# The Botanical Aspects of Ancient Egyptian Embalming and Burial[1]

*The ancient Egyptian art of embalming, a highly developed process, involved many plants and plant products. Thirty-one genera of plants have been mentioned by various writers in the operations of embalming, cosmetic application, wrapping and coffin construction. The materials employed and methods of use have interested scholars of all periods. Herodotus gave the earliest account of the various aspects of embalming.*

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## Introduction

The purpose of this paper is to emphasize the dominant role played by plant products in the preparation for burial of mummies and to include the name of any plant thought to have been employed in that capacity. Part I establishes the species of plants used in the preparation of the dead for burial. Part II considers some of the historical, commercial and botanical aspects of these plants as they applied to the ancient Egyptians.

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## PART I.

## Embalming

**Predynastic.** The origin of Egyptian embalming dates back about 5200 years to the first dynasty.[1] Before the first dynasty, it had been the custom to bury the dead in a pre-natal position in a shallow, sandy grave after evisceration and wrapping with matting, linen or skins. The warmth and dryness of the Egyptian climate seemed adequate to desiccate the body quickly and thus maintain it, in some cases, in a fair state of preservation. The body may have been dried in the sun or with the heat of a fire, however (7).

**Classical.** The most ancient (and quite accurate) account of the processes of mummification is to be found in the writings of Herodotus (20). Herodotus describes in some detail three cost-categories of embalming. He tells of drawing "out the brain through the nostrils" with a "crooked iron," after which the skull is rinsed with "drugs." Next the body is eviscerated through an incision in the flank and the cavity cleansed with "palm wine" and an "infusion of pounded aromatics." "After this they will fill the body with bruised myrrh, with cassia and every sort of spicery except frankincense, and sew up the opening." This was followed, according to Herodotus, by 70 days of soaking the body in a natrum[2] solution. It was then washed, wrapped in "cloth" and "smeared over with gum." In a less expensive preparation, "oil from the cedar tree" was injected into the bowel, the passage stopped and the body placed in natrum for the prescribed time. The pas-

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[1]See the appendix for a chronology.

[2]Natrum (or natron) is a naturally occurring mixture of sodium salts and may be obtained in a crude, solid form in several areas in Egypt, among them the Wadi-el-Natrun about 50 miles NW of Cairo.

sage was then unstopped and "such is its power (the cedar oil) that it brings with it the whole stomach and intestines in a liquid state." In the cheapest preparation, the intestines were merely cleared out with a "purge."

Diodorus Siculus (13) also discusses embalming. He mentions that the body is treated with "cedar oil and certain other preparations, and then the body is treated with myrrh, cinnamon and such spices . . . that will preserve it and give it a fragrant odor." Diodorus states that such care is taken that even the hairs of the eyelids and eyebrows remain intact after embalming.

Although the accounts given by Herodotus and Diodorus are largely accurate, there are, apparently, some errors. One of these in Herodotus is in the period (70 days) he says was required for embalming. Probably the actual embalming took only 30 days (as reported by Diodorus); the additional 40 days constituted the remainder of the mourning period.

After the viscera were removed through an incision in the flank, they were carefully embalmed with various substances. Natrum was employed as a desiccant. Coarse sawdust of "aromatic woods," (52) and sandalwood (supposedly) were sprinkled on, or stuffed into, them. It is unlikely that sandalwood was used, however, since Egypt established trade with India, the source of sandalwood, only in about the third century B.C.—long after the art of embalming had waned. The viscera were next moulded and wrapped in separate linen packets and placed in one of several places: between the legs, (50) in four canopic jars placed in the tomb, or in the thoracic and/or abdominal cavities. Budge (7) and others believe that the viscera were commonly stuffed with bitumen,[1] but the point is made by Mendelsohn (34) that the black material found in and on mummies is in all likelihood aged resin and gum-resin. Wood pitch may have been used on some occasions.

The brain was customarily removed—via a hole chipped in the ethmoid bone—through the nostrils. The skull was then rinsed with some substance, supposedly a product of cedar or juniper trees, about which there is great discussion. Lucas (29) feels that the "cedar oil" of Herodotus and Diodorus and the "cedrium" mentioned by Pliny as having been used in Egyptian embalming are actually concoctions of turpentine, pyroligneous acid and wood tar. According to the Rhind Papyri, after the skull was cleansed. . . . "Anubis as embalmer filled thy skull with resin, corn of the Gods . . . cedar oil, mild ox fat, cinnamon oil and myrrh is to all thy members."

The exact identities of "corn of the Gods" and "ox fat" are obscure. As for cinnamon, it is extremely doubtful that it could have been employed in embalming before 300 B.C. (see Part II). There is abundant evidence that resins and resin-soaked linen rags were used to stuff the cranial cavity (perhaps, also, bitumen and/or wood pitch in some cases).

Other refinements included: packing the empty orbits with linen balls or onions painted to resemble eyeballs; stuffing resin-soaked linen under the skin and subsequent moulding of the physical features (54); stuffing the ears with resin plugs (51) or onions (52).

Until recently, it was universally believed that, immediately following evisceration, the body was soaked in a natrum *solution*. But Lucas (29) argues against

[1]Bitumen is a black asphaltous material probably obtained near the Asphaltites Lake (near the Dead Sea) in Palestine. The word mummy itself is derived from the Arabic "mumia" which was given to the pitch-like bitumen (or, at least, what was thought to be bitumen) from Egyptian mummy remains. "Mummy" (that is, the "bitumen" from mummies) was, until three or four centuries ago, a standard medication for bruises and wounds.

the use of a solution and contends that natrum was used in a dry state exclusively as a desiccating agent. "The phraseology of Herodotus, Diodorus, Athenaeus and other writers makes it perfectly clear that the ancient Egyptian process of embalming the human body was analogous to that of preserving fish . . ." and in ". . . Ancient Egypt fish were preserved by drying with, or without, the use of salt" (29).

After desiccation, the body was treated with myrrh, cassia, "every sort of spicery except frankincense" (according to Herodotus); myrrh and cinnamon (according to Diodorus). Thomas Greenhill (17) claims that the cavities of the body were ". . . repleted with a composition of myrrh, aloes, cinnamon, opobalsamum (myrrh), saffron and the like." Gannel (15) mentions myrrh, aloe resin, canella (impossible: see Part II) and cassia lignea. Pettigrew (41) mentions colocynth as a component of one of the mysterious anointing balsams and Dr. J. C. Warren (62) states that a mummy he examined contained friable resins with no particular odor. The balsam, storax, was identified by Reuttner (29) in undated mummy material and Tschirch and Stock (60) mention gum mastic as one of the ingredients of mummy remains. According to the Boulaq Papyrus, the head was anointed with frankincense—as opposed to the statement by Herodotus.

The sources of the resins used are in question. Lucas (29) suggests the Cilician fir (source of Egyptian "ach wood"), the Aleppo pine, stone pine and oriental spruce. It is unlikely that oriental spruce was employed, however. Its area of distribution (North Asia Minor, Armenia, Caucasus) was much further from Egypt than other good sources of resin and was beyond the normal trade area of the Egyptians. Another likely source of resin was the Cedar of Lebanon (64).

The body cavity sometimes contained onions (one or two) (52), lichens and sawdust (sometimes cedar) (64). As the embalming art began to fail in later dynasties (circa XXI), sand, mud and linen rags were commonly employed as cavity packing and, at its lowest point, the body appears to have been merely soaked in wood pitch, bitumen or resin.

Before wrapping the body, various materials were sometimes stuffed into the limbs, neck, back, etc., in order to restore natural contours (52). The body was customarily painted over with resin before wrapping and occasionally sprinkled with "aromatic wood chips." (Pettigrew (41) says one mummy smelled of cassia and cinnamon).

Little need be said about the lower priced preparations mentioned by Herodotus and Diodorus except to say that in the lowest priced one the abdomen was rinsed out with "smyrea," a liquid which, according to Pettigrew (41), was a mixture of senna and cassia (impossible: see Part II).

## Cosmetics

Although cosmetic fidelity was not of prime importance, there are many cases in which the soles of the feet, hands or the nails have been stained red. Henna was probably the commonest source of this red dye, but madder and kermes[1] may also have been employed (29). *Carthamus tinctoria is* another possibility.

During the 21st dynasty, it became customary to color the body, or shroud, of the mummy red if it were a male and yellow if it were a female. In addition to the above dyes, which were probably also used in this capacity, inorganic paints with a gum base (probably gum Arabic) were used. Dyeing is an ancient art in Egypt. Reisner (48) describes a pre-dynastic

[1]Kermes is a dye prepared from the bodies of female insects of a variety allied to the cochineal insect. These are found on several species of oak in the Mediterranean region; most commonly on *Quercus coccifera.*

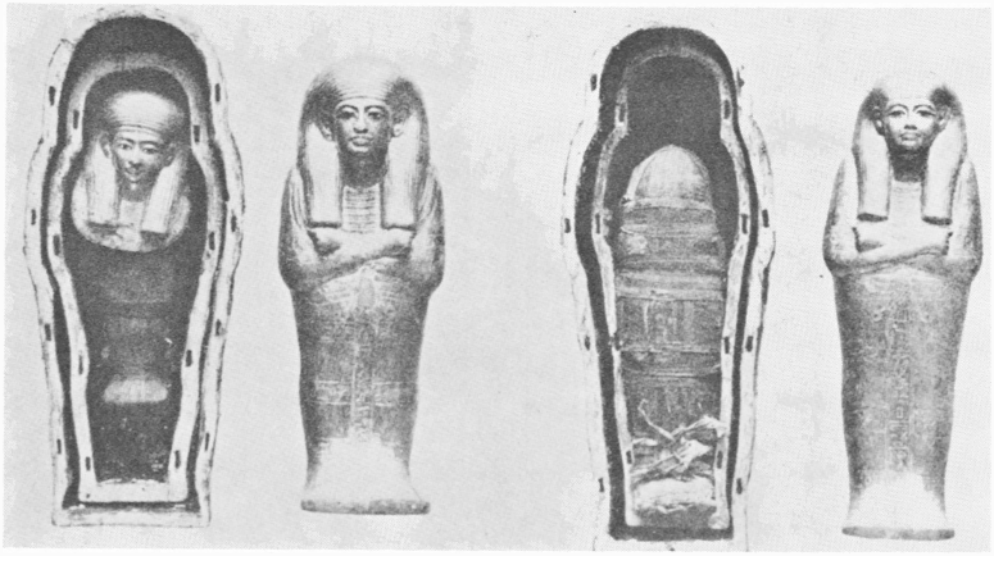

Fig. 1. Two coffins and mummies of still-born children. (After Carter).

grave in which the edges of a "shroud" mat found there had been dyed red.

## Wrappings

Mummy wrappings were, almost without exception, made of linen. The wrappings, sometimes sheets but usually bandages, were approximately 3½ inches wide and 3-13 feet long and varied in texture from that of the "finest cambric" (10) to the very coarse. Two notable exceptions exist, however. In these cases the wrappings consisted of woven aloe fibers (Rameses II) and papyrus sheets (Lady Hentmehit).

The bandages were wrapped around the body in a many as 25 (62) or more layers, gum Arabic being employed frequently as an adhesive. They were sometimes soaked in resin. This permitted sculpturing of the features so as to resemble the living state (51, 54).

## Coffins

Coffin construction probably began in Dynasty III. A six-ply coffin from that period was constructed from cypress, juniper, pine and sidder. A fifth dynasty tomb inscription states that ". . . His majesty commanded that there be made for him a coffin of ebony wood," but no ebony coffin has yet been discovered. During the sixth to twelfth dynasties, yew and acacia were often used. During the tenth dynasty, cedar became popular. Other woods employed were sycamore, fig and oak (oak in the shrines surrounding the coffins of Tut-ankh-amen).

The joints of coffins were fastened with wooden pegs or linen bandages and the spaces between the planks were filled with earth and gum (probably gum Arabic) (50).

Between the twelfth and eighteenth dynasties occurred two important developments in the use and construction of coffins: the series of nested coffins (Fig. 1) and the anthropoid coffin (Fig. 2). Although it was often carved from wood, the anthropoid coffin was also commonly moulded from a material like papier-maché consisting of plaster and layers of linen or papyrus. Coffins in later dynasties were varnished with a resin, the identity of which is unknown.

When the wrapped mummy was laid in the coffin, it was often "anointed" with a

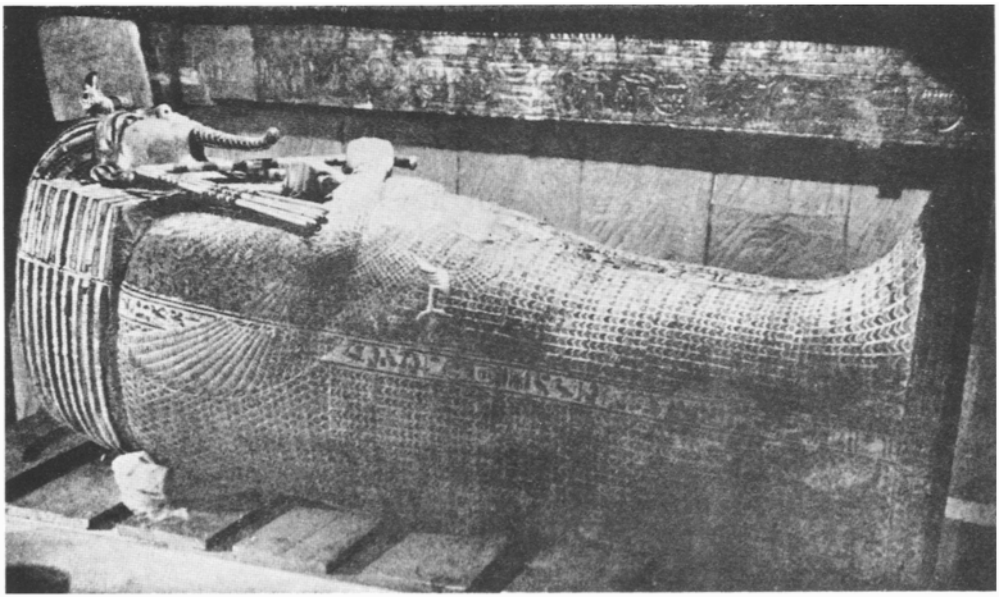

Fig. 2. Second coffin of Tut-ankh-amen. It is 6′ 8″ long; of carved heavy wood (oak?); overlaid with sheet gold on gesso; inlaid with opaque polychrome glass simulating red jasper, lapis lazuli, and turquoise. (After Carter).

viscous material which, in some cases, appears to have been wood pitch (probably from *Juniper* spp.) and, in others, a mixture of about 10% fatty material and 90% resin (29). This black resinous material was frequently the well-known "kyphi," an ointment of which Plutarch (in Isis and Osiris) states there are sixteen ingredients and Dioscorides ten. Some of these components are known with certainty. One is gum mastic (60, 64). Another, according to the Ebers Papyrus, is some product from "cyprus" (probably *C. papyrus*) (64). Others are frankincense, myrrh, juniper berries, "nebk" (*Zizyphus spina-christi*) and raisins. The "anointment" was sometimes so thorough as to "glue" the mummy firmly in its coffin.

## PART II[1]

### THALLOPHYTA

### Lichens

### Parmeliaceae

*Evernia furfuracea* (*Parmelia furfuracea*). The "sprout lichen" commonly grows on dead wood and tree bark, occasionally on certain species of *Pinus*. This genus, sometimes called "oak mosses," yields an extract known as "Mousse de Chene" (or oak moss resin), which is an important base in modern perfume manufacture. The essence of this extract is a phenol, lichenol.

It is not known whether the Egyptians used this lichen to pack the body cavity because of supposed preservative properties — the characteristic musk-lavender odor is not pronounced before extraction —or whether it was purely an accident that this potentially aromatic material was employed. It is known, however, that this lichen was an ingredient used in bread-making.

*E. furfuracea* does not grow today in Egypt, but must be imported from the more moist Islands of the Archipelago. It is likely that the ancient Egyptians, too, imported this material (37, 39, 46, 64).

[1]A table following this part gives a summary of names and uses of plants discussed.

SPERMATOPHYTA
**Gymnospermae**
**Cupressaceae**

*Cupressus sempervirens.* "Gopher wood," or "cypress," of antiquity, is fabled for its durability and has been a favorite for coffin construction since the Egyptians introduced it nearly five thousand years ago. It is a tall tree, normally 80-90 feet, and its wood produces a pleasant, insect-repelling odor.

It is not native to Egypt and what few specimens grow there today are cultigens. Rather, it is indigenous to Iran and the Levant and probably reached Egypt through Palestine, Lebanon or Latakia.

Its remarkable lasting properties and durability were spoken of by Pliny (43) ("Pine and cypress are the strongest to resist rot and wood-worms") and it is reputed to be one of the four woods used in the construction of the cross upon which Christ was crucified (8, 11, 21, 27, 29, 35, 45).

*Juniperus* spp. Since most ancient times, junipers have been confused with (and referred to as) cedars. This complicates efforts to learn the real identity and use of both *Cedrus* and *Juniperus* from ancient records. There is at least one instance in which the Egyptians were apparently aware of some difference between the two genera, however. On one of the Karnak obelisks (Dynasty XVIII) it is written: "They have brought me the choicest products of . . ? . . consisting of cedar, of juniper, and of meru wood." There is tangible proof, however, that the Egyptians used juniper in coffin construction (earliest: Dynasty III)—probably *J. phoenicea* L. Twigs of *J. phoenicea* have been found in the Graeco-Roman cemetery at Harawa (29). Berries of *J. phoenicea* and *J. drupacea* Labill. have been found in many burials, the oldest being pre-dynastic. They were supposedly an ingredient of kyphi ointment.

Egypt has no native junipers. *J. phoenicea* is native to Phoenicia (a narrow strip of land between Lebanon and the Mediterranean) and probably reached Egypt through Byblos. *J. drupacea* is native to Syria and was, likewise, probably obtained at Byblos by the Egyptians. Post (45) also lists *J. oxycedrus* L. and *J. macrocarpa* Sibth. & Sm. as indigenous to the Lebanon-Palestine region.

The juniper is venerated by Christians as the tree that hid the infant Jesus when He and Mary were overtaken by Herod's assassins on the way to Egypt (11, 14, 29, 45, 64).

**Pinaceae**

*Abies cilicia.* The Cilician fir is native to Asia Minor and North Syria where it occurs in extensive forests on Mount Lebanon and the Antitaurus in association with the Cedar of Lebanon. According to Lucas (29) the Zenon Papyri (dated 256 B.C.) refers to the planting of 300 fir trees in Egypt.

*Abies cilicia* is a large tree, up to one hundred feet tall and seven feet in girth. Loret and Jacquemin (in Lucas, 29) believe that it was the source of the famous "ach resin" and "ach wood." Apparently fir was not much used in coffin-making as only one example is known and that well into the twenty-fifth dynasty (11, 29, 45).

*Cedrus libani.* The famous Cedar of Lebanon is a true cedar. For thousands of years its 70-100 foot height and 16-25 foot girth have inspired men with thoughts of strength and solidarity and the trees have always been regarded with what Franklin Lamb (24) calls "sacred awe." The Cedar of Lebanon usually grows in association with pines and firs. The forests were extensive in Biblical times, but only five small groves exist today—about 6000 feet up Mount Lebanon. These are under the care of a Christian sect called the Maronites.

The wood is fragrant, insect-repellent, quite durable and rot-resistant. It was

highly esteemed by the Egyptians for packing the body cavities of mummies, for many kinds of wood-work and very much so for coffin-making. It was first used in coffins sometime around the tenth dynasty and persisted well into the Ptolemaic period.

According to tradition, *Cedrus libani* was another of the four species of trees from which Christ's cross was made (11, 14, 21, 24, 45).

*Pinus halepensis.* The Aleppo pine is native to Palestine, Lebanon and Asia Minor. It almost never exceeds 50-60 feet in height and 12-15 feet in girth. It was rarely used in coffin construction since pine is not rot-resistant. The earliest evidence of its use in that capacity is the third dynasty plywood coffin from Saqqara. It is likely, however, that it was extensively employed as a source of resin and pitch. It is widely cultivated in the Mediterranean area today as a source of naval stores (11, 18, 29, 45).

*Pinus pinea.* The stone, or umbrella, pine frequently grows to a height of 80 feet and a girth of up to 20 feet and is highly valued not only by the naval stores industry, but also as an ornamental because of its picturesque umbrella-shaped crown. *P. pinea* has been widely cultivated for centuries and grows today throughout the Mediterranean area, Southern Europe and even in the British Isles. This confuses attempts to locate its origin but Post (45) feels that it is native to Asia Minor and Dallimore and Jackson (11) extend its original home from Asia Minor to Portugal.

There is no proof that this species of pine was ever used in coffin-making. It seems unlikely that it was a source of resin until the beginning of the Middle Kingdom when trade began to connect with parts of Asia Minor (11, 45).

### Taxaceae

*Taxus baccata.* The common yew, or ground hemlock, is noted for its short, thick trunk (total height about 30-60 feet; girth, 20 feet; branches very near the ground) and the great strength, durability and elasticity of its wood. These last characteristics are responsible for its having long been used in bows.

It now occurs in many places around the world. In the Lebanon-Palestine area, undoubtedly the source of yew for the Egyptians, it is found in the hills and mountains.

Yew was first used in coffins at about the time of the sixth dynasty. It could not have been used as a source of resin since the tree is one conifer which yields no resin (11, 21, 29, 45).

## ANGIOSPERMAE

## Monocotyledonae

### Cyperaceae

*Cyperus Papyrus.* The bulrush is a tall (8-16 feet) sedge once extensively cultivated along the shores of the Nile. The stem is triangular, smooth and composed of pith encircled by a tough rind. The plant grows today over a wide area bounded roughly by the 38th and 26th parallels on the north and south and by the 65th and 32nd on the east and west, but is virtually absent in the lower Nile marshes where it flourished in ancient times.

The origin of *C. Papyrus* is not generally agreed upon but Woenig (64) feels that it may have originated in Nubia and then spread down the Nile to lower Egypt. At any rate, this plant grew and was cultivated in Egypt and it was not imported.

*C. Papyrus* was used early in many capacities. One of the first evidences was a "reed" mat under the skeleton of a predynastic burial found by Petrie (40) at Naqara. The earliest evidence of its use as the famous papyrus "paper" dates back to the first dynasty about 5200 years ago. This was an unused roll, as mentioned by Emery in The Tomb of Hemaka, according to Lucas (29).

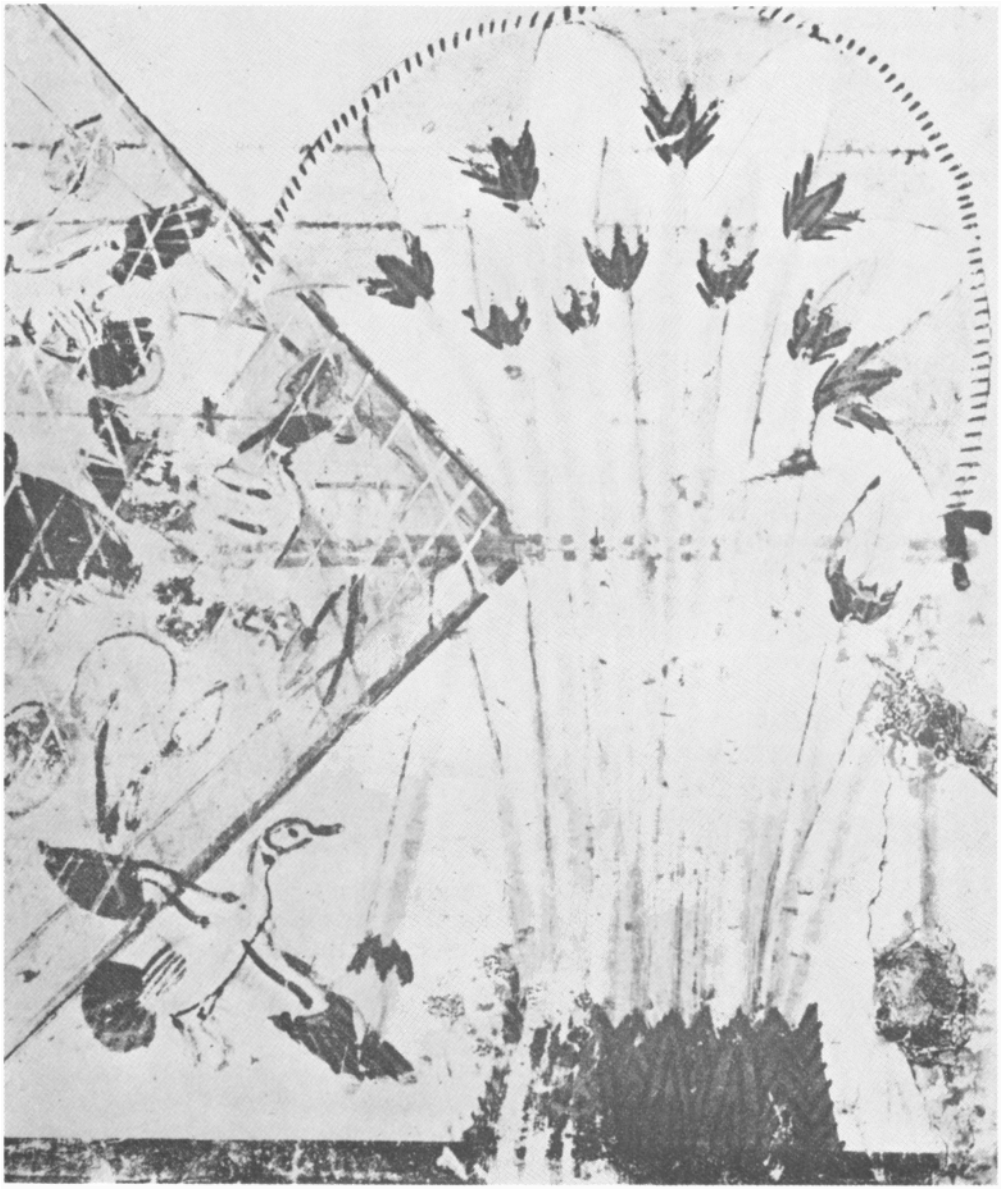

Fig. 3. Papyrus plants growing along a river bank as represented in a wall painting in the Deir-el-Bahari Temple at Thebes (circa 1400 B.C.). (Courtesy of Boston Museum of Fine Arts.)

Papyrus "paper," the commonest use to which *C. Papyrus* was put, was prepared by slicing the pith of the stem into long strips, applying some adhesive (about which there is great discussion and no conclusion) and pressing. It was then dried and impregnated with worm-repellent juices. Although papyrus was commonly employed as a writing surface for manuscripts, we have seen that it was also used for making cartonnage mummy cases, as a background for portraits to be

placed over the face of the mummy, that it contributed in some way to kyphi ointment, and that in one case a mummy was wrapped in papyrus sheets.

Pliny (43), Herodotus (20), and Theophrastus (58) discuss papyrus quite extensively and have mentioned many of the uses of the plant (8, 29, 35, 40, 64).

### Iridaceae

*Crocus sativus.* This fall-blooming species is noted primarily for the dye, saffron, which is derived from its stigmas. There is no evidence that this dye was ever used as such by the ancient Egyptians, although it was used by the Greeks and Romans. Greenhill (17) claims, however, that saffron was used in embalming (it contains an aromatic oil which breaks down to yield a terpene and crocose), and if we can believe his account (I find no one else who mentions saffron as being used in embalming), it is then not inconceivable that saffron may have been used, at least occasionally, in dyeing the shrouds or bandages of mummies.

The likelihood that saffron was used in embalming and/or dyeing would seem to be improved by the reference to saffron in the Ebers Papyrus where (according to Woenig (64)) it is mentioned as an ingredient in a cure for "kidney trouble."

The solution to this problem is little aided by a consideration of the origin of the plant, for there is no real certainty as to the place or places in which it first developed. Most authorities suggest Greece, Italy, Asia Minor and/or Persia (12, 16, 17, 35, 45, 61, 64).

### Liliaceae

*Allium Cepa.* The common garden onion is one of the oldest of cultivated plants. It is known today only in the cultivated state and is grown around the world. The origin of *A. Cepa* is not certain although Vavilov (61) states that its primary center was probably in Central Asia with secondary centers in the Mediterranean area and the Near East.

The Egyptians attached great religious significance to the onion since they saw reflected in it their own cosmology with the concentric spheres of heaven, earth and hell represented in the layers of the bulb. Thus, it is probable that the onions found in the body cavities of mummies were present for religious purposes rather than for any fancied preservative function (35, 61).

*Aloe succotrina.* According to Moldenke (35), this was the species of aloe used by the Egyptians in embalming although there are 170 species native to eastern and southern Africa and the Mediterranean basin and it would appear that there could be no great certainty as to the species employed. *A. succotrina* originated on the Island of Socotra just off the east coast of Africa at the mouth of the Red Sea. The inspissated juice has long been used in medicine as an emmenagogue and purgative.

"Aloes," a resinous material, is obtained by drying the juice of the plant. The juice is collected in animal skins after cutting off a leaf or leaves. It varies from dark, ruby-red to a yellowish or reddish brown, has a peculiar, almost fragrant odor, disagreeable taste and is easily confused with myrrh. The odor of "aloes" is due to a small amount of volatile oil.

"Aloes" contains a resinous component which would make it useful in embalming and although it is not often mentioned as having been used in that capacity by the Egyptians (Gannel (15) and Greenhill (17) mention it). Reuttner (according to Lucas, 29) detected "aloes" in some undated mummy material. There is certainty that "aloes" was used in embalming near the end of the pre-Christian period. Nicodemus brought "aloes" [from *A. succotrina*, according to Moldenke, (35)] for embalming the body of Christ.

Although Mendelsohn (34) mentions that the mummy of Rameses II was

wrapped in bandages of aloe fiber "finer than India muslin," is is doubtful that the material was actually aloe and/or that it was "fine." Aloe fiber is occasionally used in cordage and coarse textiles, but it is difficult to imagine an aloe textile "finer than India muslin." Perhaps, though, he is only mistaken about the texture of the cloth and not the fact of its use (3, 8, 29, 34, 35, 38, 55, 60).

### Palmae

*Phoenix dactylifera.* The date palm is the primary source of food, shelter and oil for innumerable inhabitants of desert regions. It grows from the Canaries to the Sahara and Arabian deserts to Southwest Asia and since it has been cultivated throughout northern subtropical Africa since remote times, its place of origin has never been satisfactorily determined. It is known to have grown abundantly in the region between the Euphrates and the Nile during pre-Christian times; the history of the genus extends well back into the Neolithic, possibly originating near the Indus.

Although the Egyptians used the tree for cordage, brushes, roofing, food and for many other purposes, emphasis is to be placed on its use as "palm wine" which, according to Herodotus and Diodorus was used for rinsing the body cavities and viscera in embalming. It is manifestly impossible to demonstrate "palm wine" in mummy remains due to its high volatility, but the ancients are known to have prepared intoxicating beverages from both the sap and the fruit of *P. dactylifera* and there is no reason to doubt the statements of our ancient historians that these wines were employed in embalming.

To make palm wine today, a deep incision is made in the trunk just below the leaves, the sap collected and allowed to ferment. Some say it has the taste of a very light, new, grape wine. "Date wine" is prepared by fermentation of macerated dates. This process is described by Pliny (43).

Pettigrew (41) thought that the function of palm wine in embalming was that of a tannin on the skin. This is unlikely, however (8, 12, 29, 35, 36).

### Dicotyledonae
### Anacardiaceae

*Pistacia lentiscus.* The source of "gum-mastic" is a native of the Mediterranean region and may be found today in Lebanon and Palestine although there is no more reason to believe that it originated there than anywhere else in the Mediterranean area. Today the main source of mastic—described as a true resin by some and as an oleo-resin by others—is the Island of Chios off the west coast of Turkey. "Chios mastic" is conceded to be the finest variety of the very expensive mastics.

The tree is a shrubby evergreen, seldom more than twelve feet in height and much branched toward the top. Mastic is the dried resinous exudation occurring naturally or obtained through a small incision in the trunk. The thick exudation either hardens in tears on the bark or falls to the ground and is picked up. The tears are the most highly esteemed form; they come in various sizes and shapes. Mastic is transparent, ranges in color from light yellow to greenish yellow and has a slightly balsamic odor due to pinene. It is widely used today as a masticatory, perfume, flavoring, medicine and varnish in microscopy.

The Egyptians used mastic in embalming, in the preparation of kyphi ointment, which was used in embalming as well as in religious capacities (it probably had religious significance even when used for embalming), and in perfumes. Theophrastus (58) and Pliny (43) describe *P. lentiscus* in such a manner that there can be no doubt of its identity in their works (16, 18, 35, 36, 38, 45. 60).

### Burseraceae

*Boswellia Carteri* Birdw. This shrubby, thorny bush seldom attains a height of

Fig. 4. Egyptians importing live myrrh trees from Punt as seen in the wall reliefs of the Deir-el-Bahari Temple at Thebes (circa 1400). (Courtesy of the Boston Museum of Fine Arts.)

more than four to five meters and is sparsely branched. It is native to Somaliland, Abyssinia and South Arabia. *B. Carteri* is the chief source of frankincense (olibanum), an oleo-gum-resin which is the most important incense material in the world. Frankincense may also be obtained from other species of *Boswellia,* notably *B. papyrifera* Hochst. *B. thurifera* Roxb. ex Flem. (*B. serrata* Roxb.), all of which grow in and are native to Somaliland, Abyssinia and South Arabia. The "Incense from Punt (roughly: Somaliland at the Bab-el-Madab Straits)" and "white incense" of Egyptian records are probably frankincense.

Frankincense is gathered almost exclusively by Somali Indians who even cross the Gulf of Aden to obtain it in Arabia. During the hot season they make a deep incision in the trunk and peel off a narrow strip of bark about five inches below the incision. The sap exudes, dries and forms tears on the bark which are then picked by hand. These tears are usually less than one half inch in diameter, of

irregular shape and varying in color from nearly white to yellowish to reddish-brown. The taste is aromatic and somewhat bitter. Frankincense is composed of 60–70% resin, 30–35% gum and 3–8% oil of olibanum.

The Egyptians used frankincense not only as an incense, but also in perfumes, ointments and unguents (esp. kyphi) and in embalming. It was one of the gifts brought by the wise men to the infant Jesus (16, 19, 27, 30, 35, 60, 64).

*Commiphora* spp. Species of the genus *Commiphora* are the source of the Balm (or Balsam) of Gilead, also called Mecca Balsam or Myrrh of Gilead, and of myrrh. They occur in the same geographical area (Somaliland, Abyssinia, South Africa) as *Boswellia* spp. and their oleo-gum-resins are produced and harvested in a manner identical with frankincense. The trees are low and shrubby, seldom more than ten or twelve feet high, with thorny branches.

It is generally agreed that *Commiphora* (*Balsamodendron*) *opobalsamum* (L.) Engl. is the source of the Balms, Balsams and Myrrhs of Gilead and Mecca. The many references in ancient writings (including Egyptian) to balms and balsams probably refer most often to the gum-resin of *C. opobalsamum,* although it is apparent that the terms were used indiscriminately for many kinds of resins, gum-resins, gums, ointments, unguents, etc.

There is much more difficulty in determining the ancient source or sources of myrrh. There are 160 species of *Commiphora* and, of these, there are two in Arabia, one on the Island of Socotra, and forty-one in northeast Africa. The species which appear to be the main supplies of myrrh are: *C. myrrha* (Nees) Engl. var. *Molmol, C. Schimperi* (Berg) Engl., *C. erythraea* (Ehrenb.) Engl. and *C. abyssinica* (Berg) Engl. According to most authorities, *C. Myrrha* var. *Molmol* is the principal source of myrrh today, but Engler says *C. Myrrha* gives no resin at all. This disagreement arises because Engler recognizes *Molmol* as a species rather than a variety of *C. Myrrha*—in opposition to most writers.

Perhaps much of the confusion may be attributed to the fact that there are two types of myrrh: herabol and bisabol. Herabol (sometimes called "true myrrh") commonly occurs in rough, eroded tears, from 2.5 to 10 cm. in diameter. It is a dull red-brown and covered with powder; it tastes bitter although its odor is agreeably aromatic. Bisabol is much like herabol in color although it is more yellowish and less dusty. It is characteristically soft and gummy. Myrrh ordinarily contains 2-5% volatile oil (bisabol goes up to 8%), 25-50% resin and the remainder gum.

The Egyptians prized myrrh very highly for use in embalming, perfumes, ointments, (esp. kyphi) and unguents. There are many references to it in Egyptian records. In the Punt reliefs may be found the description of an eighteenth dynasty expedition where ". . . the loading of the ships very heavily with marvels of the country of Punt; all goodly fragrant woods of God's-land, heaps of myrrh resin, with fresh myrrh trees . . ." is described (see Fig. 4). The Egyptians often attempted the introduction of desirable plants not native to Egypt; Tschirch and Stock (60) state that myrrh trees *were* cultivated in Egypt for a time.

Myrrh was another of the gifts from the wise men to the infant Jesus (6, 18, 19, 23, 27, 30, 31, 35, 38, 60, 64).

### Compositae

*Carthamus tinctoria.* This is a prickly, herbaceous plant, seldom more than two to four feet high, which yields safflower (also, carthamine or bastard saffron) and safflower oil. Opinion is divided as to the exact place of origin, but most authors seem to agree with Vavilov (61) that there were three (or, perhaps, any one of three) centers; India, Central Asia and

Abyssinia. *C. tinctoria* is virtually unknown in the wild state today (Theophrastus (58) and Pliny (43) say it grew both wild and under cultivation) and this greatly confuses attempts to locate its origin. It occurs today in many parts of the world, including Egypt. It is known that *C. tinctoria* was cultivated, too, in Ancient Egypt.

There is no evidence that safflower oil, which is pressed from the seeds, was used by the Egyptians, but there is much evidence that the dye was employed, especially in dyeing mummy wrappings and shrouds. *C. tinctoria* yields two dyes; red (carthamin) and yellow. The yellow is of limited usefulness because it is soluble in water. The dye is extracted from the florets which are gathered in dry weather as fast as they begin to open. These are dried, the yellow component extracted with water and the red residue, if not used immediately, is pressed into cakes (12, 27, 29, 30, 36, 57, 61, 64).

### Cruciferae

*Isatis tinctoria.* This species is the source of woad, a blue dye almost completely indistinguishable from indigo. It has always been accepted that the blue dye of the Egyptians was indigo, from either *Indigofera tinctoria* (Indian indigo) or *Indigofera argenta* (silver indigo). *I. argenta* was favored because it had been cultivated in Egypt since the fourteenth century A.D. and grew wild in Nubia, Kordofan, Sennar, and Abyssinia. It is thought unlikely that the Egyptians obtained indigo from India (*I. tinctoria*) until a very late date. Lucas (29) points out that woad is the most likely source of Egyptian blue dye. According to him, woad was cultivated in the Fayum of Egypt in early Christian times and probably earlier. This would seem to give *Isatis tinctoria* priority over *Indigofera tinctoria.* The natural home of woad is not really known. It has been cultivated all across Western Asia, Southern Europe and England since early Christian and pre-Christian days and was used by the primitive Britons, according to Pliny and Ovid, to dye their bodies. *Isatis tinctoria* is only rarely cultivated today, having been almost replaced by indigo.

*Isatis tinctoria* is a handsome plant reaching a height of three to four feet and bearing rich yellow flowers. The dye is obtained from the leaves which are crushed and rolled into balls to dry. The balls are then powdered, wet again and allowed to ferment (the dye is not naturally present but is produced only by fermentation). After fermentation, the balls of woad are ready for use in dyeing.

Blue was usually used by the Egyptians on articles for the living, although at least one mummy wrapping exists which contains blue thread (2, 12, 27, 29, 36, 44, 45, 63).

### Cucurbitaceae

*Citrullus colocynthus.* This is a climbing vine which bears a smooth, globular fruit about the size and color of an orange. The pulp of this fruit is soft and spongy and constitutes the colocynth ("bitter apple") of pharmacy. Colocynth is extremely bitter and poisonous, and is a drastic cathartic. It grows today throughout Western Asia and the Mediterranean region in general; also in several other parts of the world. In Palestine, Lebanon, Sinai, Egypt and Nubia, it grows wild in dry, sandy places and is very prolific. Apparently, it is native to this area of Western Asia and East Africa.

Pettigrew is, to my knowledge, the only writer to associate colocynth with embalming; he says it was an ingredient of one of the balsams used to prepare the dead. There is, however, mention (in an unknown connection) of colocynth oil (expressed from the seeds) in some papyri of the Graeco-Roman period (19, 27, 29, 35, 36, 38, 45).

**Fagaceae**

*Quercus cerris.* "Turkey oak" was proved definitely by the Kew Gardens to be the species from which the oak dowels in the shrines surrounding the sarcophagus of King Tut-ankh-amen were made. It grows today in the mountain forests in the Lebanon-Antilebanon region and may have been one of the oaks which, according to Theophrastus (58) and Pliny (43), grew in the vicinity of Thebes. Post (45) lists eleven species of oak growing in Syria, Palestine and Sinai and it is likely that the Egyptians also used species other than *Q. cerris* in various capacities (29, 42, 45).

**Hamamelidaceae**

*Liquidambar orientalis.* This tree is the Near Eastern source of the oleo-resin (and true balsam), storax (also called: styrax, liquid styrax, liquid storax, liquidambar). Chinese storax is obtained from *L. formosana* and American storax from *L. styraciflua.*

*L. orientalis* is native to Southwestern Asia Minor and it is rarely found outside that region today, although Tschirch and Stock (60) and Stuhlman (57) claim it may occur sporadically further east, i.e. around the Gulf of Alexandretta and Antioch. It is a medium-size tree, from 30-40 feet tall.

Storax is almost exclusively collected by a tribe of Turkish nomads called the Yuraks. They bruise the trunk of the tree and the balsam forms as a pathological reaction in the inner bark. The outer bark is scraped off and boiled in sea-water. The storax may then be skimmed off the top as it rises. For greater efficiency, the boiled bark is customarily pressed for still more yield of storax. The oleo-resin thus obtained is opaque, grayish and has a consistency approximating that of honey. It has a pungent, aromatic flavor and, on aging, acquires a pleasant balsamic odor. Storax has been used medicinally for many centuries, Pliny (43) having mentioned it in that capacity. It was used by the Egyptians, not only for embalming, but also in the preparation of ointments and perfumes. A piece of wood of *L. orientalis* was found in the eighteenth dynasty tomb of Tut-ankh-amen (19, 22, 27, 29, 30, 57, 60, 65).

**Lauraceae**

*Cinnamomum cassia* (Nees) Nees ex Blume and *Cinnamomum zeylanicum* Breyn. These are the sources of cassia and cinnamon respectively. The genus is native to Southeastern Asia and Malaysia. It does not exist in Africa or the Mediterranean area.

There is considerable doubt as to whether cinnamon and cassia were used in ancient Egypt and, if so, where they came from. The only evidence available of the use of cinnamon in dynastic Egypt (of an even slightly reliable nature) is the statement by Osburn quoted by Pettigrew (41) that on the surface of a twentieth dynasty mummy was ". . . a thick layer of spicery . . . (which) . . . still retains the faint smell of cinnamon or cassia." It may be noted that the odor of cinnamon is due to a constituent aldehyde, cinnamic aldehyde, and this is very susceptible to oxidation and volatilization so that it is, therefore, highly improbable that the odor could have persisted three thousand years.

There is, also, "evidence" in some of the ancient records. The oldest existing reference to cinnamon or cassia (they were frequently confused by ancient writers since they are very similar in many respects) is in the eighteenth dynasty Punt Reliefs wherein the loading of the vessels with, among other things, "cinnamon wood" is described. In the Karnak Reliefs of the nineteenth dynasty, it is written: "I gather together all the countries of Punt, all their tribute, of gum of myrrh, cinnamon . . ." And in the Papyrus Harris (twentieth dynasty) cinnamon is mentioned four times and cassia once in the lists of tributes.

It would thus appear that the ancient

Egyptians did have access to supplies of cinnamon and cassia. It is said that they were obtained in Punt which, in turn, must have received them from the Far East. But it is not so simple. There was no commerce between the Far East and Africa at so early a date. In 1500 B.C. (eighteenth dynasty), according to Laufer (25), Japan was not even in existence and China was yet a small inland agrarian community. China probably carried on no sea trade until about 200 B.C. Even though Laufer (25) proposes that Punt (or Egypt) received cinnamon and cassia from India or Ceylon instead of China or Indochina, there is still, according to W. S. Smith,* no real evidence of trade between Northeast Africa and the Far East until about the time of Alexander the Great in the third century B.C. There is considerable evidence that the two spices were to be had in Egypt, Greece, Palestine, etc., in the second and first centuries B.C., brought thence from India by the Phoenicians or Arabians. Strabo (56), writing in the first century B.C., mentioned India explicitly as a source of the spices.

It is very possible that the ancient records quoted above have been mistranslated; or, another alternative, as suggested by Fee (according to Laufer, 25) is that a fragrant bark, now extinct or unknown to us—perhaps a species of *Amyris*—once grew in Arabia or Ethiopia or both and it was to this that the ancient records refer.

It is extremely improbable, therefore, that the bark of *C. zeylanicum* or of *C. cassia* was ever employed by the ancient Egyptians in embalming or, indeed, that these two spices were even known to Egypt until the third or second century B.C., at which time Phoenician or Arabian traders, bringing the spices from India and/or Ceylon, introduced them to the entire Mediterranean area (6, 7, 8, 25, 29, 35, 39, 41, 49).

*Personal communication.

**Leguminosae**

*Acacia* spp. . . . Species of this genus are very numerous (about 420) and widely spread throughout the tropical and subtropical regions of the world; the majority are to be found about evenly divided between Australia and Africa, however. Post (45) lists eight species as indigenous to the Sinai-Syria-Palestine area and Muschler (36) mentions seven species growing in Egypt.

For many thousands of years *Acacia* spp. have supplied mankind with gum and timber. The timber is strong, elastic, naturally resistant to rot and fungal attack and although it is not easy to work, it was one of the earliest woods used by the Egyptians. According to the sixth dynasty Inscription of Uni: "His majesty sent me to Hatnub (middle Egypt) . . . (where) . . . I hewed for him a cargo-boat of acacia-wood." And later, "His majesty sent me to dig five canals in the South and to make three cargo-boats and four tow-boats of acacia wood of Wawat (in Nubia)." It would appear, then, that acacia timber was to be obtained in at least two places, both in the south, Middle Egypt and Nubia, which are known to have an indigenous growth of acacia.

Acacia is a small, thorny tree ranging in height from fifteen to thirty feet. but is sometimes stunted and shrubby. Its branches near the ground and the trunk may be as much as one foot in diameter. Not only is it an ancient source of timber, but it has also supplied the Egyptians with gum arabic (synonyms are based on the area of origin) since about the twelfth dynasty when it was reputedly used in making paints. Among other things, it also served to "stick" mummy wrappings.

Although many species of *Acacia* produce gum, today's main sources of gum arabic are *A. senegal* (L.) Willd. (*A. verek*), in the Anglo-Egyptian Sudan, and *A. arabica* (Lam.) Willd. var. *nilotica* (L.) Delile growing in Syria, Sinai, Egypt and south Ceylon, India, etc. . . .

The gum exudes naturally from the trunk of the tree, but this exudation is frequently abetted by breaking the bark without injuring the cambial layer or wood. The wound is at least two feet long. After three weeks to two months, there is sufficient exudation for gathering. The gum forms on the wound in large globular tears, soft at first, but gradually becoming hard. After picking, the tears are customarily bleached in the sun. Bleaching causes innumerable minute cracks to appear on the surface of the tear, giving it a characteristic opacity. Colors range from white through yellow and red depending on the source, species, method of preparation and many other factors. Gum arabic is used today in the textile, mucilage, paste, polish and confectionary industries and in medicine as an emulsifier and demulcent (5, 6, 18, 22, 29, 30, 32, 36, 45, 59).

*Cassia acutifolia* Del. Along with *Cassia angustifolia* Vahl., *Cassia acutifolia* is the source of true senna. *C. angustifolia* is native to Arabia and probably Africa and *C. acutifolia* is indigenous to the Anglo-Egyptian Sudan. Both species are straight, branched and about ten feet tall and both could have conceivably supplied the leaves from which senna, a cathartic of ancient usage, is derived.

However, its use as a cathartic dates only from the ninth century A.D. in Arabia and there is apparently no mention of senna in Egyptian records. The only suggestion that senna was used in embalming comes from Pettigrew (41), who claims that cassia and senna were components of "smyrea," a liquid used in the cheapest embalmings. We have seen the improbability that cassia was used and it appears likely that the same is true of senna. Pettigrew does not state his reason for believing that senna was a constituent of "smyrea" and it is extremely doubtful that it was used, in any capacity, in the embalming processes (30, 38, 41).

*Dalbergia melanoxylon.* "Ebony" may be the black heartwood of many kinds of tropical trees, but the "ebony" used in ancient Egypt (one might say the "true ebony" since the English word "ebony" is derived from the Egyptian "hebony") has been identified as *D. melanoxylon* (known today as African Blackwood). It is a small tree growing profusely in the scrub country and coastal regions of eastern Africa south of Egypt at least as far as Mozambique and Madagascar. African Blackwood is a dark, purple-plum color, very hard, close and free from pores. It is surprisingly easy to work and has long been a favorite material for the manufacture of clarinets, flutes, etc.

Ebony is mentioned often in Egyptian records as a material for the building of chests, shrines, coffins, etc., and although many articles of ebony have been found in tombs, there is yet to be discovered a coffin with even so much as dowels of ebony. Also, Egyptian records speak of ebony coming from Negro lands, Punt, Nubia, Genebteyew, Kush and the south countries, all of which are south of Egypt along the eastern coast of Africa. Apparently, the most ancient examples of ebony in Egypt are the small tablets and part of a cylinder seal from the first dynasty (1, 6, 21, 29, 57).

### Linaceae

*Linum* is a large genus of herbs found in temperate and subtropical areas around the world. *L. usitatissimum* L., a cultigen, is the present-day source of flax. *L. angustifolium* Lodd., according to the majority of writers, is the parent of *L. usitatissimum* although there are others who claim that distinction for *L. perenne* L.

Flax has been under cultivation since prehistoric times, and there is naturally some doubt as to which species were (was) cultivated. Post (45) says *L. angustifolium* was cultivated prehistorically and that *L. usitatissimum* replaced it in more recent times; there is little quarrel with this conclusion. DeCandolle (12)

states that *L. usitatissimum* has been cultivated for at least four or five thousand years in Mesopotamia, Assyria and Egypt and that it was and still is wild between the Persian Gulf, the Caspian Sea, and the Black Sea. Indeed, it appears, according to Post (45), Vavilov (61), and others, that *L. usitatissimum* did originate in or around Mesopotamia. Vavilov also lists Central Asia and Abyssinia as centers of origin.

As for the origin of *L. angustifolium* itself, there can be even less certainty. It is found wild from the Canary Isles to Palestine and the Caucasus, and its seeds, capsules and the lower part of the plant have been identified in the remains of the Swiss Lake-dwellers' culture at Robenhausen.

The species cultivated by the Egyptians is likewise obscure. However, Unger (according to DeCandolle (12)) identified a capsule from a 13-14 century B.C. monument as resembling *L. usitatissimum* more than *L. angustifolium*. But there is really no reason to split hairs over this point. It is generally agreed that *L. usitatissimum* has been cultivated in Egypt at least since the beginning of the first dynasty and probably before. It is certainly conceivable that *L. angustifolium* was cultivated previous to the intrusion of *L. usitatissimum* and even that it persisted in cultivation, in at least some instances, for some time after the latter had gained dominance.

According to Ethel Lewis (26) the oldest existing fabric is of linen and this is certainly to be expected; the Egyptians have been weaving this textile for about six thousand years. They were the linen-makers *par excellance* of antiquity and produced cloth that ranged in quality from the very delicate to the very coarse. Egyptian techniques of linen-making are well described by T. Midgley (quoted by Lucas, 29). "The structure of textile fabrics of the earlier dynastic period in Egypt is now fairly well understood, and the character of the loom and its accessories equally well known. . . . From the tomb paintings . . . we have learnt how the flax stem was treated to obtain the bast fibers, how they were cleansed, heckled, roved, spun and warped. Finally, we have in these pictures the breast and warp beams shown pegged to the ground, lease rods and heddles inserted, and the weaving of cloth from carefully prepared yarns. No reed was used, so that . . . there is a great irregularity in the spacing of the warp threads as compared with modern fabrics; . . . Apart from this, it is singular how little within the range of plain weaving which is known today was not practised by the weavers of the Old Kingdom. . . . Thus at the very dawn of the historic period in Egypt we find the craft of the spinner and the weaver very highly developed in technique; manifestly the early stages of the evolution of the loom must be sought far back in the pre-dynastic era."

Linen manufacture was a large industry in Egypt and the Egyptians exported large quantities of it. The city of Apu was famous for its linen, and the city of Tanis was the center of linen manufacture in Lower Egypt. However, due to the large quantities exported, the industry must have flourished in other cities as well (7, 8, 12, 26, 29, 45, 61, 64).

### Lythraceae

*Lawsonia inermis* (*Lawsonia alba*). This shrub is six to eight feet high and is widely distributed in the arid parts of north and east tropical Africa, Madagascar, tropical Asia and Australia. Most authorities believe that it originated in the East (Vavilov (6) says India) and spread early to the Mediterranean and Africa.

The leaves of *L. inermis* are dried, powdered and made into a paste called henna —a bright red, yellow or orange dye. The dye was and is used as a cosmetic and was probably used to stain the nails of mummies (although many writers feel that

stained nails could be due to the embalming materials) and, occasionally, to dye mummy wrappings.

The flowers are very fragrant and make an excellent perfume. It is likely that the Egyptians also employed the flowers in this capacity (8, 12, 27, 29, 30, 35, 36, 45, 61, 64).

### Moraceae

*Ficus sycomorus* L. The "Egyptian fig tree" or "sycomore fig" is cultivated today in Egypt and may also be found along the eastern shore of the Mediterranean. That it grew in Palestine during Bible times, there can be little doubt; it is frequently referred to in the Bible (as "sycomore"). Strabo (56) says that it grew in Ethiopia and this would seem to be substantiated by several statements in ancient records which indicated that the sycomore fig was obtained in Punt (e.g. in the Papyrus Harris: "I planted incense and myrrh sycomores in thy great and august court in Ineb-Sebek, being those which my hands brought from the Country of God's-Land"). Theophrastus (58) states that the "sycomore fig" grows in Egypt and Lucas (29) seems to feel that the Egyptians had a domestic supply of the tree. Schweinfurth, according to Muschler (36), places the origin of *F. sycomorus* in Yemen just east across the Bab-el Madab straits from Punt.

*F. sycomorus* is an evergreen, growing to a height of 30-40 feet and sometimes attaining a trunk girth of 20 feet. The wood is very soft and porous, but is, nonetheless, very durable and was a great favorite with coffin-makers. Sycomore fig coffins have been discovered which date from the twelfth dynasty and up through the twenty-sixth dynasty. Remains of *F. sycomorus* have been found in predynastic graves (6, 29, 35, 36, 45).

### Rhamnaceae

*Zizyphus* spp. This genus embodies about fifty species scattered about the tropics and subtropics of the world but found chiefly in Asia and America. The wood, sidder, found in a third dynasty plywood coffin and later as coffin dowels, was probably (according to Lucas (29)) obtained from *Z. mucronata* Wilbl. or *Z. spina-Chrisi* Lam., but the sidders are exceptionally difficult to differentiate even by microscopic examination. *Z. mucronata* is quite common in the drier parts of tropical and southern Africa and the Sudan and might have been used by the Egyptians except, according to Lucas (29), that there is no mention in ancient records of woods other than ebony and certain sweet and fragrant types having been brought from the south of Egypt. *Z spina-Christi* is probably the species used in coffin construction. It grows throughout the Mediterranean region including Egypt, the Levant and tropical Africa. It is a small tree, 9-15 feet tall, and thus too small to be extensively used in coffin construction, but it apparently grew in Egypt, was hard and durable and large enough for dowels.

The dried fruit of *Z. spina-Christi* has been found in predynastic remains. It may have been this part of the plant that was used in kyphi ointment (29, 30, 35, 36, 45).

### Tamaricaceae

*Tamarix* spp. This genus contains about seventy species. They are numerous in temperate Asia and around the Mediterranean; Muschler (36) lists eight species growing in Egypt and Post (45) twelve in the Lebanon-Palestine-Sinai region. *Tamarix* (or tamarisk) is definitely indigenous to Egypt, stems and branches from the late Quartenary Period having been found in the Wadi Qena (29).

Tamarisk is a halophyte and may be found growing profusely in the salty deserts and along the sea coasts. The tree is usually straight and may range in height from a few to one hundred feet, but in the desert it is frequently a gnarled shrub. The wood is hard, tight, heavy and workable and was used for walking sticks, etc., as early as the Middle Kingdom. It did

not find its way into coffin construction until about the twentieth dynasty.

Tamarisk is mentioned ("tamarisk bundles") in the twentieth dynasty Papyrus Harris and Pliny (43) states that ". . . in Syria and Egypt this shrub is abundant." It is now generally supposed that the "manna" eaten by the Israelites during their trek from Egypt was the hardened, sweet sap of *Tamarix* spp. drawn off, predigested and exuded by aphids (4, 6, 9, 28, 29, 35, 36, 45, 53, 64).

## Vitaceae

*Vitis vinifera*. The records of the cultivation of the grape and of the making of wine in Egypt go back five or six thousand years. Wide cultivation of the grape since ancient times complicates the problem of origin, but Vavilov (61) places it in the Near-Eastern center (interior of Asia Minor to Turkmenistan), DeCandolle (12) places it to the south of the Caucasus and Post (45) says ". . . its home is between the southern shores of the Caspian Sea and the Taurus."

*V. vinifera* grows today in Egypt, Lebanon and Palestine (and elsewhere) and *V. orientalis* may be found in Lebanon and Palestine. Although there can be no real certainty as to the species employed by the Egyptians in wine-making and as raisins which were used in kyphi ointment, it is generally conceded that it was *V. vinifera* (8, 12, 35, 36, 45, 61).

TABLE I

SUMMARY OF PLANTS MENTIONED IN THIS PAPER

| NAME | PAGE | PART OR PRODUCT USED | USE |
|---|---|---|---|
| *Abies cilicia* Carr. | 89 | Exudate, wood | Embalming, coffins |
| *Acacia* spp. | 98 | Exudate, wood | Coffins, paints, adhesive |
| *Allium cepa* L. | 92 | Bulb | Religious, embalming (?) |
| *Aloe succotrina* Lam. | 92 | Exudate, fiber | Embalming (?), wrappings (?) |
| *Boswellia* spp. | 93 | Exudate | Embalming |
| *Carthamus tinctoria* L. | 95 | Floret | Dye |
| *Cassia* spp. | 99 | Leaf | Embalming (?) |
| *Cedrus libani* Loud. | 89 | Wood | Embalming, coffins |
| *Cinnamomum* spp. | 97 | Bark | Embalming (?) |
| *Citrullus colocynthus* (L.) Schrad. | 96 | Fruit | Embalming (?) |
| *Commiphora* spp. | 95 | Exudate | Embalming (?) |
| *Crocus sativus* L. | 92 | Stigma | Dye (?) |
| *Cupressus sempervirens* L. | 89 | Wood | Coffins |
| *Cyperus papyrus* L. | 90 | Pith of stem | Embalming |
| *Dalbergia melanoxylon* Guill. & Perr. | 99 | Wood | Coffins (?) |
| *Evernia furfuracea* (L.) Ach. | 88 | Whole plant | Embalming |
| *Ficus sycomorus* L. | 101 | Wood | Coffins |
| *Isatis tinctoria* L. | 96 | Leaf | Dye |
| *Juniperus* spp. | 89 | Wood, fruit | Coffins, embalming (?) |
| *Lawsonia inermis* L. | 100 | Leaf | Dye |
| *Linum* spp. | 99 | Fiber | Wrappings, embalming |
| *Liquidambar orientalis* Mill. | 97 | Exudate | Embalming |
| *Phoenix dactylifera* L. | 93 | Exudate | Embalming |
| *Pinus halepensis* Mill. | 90 | Exudate | Embalming |
| *Pinus pinea* L. | 90 | Exudate | Embalming |
| *Pistacia lentiscus* L. | 93 | Exudate | Embalming |
| *Quercus cerris* L. | 97 | Wood | Coffins |
| *Tamarix* spp. | 101 | Wood | Coffins |
| *Taxus baccata* L. | 90 | Wood | Coffins |
| *Vitis vinifera* L. | 102 | Fruit | Embalming |
| *Zizyphus* spp. | 101 | Wood, fruit (?) | Embalming (?), coffins |

## Appendix

CHRONOLOGY OF ANCIENT EGYPT
(after W. S. Smith. Ancient Egypt as Represented in the Museum of Fine Arts, 3rd ed., 1952)

Prehistoric:
Pre-dynastic: 4000-3200 B.C.
Archaic Period: 3200-2680 B.C.
Dynasty I: 3200-2980 B.C.
Dynasty II: 2980-2780 B.C.
Dynasty III: 2780-2680 B.C.
Old Kingdom. 2680-2258 B.C.
Dynasty IV: 2780-2680 B.C.
Dynasty V: 2565-2420 B.C.
Dynasty VI: 2420-2258 B.C.
First Intermediate Period: 2258-2052 B.C.
Dynasty VII: Interregnum
Dynasty VIII: 2258-2232 B.C.
Dynasty IX: 2232-2180 B.C.
Dynasty X: 2180-2052 B.C.
Middle Kingdom: 2052-1786 B.C.
Dynasty XI: 2052-1991 B.C.
Dynasty XII: 1991-1786 B.C.
Second Intermediate Period: 1786-1570 B.C.
Dynasties XIII-XIV: 1786-1680 B.C.
Dynasties XV-XVI: 1720-1570 B.C.
Dynasty XVII: 1600-1570 B.C.
New Kingdom: 1570-1085 B.C.
Dynasty XVIII: 1570-1349 B.C.
Dynasty XIX: 1349-1197 B.C.
Dynasty XX: 1197-1085 B.C.
Period of Decline: 1085-663 B.C.
Dynasty: XXI: 1085-950 B.C.
Dynasty XXII: 950-730 B.C.
Dynasty XXIII: 817 (?)-730 B.C.
Dynasty XXIV: 730-715 B.C.
Dynasty XXV: 751-663 B.C.
Saite Period: 663-525 B.C.
Dynasty XXVI: 663-525 B.C.
Foreign Domination

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The reader is referred to the many excellent works on Ancient Egyptian flora by Schweinfurth, by Keimer and by Tackholm.