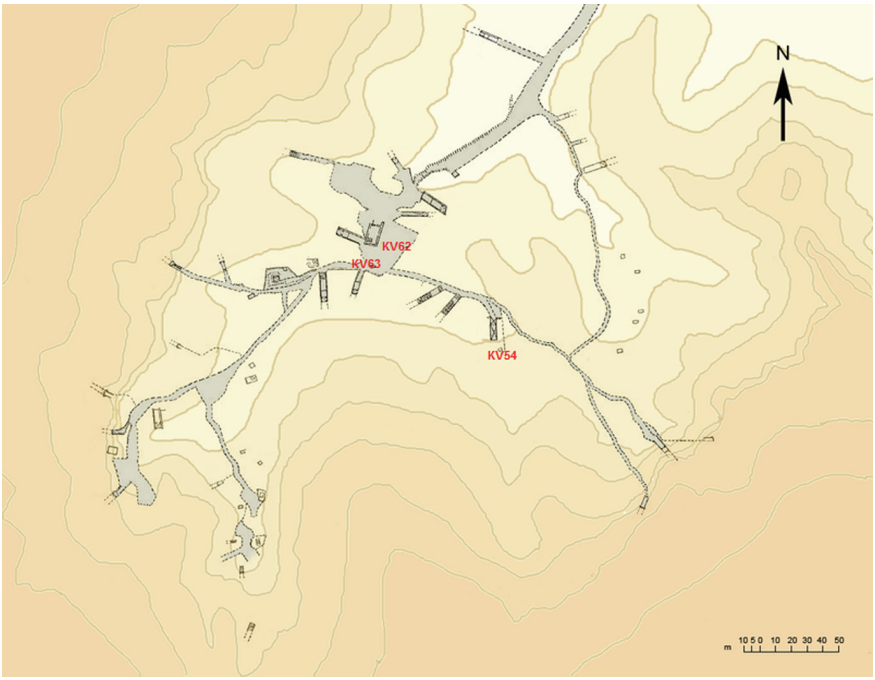

Fig. 1. Location map of KV63, Valley of the kings, Luxor, Egypt.

The discovery that the shaft led to a chamber was announced on 8 February 2006 by the Supreme Council of Antiquities. The shaft descends 5 m and is connected to a doorway that blocked the entrance to an undecorated L-shaped chamber, measuring 4 × 5 m. The chamber (Fig. 2) contained 28 large jars and seven wooden coffins (A, B, C, D, E, F and G). A golden anthropoid coffinette was discovered inside coffin G. No human remains were found inside the coffins, but floral collars and mummification debris were discovered in coffin E, the only sealed coffin which was found in the back corner of the chamber behind other coffins (Schaden 2010). It was initially believed that KV63 was a royal tomb, however, it is now considered to have been a chamber used for the storage of embalming materials.

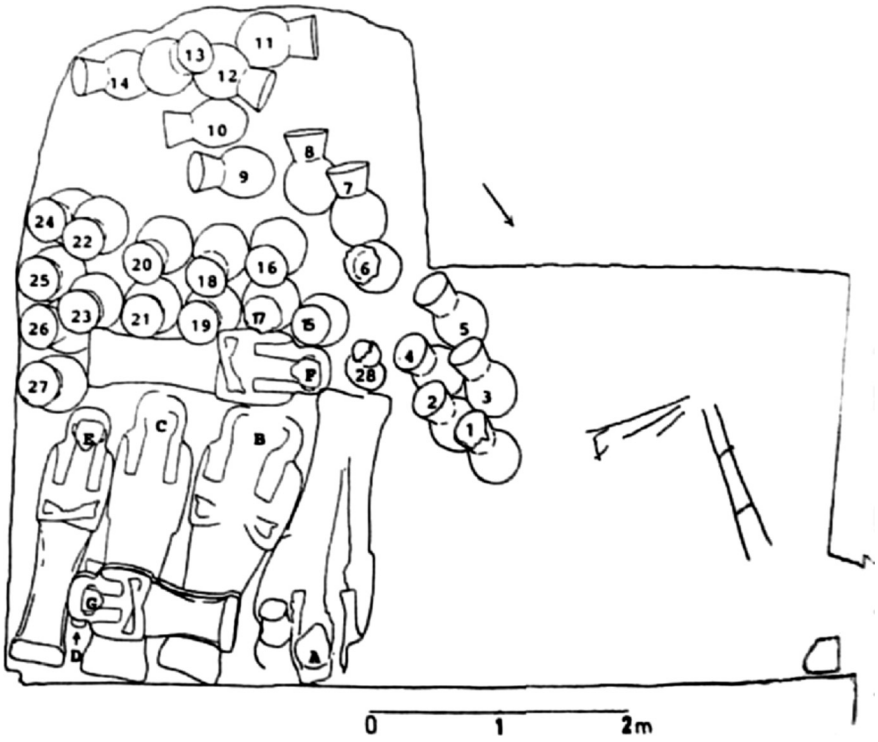

Fig. 2. Chamber plan of KV63, illustrating the arrangement of coffins and pottery jars (Schaden 2009).

Floral Collars in Ancient Egypt

Floral collars in ancient Egypt are usually made of papyrus sheets sewn together to form a backing for strands of individual flowers, petals, fruits or leaves arranged one above the other (Winlock 1941). During the XIXth dynasty (13th–12th BC), 'Nedjemger,' the overseer of the garden of the Ramesseum at Thebes, is depicted in his tomb inspecting the manufacture of collars from fresh plant material (Fig. 3).

In ancient Egypt, floral collars were used in religious and celebratory events (Manniche 1989), placed around the necks of the dead. They were probably worn at the funerary banquet or draped around statuettes (Manniche 1989). The most famous intact floral collar was found upon the innermost coffin around the golden mask of Tutankhamun (Carter number 255a). The ceremonial or banquet dress worn by both sexes was not complete without a floral collar and until the Late Period anthropoid sarcophagi are regularly painted with collars (Kantor 1999). Plants were usually chosen on the basis of colour, fragrance, shape or size, and a particular craft was involved such as twisting, braiding or wrapping the plant materials (Barakat 1986). In addition to floral parts, faience or glass sequin beads were incorporated in the manufacture of collars and

Fig. 3. The picture shows Nedjemger, inspecting the manufacture of collars, Tomb TT138, Sheikh Abd el-Qurna on the west bank of the Nile, opposite to Luxor (Feucht 2006).

were found either in separate strands or alternately arranged with plants. It later became fashionable to wear collars of faience usually made in the form of flowers, leaves or fruits.

According to Kantor (1999), XVIIIth dynasty floral collars retrieved from archaeological sites in Egypt, especially those of Tutankhamun, have interested many botanists to identify botanical and other materials used in the design and production of collars, including Newberry (1927), Germer (1989), Manniche (1989), Hepper (1990) and Vartavan (1999). In addition, Winlock (1941, 2010) described collar-like floral garlands held by the New York Metropolitan Museum of Arts, which were found in pottery jars discovered by Davis (1907–1908) in a pit near the entrance of Tutankhamun's tomb. These are believed to have been accessories used during burial ceremonies of the young king, and were gathered afterwards and packed away in jars, which seems to have been the custom in Egyptian royal burials (Carter 1927).

This study aims to identify the botanical materials found in tomb KV63, especially those used in making floral collars and to integrate these records with existing studies. This will help to shed some light on the function of this tomb, located approximately 14 m from the southern edge of Tutankhamun's tomb (KV62).

Materials and Methods

Desiccated plant macroremains were clearly visible when the tomb was opened, therefore all visible samples were collected. However, natron samples beneath the collars have been identified while searching smaller seeds and fruits. Dry sieving was used to separate plant macroremains from the archaeological natron, using a 0.5 mm mesh sieve. Each sample was investigated using a binocular microscope with 10–50x magnification. Identifications were completed using the floras of Egypt, Africa, and the Middle East (Boulos 1999, 2000; Zohary and Feinbrun-Dothan 1966, 1972). Digital images have been taken of almost all macroremains in order to check and confirm identifications using local plant specimens and the reference collection kept at

the archaeobotanical laboratory of Cairo University Herbarium (ABL). It should be mentioned that the collars retrieved from KV63 during the 2006 season were intact and in situ, preserved only by drying inside the coffin when they were discovered. However, Schweinfurth (1883) mentioned that some garlands were broken and reduced to powder due to careless handling when the coffins were first opened. The fragile collars were handled and transported from KV63 into KV10 for investigation, and were treated with Paraloid for consolidation which unfortunately caused damage to fragile plant structures.

Results and Discussion

The plant species identified in KV63

A total of seventeen species of seed plants were identified according to their gross morphology. These are listed below and arranged in alphabetic order. For each species the scientific name is followed by its family and English common name. Short notes concerning origin, habit and use are also provided.

1. *Carthamus tinctorius* L., Asteraceae–Safflower

Safflower is an annual herb with yellow-red flowers, probably indigenous to Persia and NW India. It was well known in ancient Egypt (Zohary and Hopf 1993), where it has been recorded since the XIIth dynasty as a dye on the tomb of the two brothers at Tell el Dab'a (Vartavan and Amorós 1997). Ancient Egyptians found its flower pleasing to the eye and included it in garlands during New Kingdom and Late Period (Hamdy 2015). A few seeds were found in Tutankhamun's tomb (Germer 1989; Hepper 1990; Zohary and Hopf 1993) compared with the large number of flowering heads recorded in KV63.

2. *Centaurea depressa* M. Bieb., Asteraceae–Low cornflower

An annual herb with bright-blue flowers, low cornflower was introduced to Egypt from Western Asia probably as a fields weed (Newberry 1889). Cornflower has been recorded since the Predynastic period at Hierakonpolis (El Hadidi 1982), while the flowering heads were recorded in Tutankhamun's tomb (Vartavan and Amorós 1997) and KV54 (Winlock 2010). Only a few flower heads were recorded in KV63.

3. *Cyperus papyrus* L., Cyperaceae–Papyrus

A perennial herb with triangular culms, papyrus is native to Egypt, and grew in abundance along the Nile River in ancient times. It was used as a twine and fibers were used as thread in sewing on or binding and the pith for manufacturing artificial flowers (Täckholm and Drar 1950). The feathery flowers born on long stems were an ideal base for tall composite bouquets used to decorate temples and tombs (Manniche 1989). First recorded at Naqada during Predynastic times, papyrus is considered the core material for all collars, and was abundant in KV63.

4. *Hordeum vulgare* L., Poaceae–Barley

Barley was one of the main cereals of Egypt since Predynastic times onward. It was used for making bread and beer and as fodder. Barley sprouts found during excavations were part of burial rites, being symbolic for the resurrection of Osiris (Manniche 1989). The presence of eigth bags full of chaff in KV63 is very interesting. It is believed to have been used as stuffing in body cavities during the embalming process (Schaden 2010).

5. *Hyphaene thebaica* L., Arecaceae–Doum palm

The doum is a fan palm with a dichotomously branched trunk and is native to Egypt. The fruit is ovoid, glossy and dark brown in colour. It has been recorded in Egypt since Predynastic times or earlier. Almost every part of the palm was used in antiquity. The hard trunks were used for roofing and supports, the leaves were used for basketry, ropes and similar fibrous items, and the fruit stone served as an ivory substitute to make buttons, rings and beads. The spongy pericarp is edible and is of medicinal value (Darby et al. 1977). A few fruits were recorded within the sealed jars in KV63.

6. *Juniperus* sp., Cupressaceae–Juniper

The only juniper in Egypt is *Juniperus phoenicea*, a shrub or small tree, today growing in restricted mountainous areas in Sinai, Jordan and is widespread in the Mediterranean (Boulos 1999). The fleshy megastrobili of juniper (commonly known as berries) were recovered inside Tutankhamun's tomb in a basket mixed with dates, raisins and coriander (Germer 1989; Hepper 1990). They also have been mixed with salt in which the bodies were laid for dehydration (Manniche 1989). The oil from seeds was used for anointing the dead body (Darby et al. 1977). Ten berries were recorded in KV63.

7. *Linum usitatissimum* L., Linaceae–Linseed/Flax

Linseed or flax is an annual herb, cultivated for its stems, which are used in the manufacture of linen, and for its seeds, which produce linseed oil (Manniche 1989). The earliest record of flax fibers dates to Predynastic times (Vartavan and Amorós 1997), and it was represented in KV63 by remnants of fibers and textiles.

8. *Mimusops laurifolia* (Forssk.) Friis, Sapotaceae–Persea

Persea is an evergreen tree which was introduced from highland Ethiopia and Yemen and cultivated in Egypt (Friis et al. 1986; Germer 1989; Hepper 1990). It was recorded at Saqqara in IIIrd dynasty contexts, where fruits were deposited as offerings (Vartavan and Amorós 1997). Since the 12th Dynasty onwards, the leaves were used in making garlands and collars, and its branches were used to make the large bouquets found in the tomb of Tutankhamun. Only a few leaves and seeds of persea were recorded in KV63.

9. *Nymphaea caerulea* Sav., Nymphaeaceae–Blue waterlily

Blue water lily is a perennial aquatic herb native to the Nile valley (Boulos 1999). Its petals were recorded first at Deir el-Bahari in the garland adorning Pharaoh Ahmose's mummy dating to the XVIIIth dynasty (Vartavan and Amorós 1997). To the ancient Egyptians, the blue waterlily symbolized the sun and the renewal of life (Manniche 1989). Petals were recorded among the collars in KV63.

10. *Olea europaea* L., Oleaceae–Olive

Olive is an evergreen shrub or tree characterized by silvery leaves and edible fruits. Its kernels were recorded in Kom Rab'ia during the Middle and New Kingdom. The presence of olive leaves in the KV63 floral collars indicates that they were cultivated locally. Olive trees grow in the Mediterranean region where the winters are cool and moist and summers are hot and dry. Leaves and fruits also have been recovered inside the tomb of Tutankhamun (Hepper 1990). A few desiccated stones were recorded in KV63.

11. *Phoenix dactylifera* L., Arecaceae–Date palm

The date palm is a feather palm, with an unbranched trunk. The fruit is variable in shape and colour. It is a multipurpose species, and today is known only in cultivation. Trees were used in ancient Egypt for thatching, basketry, sandals, nets and similar items (Germer 1989). It has been present in Egypt since Palaeolithic times at the site of Nabta Playa in the Nubian Desert (El Hadidi and El Fayoumi 1996). Fifteen stones were recovered in KV63.

12. *Pinus* sp., Pinaceae–Pine

Pine is an evergreen tree, and its wood, strobili (cone) fragments and seeds have been recorded in many archaeological sites in Egypt (Vartavan and Amorós 1997). Several species of pine are found in the Eastern Mediterranean region, where the climate is moister than in Egypt. Pine timber was used in making the doorway into the burial chamber of Tutankhamun's tomb, in addition to the wood of date palm and ebony (Hepper 1990). A few pine seeds were recorded in KV63.

13. *Punica granatum* L., Punicaceae–Pomegranate

The pomegranate is a shrub or small tree, with scarlet red flowers present in clusters or solitary. It has been recorded in XIIth dynasty contexts by Schweinfurth at Dra Abu el-Naga (Vartavan and Amorós 1997). Each part of the plant has medicinal value. Pomegranate flowers and leaves were set in many garlands, especially the leaves in the KV63 samples. It can be surmised that pomegranate was used in a large quantities during this period.

14. *Salix subserrata* L., Salicaceae–Willow

The willow is a deciduous tree native to Egypt, common along the banks of the Nile and in the Delta (Hepper 1990). Its leaves have been recorded in many preserved garlands, including those of Ahmose I, Amenhotep I and Nsi-Khonsou (Vartavan and Amorós 1997). It is frequently mentioned in ancient religious texts, and was

represented in festivals held at Dendrah, Habu, Kom Ombo (Keimer 1931) and Ineni (Baum 1988) temples. Large amounts of willow leaves have been recorded in KV63.

15. *Vitis vinifera* L., Vitaceae–Grape vine

Grape is a deciduous vine climbing with tendrils. The leaves are lobed, and fruits appear as clusters of sweet globoid berries with pear shaped pips. In Pharaonic Egypt, the best vineyards were found in the Delta and in the oases. Grapes were eaten, used in making wine, formed a component of medical recipes (El Hadidi and El Fayoumi 1996), and used in embalming (Baumann 1960). Grape leaves were commonly found among offerings to the dead in Egyptian tombs (Hamdy 2015). Twenty four pips were recorded in KV63.

16. *Withania somnifera* L., Solanaceae–Ashwagandha

Ashwagandha is a perennial to semi-woody shrub. Its red fruits were commonly threaded on thin strips of date palm leaflets. Due to its showy appearance, it was included in many garlands and collars since the XVIIIth dynasty. Many berries were found in KV63.

17. *Ziziphus spina-christi* L, Rhamnaceae–Christ's thorn

Christ's thorn is an evergreen tree, and one of the most important and well known native plants of ancient Egypt. It was used as food, medicine and timber. Fruits were eaten raw or fermented with wine. Its fruits, seeds and wood were recorded from the tomb of Tutankhamun (Hepper 1990). A few stones were recorded in KV63.

The Plant Remains Arranged in KV63: Floral Collars and Other Plant Remains

The KV63 macro-botanical samples can be classified into two major groups: floral collars and other plant remains.

Floral Collars

An accumulation of semi-circular floral collars was found intact and in situ inside coffin E. One collar was placed near the knee (E1) and three in the chest area (E2, E3 and E4) (Fig. 4).

The examination of the fragmentary collars in KV63 reveals a similarity in most plant species used in constructing these collars where papyrus sheets are used as a foundation for either the leaves of olive (Fig. 5a), willow (Fig. 5b), or pomegranate (Fig. 5c), strung together on thin strips of papyrus culms or date palm leaflet strips. The leaves served as clasps for either the petals or sepals of blue lotus (Fig. 5b), or the flower heads of safflower, fruits of ashwagandha (Fig. 5d), cornflower, grass culms (Fig. 6) or gold foils (Fig. 7). Moreover, fibers of flax were used to tie the collar around the neck of the mummy.

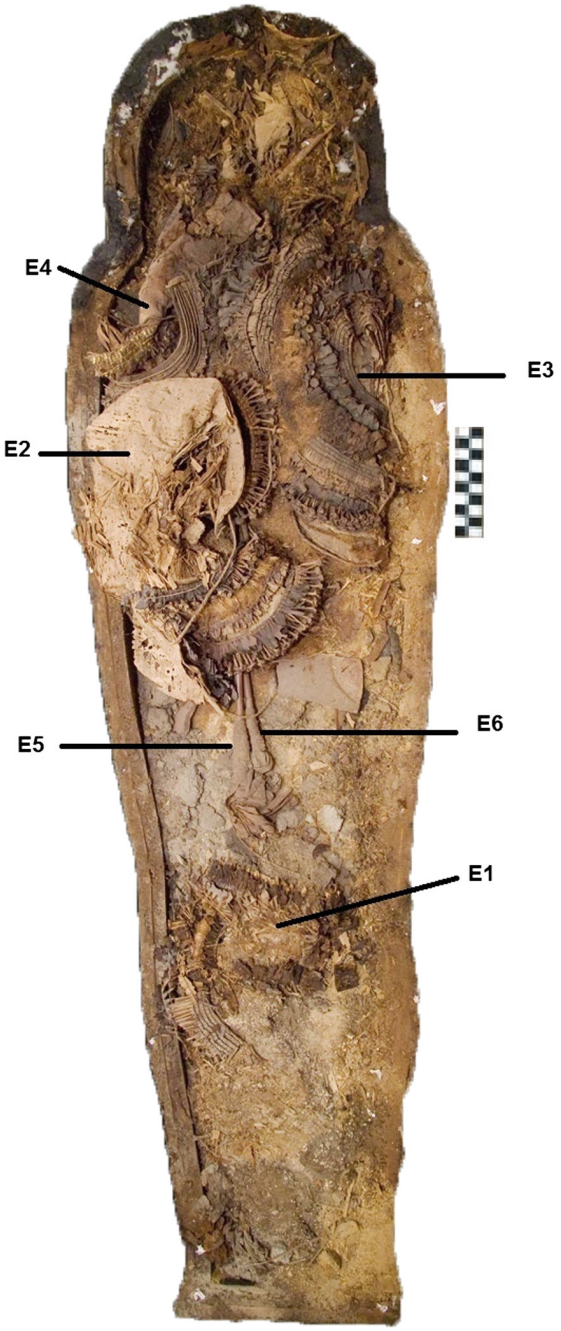

Fig. 4. Coffin E after removing the lid with E1–E4 floral collars; E1: at the knee area and E2, E3 and E4: at the chest area and embalming refuses; large swabs E5 and E6 (photo taken by Sandro Vanini, personal communication).

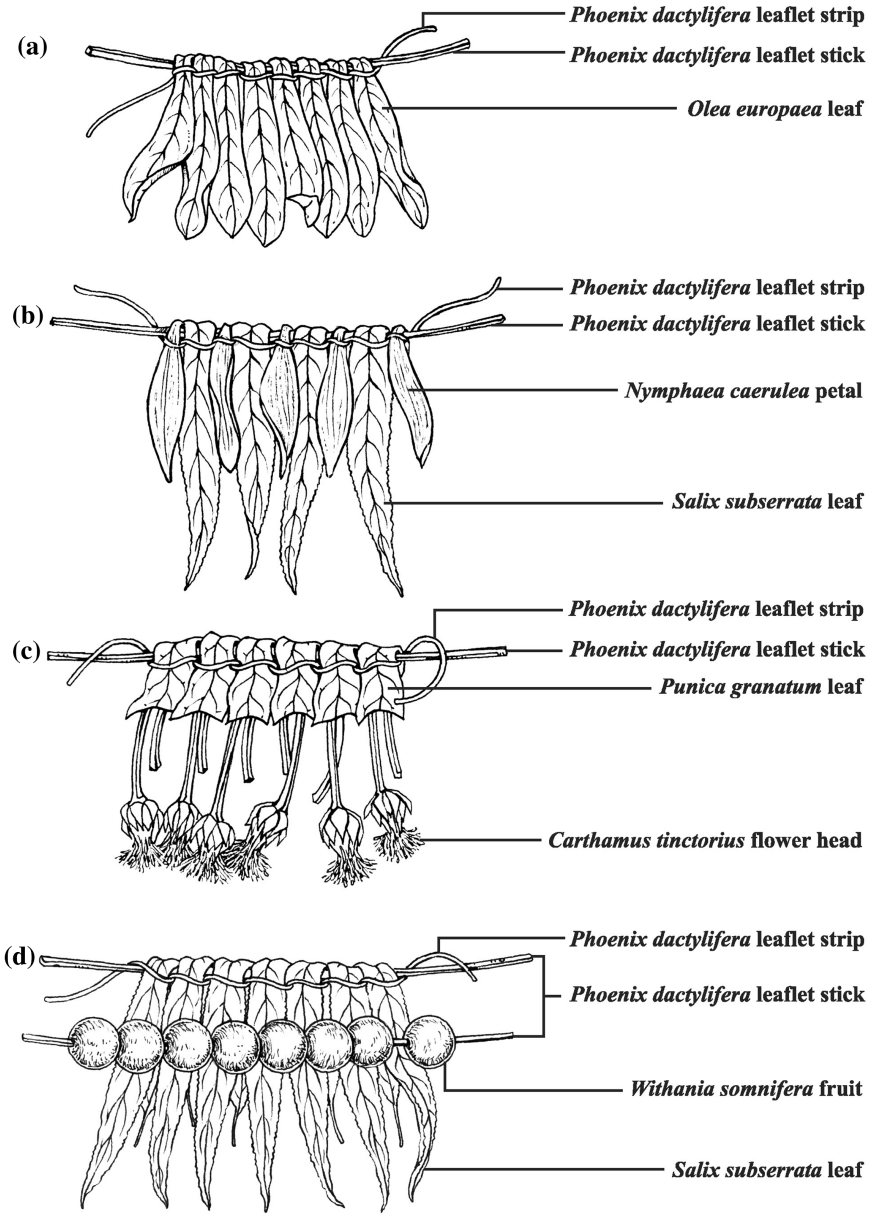

Fig. 5. Diagrammatic reconstruction of floral collar: **a**—*Olea europaea* leaves strung on thin strips of *Phoenix dactylifera* leaflet; **b**—Fragmentary part of collar (E1); **c**—Fragmentary part of collar (E2-a); **d**—Fragmentary part of collar (E2-b).

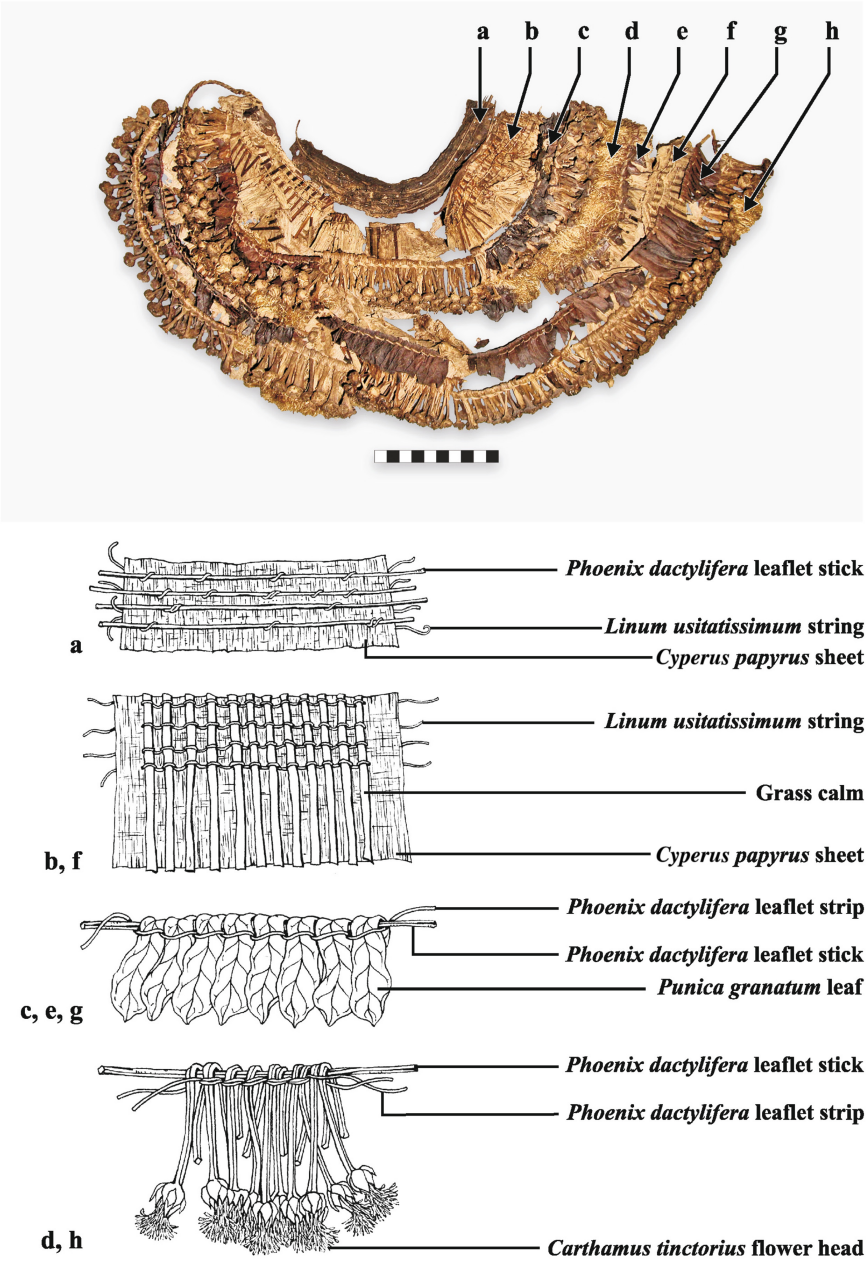

Fig. 6. Part of floral collar E3 and its diagrammatic reconstruction.

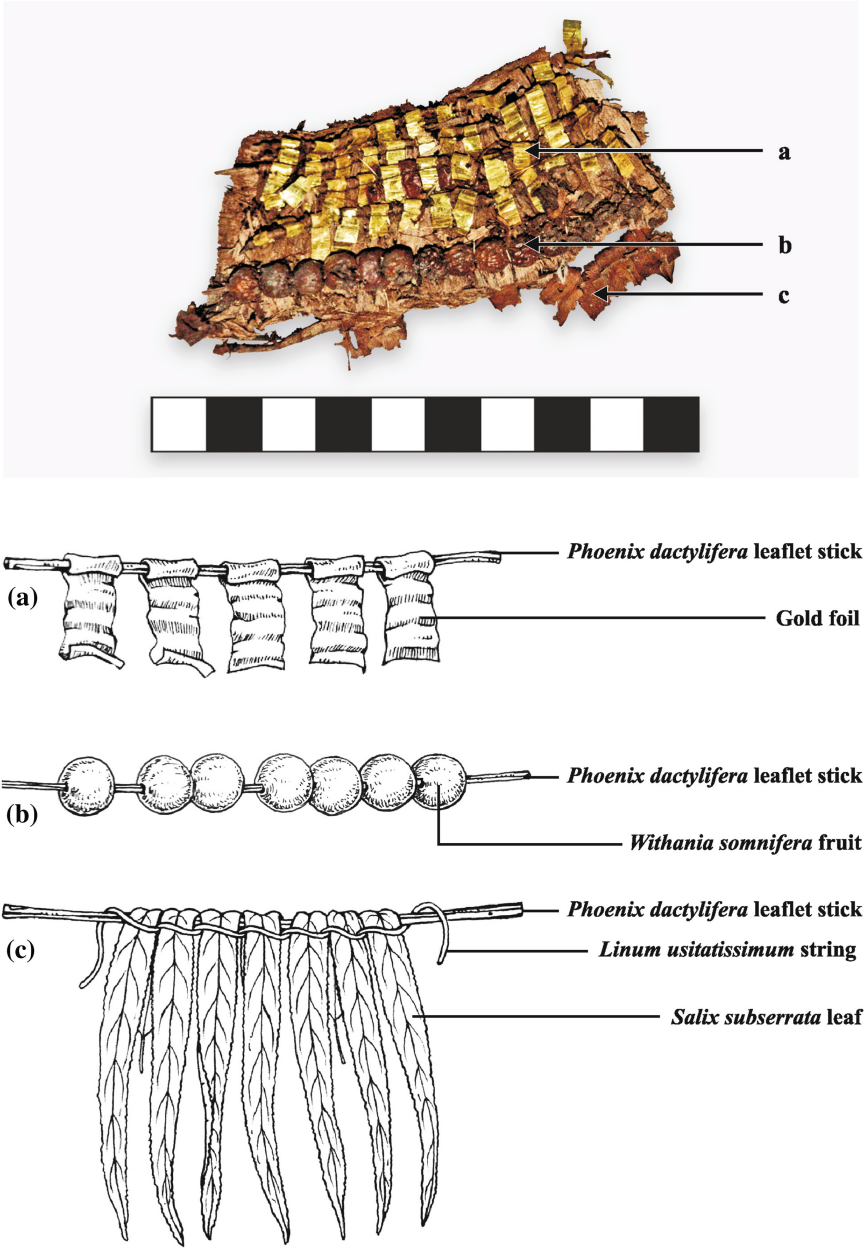

Fig. 7. Part of floral collar E4 and its diagrammatic reconstruction.

Table 1. Comparison between the species found in KV63, KV54 and KV62.

Valley of the kings tombs		KV54			KV62	KV63			
Number of collars (label)		214	215	216	255a	E1	E2	E3	E4
Number of rows		15	5	12	9	8	–	–	–
Foundation	*Cyperus papyrus*	•	•	•	•	•	•	•	•
Binding strips	*Cyperus papyrus*	•	•		•	•	•	•	•
	Linum usitatissimum		•	•		•	•		•
	Phoenix dactylifera	•	•	•	•	•	•		•
Leaves	*Apium graveolens*			•					
	Mimusops laurifolia	•	•	•					
	Olea europaea	•	•	•	•	•			•
	Punica granatum				•	•	•	•	•
	Salix subserrata				•	•	•	•	•
Flowers	*Apium graveolens*		•	•					
	Carthamus tinctorius					•	•	•	•
	Centaurea depressa	•		•	•	•			
	Nymphaea caerulea	•			•	•		•	
	Picris asplenioides	•			•				
Fruits	*Mimusops laurifolia*				•				
	Withania somnifera	•		•	•	•	•		•
Culm	Grass type						•		
Total		9	7	9	11	11	9	6	9

Table 1 shows a comparison between the examined collars from KV63 and similar collars found in KV54 and KV62. These collars were either part of the adornment on the pharaoh's body during embalming rites or were created for one of the coffins that were not used.

As evidenced in the field observations, only fragmentary collar parts were recovered. In fact, neither the count of collar rows nor the reconstructions of the collars were possible in the KV63 samples because of the fragility of the plant fragments caused by the addition of Paraloid consolidation material.

A total of fourteen species were used in the formation of collars studied, and six were recorded in all three tombs: *C. papyrus, P. dactylifera, O. europaea, C. depressa, N. caerulea* and *W. somnifera*. *Linum usitatissimum* was recorded in KV54 and KV63, *M. laurifolia* and *Picris asplenioides* L. were recorded in KV54 and KV62, while *P. granatum* and *S. subserrata* were recorded in KV62 and KV63. *Apium graveolens* L. (celery) was recorded only in KV54 while *C. tinctorius* and a grass-type culm were found only in KV63. The outer surface of the grass-type culm with its golden brown color was used instead of flowers in (E3).

During the New Kingdom and Late Period, *C. tinctorius* flower heads were rarely used in the ornamentation of garlands and collars (Hamdy 2015). Gold foils included on the gilded collar E4 were confirmed by Valentin Boissonanus, conservator at Zurich Botanical Museum, as untarnished bright yellow gold of high purity (Boissonanus personal communication). Gold in ancient Egypt represented the fire and glory of the

sun, the flesh of the gods, and the idea that its luster was never lost, meaning eternal life (Axelrod 2013). Although the number of *C. tinctorius* flower heads and seeds recorded in XVIIIth dynasty collars (Germer 1989; Winlock 2010) and garlands (Hamdy 2015) is small, it is important to mention that a large number of safflowers (approximately one thousand) were recorded for the first time in all the collars examined in this study. This suggests that safflower may have been cultivated in the area during the use of KV63. This observation supports the idea that KV63 was used after the time of Tutankhamun, especially if we consider that safflower was observed on the garland of Amenophis I whose mummy was re-embalmed during the XXIst dynasty (Germer 1989) and re-examined by the authors.

Clustering Agglomerative Ward's Analysis (Henderson and Seaby 1999) was applied to the species data collected from the collars recovered in the three tombs (Fig. 8). Based on the frequency of species, the collars were segregated into two groups. Collars from KV63 are clearly separated from those discovered in KV54 which is considered to be the embalming cache of Tutankhamun (Winlock 2010) and the pectoral collar of Tutankhamun recorded from KV62 (Newberry 1927; Germer 1989).

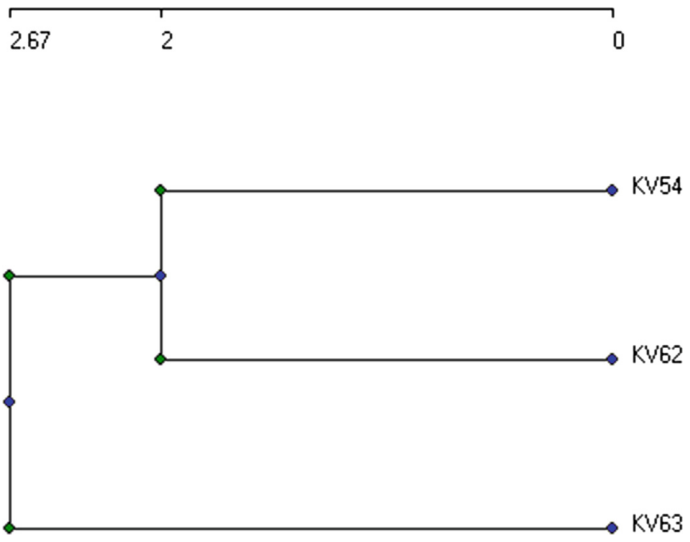

Fig. 8. Cluster analysis dendrogram for the different collars recorder from KV54, KV62 and KV63.

Other Plant Remains

A total of nine plant species were identified in KV63 in addition to those associated with the floral collars. These species included the chaff of *H. vulgare* (Fig. 9a), kernels of *P. dactylifera* (Fig. 9b), endocaprs of *O. europaea*. (Fig. 9c), and *Z. spina-christi,* nuts of *Pinus* sp., pips of *V. vinifera* (Fig. 9d), Seeds of *Juniperus* sp. (Fig. 9e), seeds of *M. laurifolia* (Fig. 9f) and *H. thebaica.* These plant remains were dispersed among the floral collars, natron, and found within sealed jars. In addition, eight bags full of

Fig. 9. **a**—Chaff of *Hordeum vulgare*, **b**—Kernels of *Phoenix dactylifera*, **c**—Endocarps of *Olea europaea*, **d**—Pips of *Vitis vinifera*, **e**—Seeds of *Juniperus* sp., **f**—Seeds of *Mimusops laurifolia*.

H. vulgare chaff were particularly interesting. The chaff in these samples consist of very fine glumes (lemmas and paleas) with a complete absence of rachis internodes. In addition, a few leaves of *M. laurifolia* were recorded in coffin F, which could be remnants of another garland, collar or bouquet.

The items present in KV63, including sealed jars, coffins, 459 kg of natron (some inside the coffins and some inside little sacks), chaff, animal bones, linen, seal impressions, sherds, and a bedstead with lion head finials suggest that the tomb was used for preparing mummies during the embalming process. In addition to many textiles, several alabaster vessels, tiny pieces of papyrus, and large swabs E5 and E6 found over the chest area of coffin E, composed of textiles wrapped around one end of a reed like stick, were all likely used to cover the coffins or mummies with resin.

Comparing the materials found in KV62 and KV54, which is considered to be the embalming cache of Tutankhamun (Winlock 2010), and the other three from Dra Abu el-Naga (Ikram and Lopez-Grande 2011), reveals that KV63 also could be an embalming cache as the associated artifacts and plant remains are similar. The diversity of

plant species and the large amount of natron salt found in KV63 may indicate that it was linked to a royal burial or other royal associate as confirmed by Ikram and Lopez-Grande (2011). Likely wealthier individuals experienced more painstaking embalming processes which would result in larger embalming deposits.

Conclusion

Given the location of the tomb, it seems most likely that KV63 was initially designed as a tomb but eventually came to be used as an underground chamber, where royal bodies were embalmed, decorated and otherwise prepared for formal burial. The archaeobotanical evidence obtained from this study supports this interpretation for KV63. Morphological investigation of plant macroremains reveals the presence of a wide diversity of botanical materials, including wild and cultivated plants as well as indigenous (e.g. *Cyperus papyrus*) and non-native taxa (e.g. *Pinus* sp.). Although, there is a great similarity between the plant remains of KV63 and those identified by Germer (1989) and Hepper (1990) in the tomb of Tutankhamun, KV62, the presence of a remarkable quantity of safflower and pomegranate in KV63 suggests that this chamber was used for mummification during the Late Period or the 3rd Intermediate Period of ancient Egypt. It was during that time that these two species flourished and they were not well known during the XVIIIth dynasty (Hamdy 2015). In addition, the practice of using coffins as containers (Eaton-Krauss 2007) was previously known only from much later non-royal embalming caches unearthed outside the Valley of the Kings.

Finally after recovering and studying this unique material, we must conclude with an important recommendation. Treating botanical materials with polymers such as Paraloid should no longer continue, because it destroys the morphological and anatomical characters of macro-botanical remains, making identification difficult.

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