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ΕΘΝΙΚΟΝ ΙΔΡΥΜΑ ΕΡΕΥΝΩΝ

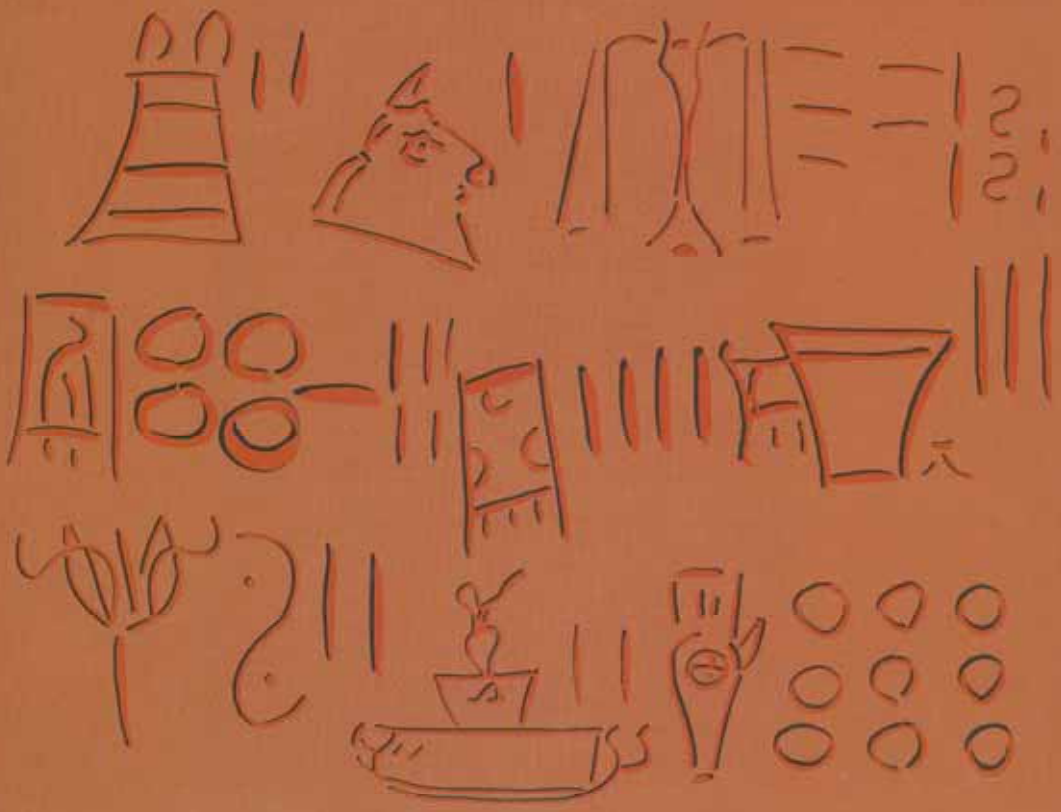
RESEARCH CENTRE FOR GREEK AND ROMAN ANTIQUITY
NATIONAL HELLENIC RESEARCH FOUNDATION

ΜΕΛΕΤΗΜΑΤΑ
33

Anna Michailidou (Editor)

MANUFACTURE AND MEASUREMENT

Counting, Measuring and Recording Craft Items in Early Aegean Societies



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Anna Michailidou (ed.)

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Edited with the assistance of
Pigi Kalogerakou & Katerina Voutsa

ATHENS 2001

Dedicated to the memory of Manolis Andronicos

By those of the authors
Who were his students
And by the others
Who wish they had been

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FOREWORD

The publication of each new volume of the ΜΕΛΕΤΗΜΑΤΑ series is an event which gives great pleasure. But the publication of this new volume edited by Anna Michailidou and dedicated to manufacture and measurement in early Aegean societies has a special significance. It is the first in the series to deal with second millennium archaeology and history, and it will soon be followed by others, opening a new and promising field of research for our Centre.

Early Aegean and, more particularly, Mycenaean Studies, after a rapid expansion in the third quarter of the last century, mainly due to the decipherment of the Linear B script, experienced a long period of stagnation before a new blossoming in very recent years. This we owe to two independent but converging developments: on the one hand the increase of the corpus of texts, thanks to the patient joining of fragmentary documents already known as well as to the discovery of new archives in unsuspected parts of the Mycenaean world; and on the other hand the application of novel approaches, inspired by new trends in archaeology, to their study.

Old passions, particularly passions of youth, die hard and a little fresh air is enough to rekindle the flame. Long before the stones of Macedonia, even before structural analysis of Spartan cults, my first scholarly infatuation was with the Mycenaean world. I was fortunate to be initiated to it by Michel Lejeune and to discover it in the company of my life-long friend Olivier Masson at the IVe Section of the École Pratique des Hautes Études. Since then I have followed with enthusiasm the progress of Mycenaean studies and always regretted that they are not given the importance they deserve in Greece. Recently, parallel discoveries and scholarly breakthroughs on both sides of the Aegean sea have revealed to us in its complexity and richness the political map of the Late Bronze Age. Hieroglyphic and cuneiform documents allow us to recover the political history and the historical geography of that period, while the ethnics figuring in the Linear B tablets indicate, be it indirectly, trade routes, ports of call and points of contact between Achaean Greece and Hittite Asia Minor. Such high-level history, passionately interesting though it is, would remain to a large extent unexplained, not to say incomprehensible, without the study of the humbler activities of the craftsmen who produced, measured, weighed and thus prepared for commercialisation the artefacts which followed the great trade-routes and were exchanged at Knossos, Thebes, Miletos, Ephesos or other important centres of the Aegean. To these activities is the present volume dedicated, and I am grateful to Anna Michailidou and all those who contributed to it for having conceived, planned, financed and prepared it for us to read and learn from.

Miltiades B. Hatzopoulos
Director of the Centre for Greek and Roman Antiquity

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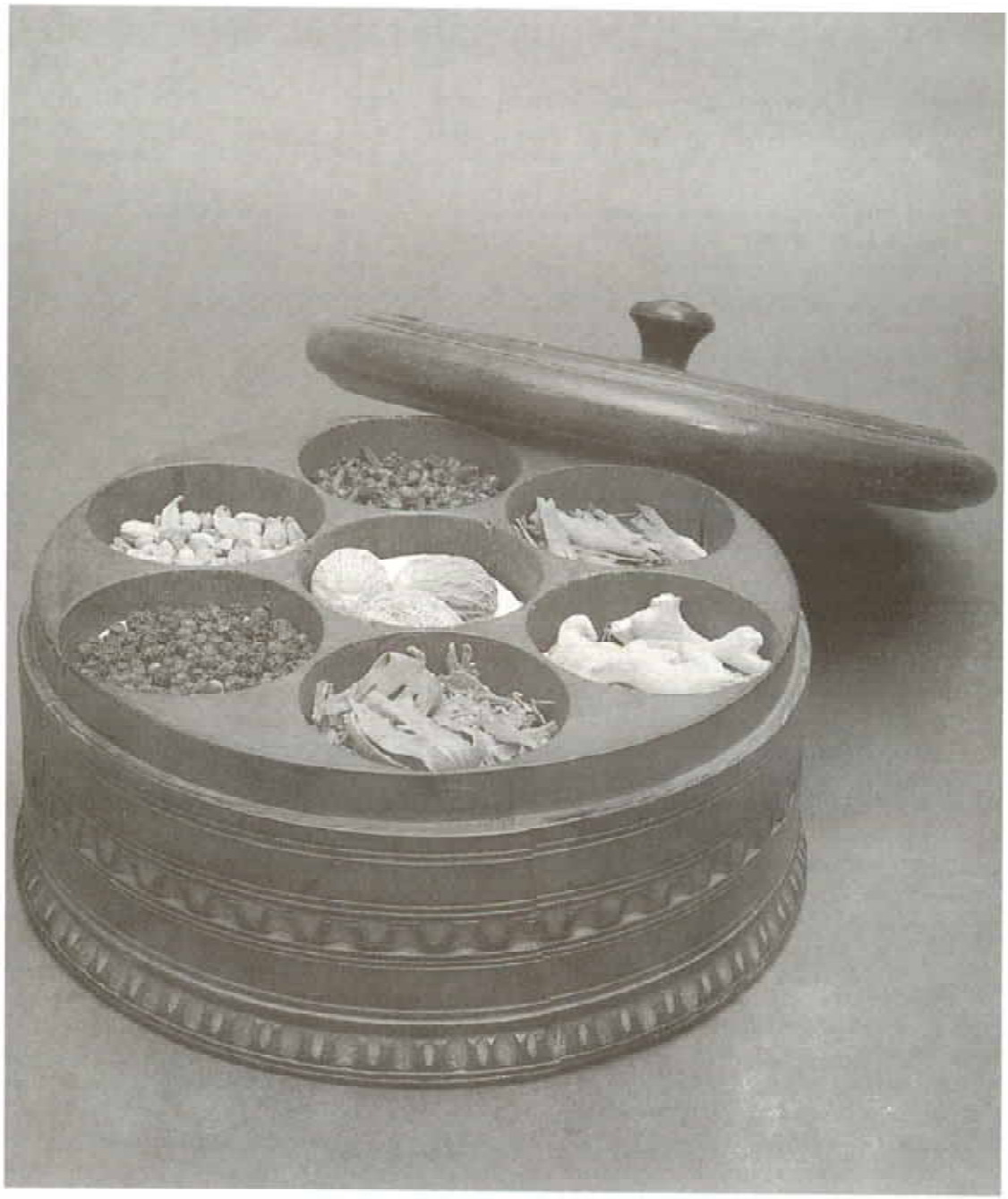

Spice box, 17th century, containing nutmeg, cinnamon bark, coriander and ginger, pimento and pepper. As late as the 19th century, pharmacists traded not only in medicines but also in spices and sweets (after W.-H. Hein & W.-D. Müller-Jancke, *Kostbarkeiten aus dem Deutschen Apotheken-Museum Heidelberg*, 1993, 62-63).

CONDIMENTS, PERFUME AND DYE PLANTS IN LINEAR B: A LOOK AT THE TEXTUAL AND ARCHAEOBOTANICAL EVIDENCE*

Anaya Sarpaki

INTRODUCTION

The aim of this chapter is to re-examine the condiments, perfume and dye plants mentioned in the Linear B archives in order to readdress problems of identification. Moreover, the available textual, archaeobotanical, botanical and ethnobotanical evidence has been collected in order to try to tackle issues which touch upon social, political and economic explanations of the Mycenaean world.

There has been a temptation, so far, to see the Mycenaean world as an undifferentiated whole, in both cultural and chronological terms. Culturally it covers or influences the whole of the geographical area of Greece but with greater emphasis on the south of Greece, and chronologically it spans the period 1450 to 1200 BC. This, at least, is the period when Linear B was the accepted administrative script. This simplistic view has stopped us from evaluating the subtle geographical/cultural differences, which could have immense repercussions on agricultural practices, population needs for goods, and evaluation of priorities in administrative concerns. Dissenting from a simplistic view of the Mycenaean world, and comparing with what Rothman[1] has said about the Greater Mesopotamian area, it would be a mistake to see it as totally uniform or homogeneous. He claims that from the very beginning, differing groups drew selectively from the great pool of cultural traditions and organisational structures in the region to create unique, local cultural and possibly organisational arrangements. As much as the commonalities in the region, these local arrangements determined the organisational dynamics of complexity in Greater Mesopotamia. This, it is believed, explains, very well –although it refers chronologically to earlier periods– what must have taken place in the Mycenaean world.[2] The clay tablets are just one source of data mirroring this complexity and are just pieces –nevertheless, very important ones– in the puzzle leading to our understanding of this complex society. It is not just the general economic information which is important, but the local differences within the Mycenaean world, which, we hope, will become clearer as research progresses in all fields of epigraphical, archaeological, and archaeological science studies.

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* I would like to thank my colleague and friend Anna Michailidou for inviting me to participate in the programme 'Prehistoric Technology and Exchange: Counting, Weighing and Recording the Raw Material and the Product', of the Research Centre of Greek and Roman Antiquity; also for challenging me with a more intimate acquaintance of Linear B. In the preparation of the tables I greatly tapped into the Linear B database, which has been created at this centre, and was assisted by Alkis Dialismas, Dimitra Kriga and Katerina Voutsa, whom I wholeheartedly thank. George Landers and David Hardy have provided a good English shake-up and I thank them warmly for it.

[1] Rothman 1994, 7.

[2] Sjöberg 1995; Shelmerdine 1999, 555, 564, 565 (for scribes), 567, 573: 'the Mycenaean kingdoms are different in a number of ways'.

Little is known of Mycenaean economic transactions in comparison with the details that other economic systems in the Near East have offered through the decipherment of their written documents. The little we know comes from a 'slanted' view, through the few ephemeral documents which happened, temporarily, to record economic transactions before they were copied on to more durable material, probably, papyrus, wood and/or parchment. The Linear B tablets, as we know, refer only to the economic year during which the tablets were destroyed. As the discovery of these written clay documents is just a mere accident of fate, the picture that is drawn is, as a result, quite distorted. Even so, there is no way of even evaluating the degree of misrepresentation. Tablets were preserved only where conflagration occurred in the palaces. We would need an evaluation of the degree of destruction such as a knowledge of which area(s) were subjected to fires, in order to be able to evaluate the likelihood of the preservation of the relevant tablets, and in order to be surer of what we are missing in each case. Therefore, areas, which were not exposed to burning did not produce equivalent evidence, but, nevertheless, probably held very important economic documents of the same or other activities. What is interesting is that products of the same category often tend to be recorded in the same area(s), and, therefore, we could claim that, for certain products, we have much of the concurrent evidence for the specific part of the year.

1. The Plants in the Tablets: Indirect Observations

It is interesting to note that some plants, which are mentioned in some archives, are not referred to at other sites.[3] The interpretation of such phenomena is obscure and there may be many explanations. First, it may be a quirk of chance, whereby the preserved tablets do not mention the products, which might have been annotated in other archives –now lost– due to the accident of preservation. A second explanation is that plants considered of economic importance in one area of study, cannot necessarily be thought of as being of the same economic stature in another geographical region. For example in areas where the saffron crocus does not grow, this plant would have been either of very high value due to its rarity, or of no use, as needs, in the first instance, develop by exploring the local availability of species. It is very probable that similar local differences could have been greater in prehistory than one can presently imagine. The palace 'centres' might have annotated different crops for a multitude of reasons. The appearance of certain crops only in certain 'centres' (Table 1) does not demonstrate conclusively that these were not cultivated in other areas as well, but might indicate that 'transactions' involving them did not interest the palace, for some reasons not yet understood.

One reason might be related to the type of land where these crops would have grown: in certain areas, that is, some crops might have been 'palace related' in that the land on which the crops would have grown, might either have been state owned or connected to the palace under some system of taxation.[4] Another reason might have been the control that the palace might have wished to exercise over certain 'crafts'. For example one can detect a rather diversified interest of Mycenae, perhaps, in dyeing with safflower (Table 2) where there is a recording of seed as well as of harvest –florets.[5] Mycenae, also, seems to have 'controlled' some condiments, such as

[3] Of course, we should also take into account the fact that all the tablets are not chronologically synchronous.
[4] Duhoux 1976.
[5] A discussion of this point is presented below under *ka-na-ko*.

celery (Table 2), cumin,[6] mint,[7] sesamum,[8] *ko-no*[9] and cardamon.[10] On the one hand, Mycenae seems to have favoured annotating imported plants (such as ginger grass (?) and cumin), to a much greater extent –from the evidence at hand– than Knossos, which, to my mind seems more involved in local production. Pylos is nearer to the inclination/policy of Mycenae, with its mention of cinnamon,[11] henna[12] and aromatised oils.[13] From the fragmentary evidence at hand, we could say that Mycenae and Pylos provide an image of 'higher'-level 'trade'[14] with other centres abroad than does Knossos. Mycenae together with Pylos, in present parlance, could be identified as the more 'urban' centres of the Mycenaean period –as seen from the tablets– compared with Knossos, which fell behind in terms of 'status' products such as condiments. In this respect, the impression formed, is that Mycenae and Pylos were more centres of consumption,[15] whereas Knossos was a centre of production[16] of 'higher level' goods. Does this mean that the palate of the Knossians was less extravagant and, therefore, more provincial, or that external 'trade' was no longer in the hands of Knossos but went via the intermediary and/or control of the Peloponnesian centres? Another sign of the 'urbanity' of Mycenae is the mention of mint and celery, two plants which could well have been grown in gardens, near the towns, but, obviously, its inhabitants, either did not have the garden space or were involved in more 'urbanised'[17] endeavours rather than engaging in the pursuit of 'humble' row-gardening. This, for whatever reason, is an indirect indication of 'heavy' urbanism. Due to the unavailability (or difficulty of access) of such produce, the palace administration was forced to annotate its possession, which is seen from their mention in their archives.

Knossos, on the other hand, seemed to deal far less with exotics, and more with products, which were implicated in industrial uses such as dyeing,[18] and resins, which would have been useful as unguents and for different purposes often connected with industrial endeavours. The textile industry must have been of great importance for Knossos, as is clear from the several very thorough studies of Killen,[19] but also seems to be verified by the evidence arising from the

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[6] See Table 8.

[7] See Table 9.

[8] See section under *sa-sa-ma* where it is suggested that sesamum does not refer to sesame but to an oil. For sesamum see Table 10.

[9] See Table 11 and catalogue of plants (Section 4).

[10] See Table 3.

[11] See Table 12.

[12] See Table 3.

[13] See rose and sage in Tables 3 and 17.

[14] By 'higher'-level 'trade' I mean that it is not exactly staple goods, nor does it refer, necessarily, to luxury items, such as precious commodities, but to goods which would be more in demand by an urban and opulent community, rather than by an urbanised but more farmer-based society (Godart 1981).

[15] A very interesting article by Stein (1994) refers to these chiefdom economies for the Ubaid period in Mesopotamia as having strategies of wealth finance –which in our case would suit the Mycenae and Pylos archives– versus a polity of staple finance, which would suit the Knossos model. One can assume that 'wealth finance' embodies the consumer mentality, whereby valued materials are of primary interest and importance.

[16] The terms 'consumption' and 'production' are generally referred to agricultural communities but here they are used in the context of complex societies, and therefore produce a divide, at a higher level, of urban societies.

[17] Surely, there is a hierarchy within urbanism (Sjöberg 1995, 27). Could we be seeing a difference between redistributive 'exchange' and the beginning of a 'market' economy?

[18] See crocus, and *po-ni-ki-jo* (alkanet?).

[19] Killen 1984 *inter alia*.

Table 1. Linear B archives, which mention the relevant plants.[20]

PLANT SP.	LINEAR B
ka-na-ko, e-ru-ta-ra, re-u-ka	MY Ge
mi-ta, mi-ta-qe, ka-ra-ko	MY Ge
sa-sa-ma, SA	MY Ge
ko-no, ko-i-no	MY Ge
ku-mi-no, KU	MY Ge; Ui
po-ni-ki-jo	KN Bg; Ga; Sd; X
wo-do-we	PY Fr
CROC, ko-ro-ki-no	KN Np; X
KAPO	PY An; Un, KN F
CYP, PYC, ku-pa-ro	MY Fu; Ue, PY An; Fa; Fr; Ua; Un, TH Wu, KN E; F; G; Ga; Uc
ma-ra-tu-wo, MA	MY Ge, KN Ga;
ko-ri-ja-do-no,[21] KO	MY Ge; Ue, PY An; Un, KN Ce; F; G; Ga; V
ki-ta-no, AROM (*123) (?)	KN Ga, PY An[22]

botanical listings.[23] What seems to occur is that the control of the palace ran through all of the stages of this industry, from the ownership/control of flocks to the dyeing of the fibre and to the weaving of the various types of cloth.[24]

In the field of perfumery, Knossos does not seem to lag behind. Iris root (?)[25] is controlled, together with fennel oil (?), coriander, saffron,[26] and cyperus. The production of drinks, such as wines, must have also been an important source of income and socio-economic control for the ruler(s) of Knossos. The resins[27] would have helped to aromatise drinks (?) such as wine or other, made them more appealing to the senses, and also helped preserve them during their long voyages.

Stein[28] in his stimulating article on Ubaid economy, ritual and power, argues that the 'chiefly strategy of locally-based, ritually generated staple finance resulted in the peaceful spread and

[20] For a discussion for each and every one see the catalogue of plants (Section 4).

[21] For several other forms of the term see Table 7.

[22] **PY An** is included if *AROM* (**123*) is *ki-ta-no*. It is perhaps not a coincidence that the *AROM* (**123*) (Table 4) is also in **KN Ga** series.

[23] The mention of dyes such as *po-ni-ki-jo* and saffron.

[24] Varieties of cloth are mentioned in the Knossos tablets. See Tzachili's relevant chapter in the present volume.

[25] We have used a question mark as the question is still disputed. I personally incline in the direction of the iris. Here we would also need to mention the results of the analysis of the organic content of a tripod jar, found at the site of Chamalevri, Crete, which was identified as *Iris sp.* (*Minoan and Mycenaean Flavours*, 50, 51). However, the scientific article related to this find is still awaited so as to evaluate the level of probability of this chemical compound. See Table 3.

[26] Saffron could be used to both aromatise and colour perfumery.

[27] *re-di-na-to-mo* (André 1964, 88) is the collector of resin? The new reading is *re-qo-na-to-mo* (Aura Jorro & Adrados 1993, Vol. II, 236, 241). Refer to the term *ki-ta-no* (**123*), which is not yet accepted by all as equated to **123*.

[28] Although Stein (1994, 44) refers to much earlier societies, the Ubaid (*ca.* 5th millennium), and comparisons cannot be strictly justified, yet, the degree of complexity of those eastern societies, provides material for thought, when interpreting the Mycenaean world.

long-term stability of small scale chiefly polities throughout greater Mesopotamia', a description which would suit the Knossian economy, as we see it from the present archives and especially the agricultural resources. Knossos seems to mobilise indigenous resources as staple finance, whereas Mycenae and Pylos seem to have economies depending more, perhaps, on wealth distribution from exotic trade goods. These are very important and subtle matters whose impact is felt not only on the economy but the repercussions affect aspects of social organisation and aspiration, which need much further investigation for the Aegean of the Mycenaean period.

The plants listed in the tablets[29] surely demonstrate the minimum number of the plants, either imported or existing in the then 'markets', whose importance was considered worth annotating in the tablets, for we can assume that not all produce was recorded.[30] The administrative centres registered all that was of interest to the palace for (a) redistributive or (b) other 'trade' purposes, and (c) purposes which still evade us but must have been connected with special categories of land ownership and/or use, e.g. share-cropping state-owned land, cultivation of particular crops which might interest the palace, or tax concessions connected with other rights of cultivation. Certainly, much more research is needed regarding land ownership and all that it entails, although a great deal has already been written.[31] The listed plants cover the entire spectrum, from one end, humble agricultural produce, such as barley, to, at the other end, condiments, perfumes and dye plants, which are listed as luxury goods. This study concentrates only on plant material, which belongs to the group classified as 'higher'[32] status crops, namely aromatic plants, condiments, and dyes, which are 'transacted' in measures of volume, are weighed and/or counted in various sorts of unknown ways.[33]

Interestingly we notice that some aromatics occur, time and again, at different centres, such as *Coriandrum sativum* (coriander)[34] at Knossos, Mycenae and Pylos and *Foeniculum vulgare* (fennel)[35] at Knossos, and Mycenae. *Cyperus spp.*[36] is also mentioned in several centres (Mycenae, Pylos, Knossos but also at Thebes). Some plants, such as *Carthamus tinctorius* (safflower), *Mentha spp.* (mint), *Sesamum indicum* (sesame), *Pistacia lentiscus* (σχῖνος)/ *Cymbopogon schoenanthus*[37] and *Cuminum cyminum L.* (cumin),[38] appear only in the Mycenaean archive. Others, such as *Alkanna tinctoria* (alkannet), *Pistacia terebinthus* (terebinth resin), and *Crocus spp.* (including cartwrightianus and sativus) (saffron), are mentioned only at Knossos. The explanation of such a phenomenon is complex, as mentioned above, as it could be due to a combination of factors. The mere presence of and haphazard cultivation by private farmers would not have required the central authority to keep official records. Assuming they were reflections of real economic structures, it might be that these portray records of areas of influence, a type of 'economic catchment area', whereby, the administration of any area registered what was

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[29] See Tables 1 and 2.

[30] An example is the total absence of recording of pulses in Linear B, although we find them, time and again, in the archaeobotanical samples.

[31] See Duhoux 1976 *inter alia*.

[32] Here 'higher' level is used instead of 'luxury' plants as this last term, I believe, is better used for products of extravagance.

[33] For example bunches, baskets, 'primary units' (see note under Table 3), which tend to be different for each plant/plant-substance, where it is not always clear to us as to what is meant.

[34] See Tables 1 and 7.

[35] See Table 6.

[36] See Table 14.

[37] See discussion of *ko-no* in the catalogue of plants. See Table 11.

[38] See Table 8.

within its catchment area: *Crocus spp.* for example, is only mentioned at Knossos. This could be a reflection of a real situation in that saffron crocus exists in the wild in Crete and the Cyclades,[39] and *Crocus cartwrightianus*, *C. tournefortii*,[40] *C. cancellatus* may have been intensively collected only in those areas.[41] It would make sense for Knossos to have been a registry centre of this aromatic plant, as the crocuses which produce saffron are mainly found in Crete, and, if the Cyclades were incorporated in the politico-economic sphere of the Knossos palace administration, due to their geographical proximity,[42] they too could have provided some produce.[43]

2. Quantities of Aromatic Plants: Possible Interpretations

Most of the above mentioned aromatic plants were measured by volume, and/or some were weighed and a few were counted in primary unit measures, which might have been different for each plant/plant-product. Only one of the identified plants, mint[44] was counted in 'bunches' (*PE*).[45] However, the size of these 'bunches' is unknown: could it have been the size of today's batches of onion/garlic, or smaller, in the way parsley and even mint is traded? Probably, one should envisage larger quantities, for example the quantity that an equine (donkey, mule, horse) can carry as one load.[46] One plant in particular, *ki-ta-no*, is annotated in fairly large quantities of *ca.* 16,500 litres (1.65 tons)[47] and its listing is centred on Knossos. The highest value was 5,568 litres and no transaction fell below 960 litres.[48] On the other hand, plants/plant-material such as *ka-na-ko* (safflower) (mostly weighed, but the white variety measured by volume), *ma-ra-tu-wo* (fennel), *ku-mi-no* (cumin), as well as *sa-sa-ma* (sesame), were all measured by volume, which is commonly done for measuring materials which are in seed form. All are also referred to in rather small quantities, which do not greatly exceed a few litres. Others are referred to with even the smallest values, in units as small as 3 gr., such as the crocus (measured by weight) (Table 16). *po-ni-ki-jo* (weighed) also has rather small quantities (*ca.* 1-4 kg. and only occasionally more) (Table 13). The commodity *ko-ri-ja-do-no* (coriander) is rather variable, as there is mention of fairly small quantities (9.6 litres) and very large ones (12,480 litres) (Table 7). Could it also be possible that we are dealing with oils aromatised by –or even coming from– these plants, instead of the seeds alone? Or else could it have been seeds of these plants coated with oil and/or even taking the form of an aromatic paste, in order to prolong their preservation and their aroma? All of these aromatic plants could have grown in Greece, but most have not been found archaeobotanically to date, for reasons which touch upon the problem of preservation on Greek

[39] They also exist in Attica but obviously they are beyond the catchment area of Mycenae, Pylos and Thebes.

[40] This species and the previous one are found in Crete, whereas, the next, *C. cancellatus* has edible bulbs and is found all around Greece. *C. oreocreticus* is an endemic species in central and east Crete, and I have to thank Don Evely (oral communication) for the information that it was also collected, in modern times, as saffron. However, this needs more verification.

[41] See Sarpaki 2000.

[42] It is interesting to note that *Crocus cartwrightianus* is found, today, only in the west of Crete, but its distribution might have been greater in the past.

[43] It is worth mentioning the high importance of this plant in the LM IA/LC I period (Sarpaki 2000).

[44] See Table 9.

[45] See also *ko-no* calculated in 'bundles' –annotated as *E*– (cf. Table 11).

[46] It would be *ca.* 70-100 kg., which would be the average weight of a person. Horses and mules would have been able to carry more than donkeys.

[47] See Table 15.

[48] Some 28,000 litres are added (see Table 4) especially if one includes **123*.

sites, but are, also, due to behavioural tendencies involving aspects of the harvesting, processing and disposal of these plants.

On the whole, we are dealing with fairly small quantities of these plants/plant-substances,[49] even though these figures relate to one season's harvest, and more would definitely have been expected for the palatial 'machinery'; the more so as the cultivation of most could well have been implemented, in Greece, at this early date. This phenomenon is difficult to explain. Have we lost most of the tablets and are these a mere window to the past, representing a bare shadow of the Mycenaean economic system? The small quantities continue to puzzle us. Plants such as fennel (Table 6), rose (Table 3), cumin (Table 8), and sage (Table 17) would have been expected to be annotated in larger quantities.[50] As the quantities are rather small, and their 'transaction' could have been effected in some form of liquid measure[51] (liquid volume), this induces me to suggest that there is some reason to believe that these quantities could refer to the product of the processed plant, i.e. concentrated aromatic water and/or oil, or even seed crop. The terms, *pa-ko-we* (aromatised with sage), and *wo-do-we* (aromatised with roses) are probably simply examples of a substance (oil?/water?) perfumed with sage, and rose. This may, of course, be only one of the explanations for their archaeobotanical absence, but others need to be explored.

For Mesopotamia, Levey[52] suggests that some specialised apparatus, dating back to 3500 BC. has been found at Tepe Gawra (Fig. 1)[53] which 'indicates that ancient Sumer knew extraction, sublimation and a proto "distillation"'. These vessels are described as having a large trough formed by their double rim. In the inner lip are drainage holes leading back to the container. For extraction, botanical or faunal material would be placed in the trough or channel. The solvent, water or oil, would be volatilised, strike the cover and run down over the material in the channel and then back again into the pot, thus forming a continuous extraction process. Variants of this vessel have been found at Tepe Gawra, others where there are no holes leading back to the boiling solvent in the pot. 'The sublimate/distillate is then retained in the circular channel formed by the two rims'.[54] This process could, one assumes, also have been carried out with simple cookware pottery, whereby the botanical material would be imbibed in the water or oil, depending on the medium used. These would be heated and a fragment of absorbent cloth would be used, either under the lid or instead of one, and would occasionally be squeezed and replaced.[55] In this manner, volatile oils would be procured. If a simple kind of distillation was

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[49] Taking into consideration that an approximate equal weight of rhizomes is needed to the quantity of material to be dyed.

[50] The reason, I believe, we qualify them as small quantities is when we have in mind the accepted model of the palace as a re-distribution centre. If they were used as a condiment for the population of a whole palatial complex, unless used very sparingly, the quantities should be seen as fairly small. On the other hand, if this model only refers to staple products, and condiments were not included in this re-distribution system, then those seasonings which were in current use for the palace might not have been annotated, and only seed crop for next year's planting would have been archived. If this explanation is correct, the small quantities of seed make sense.

[51] Unfortunately, for fennel and cumin we only have the *V* and *Z* denominations and not the *S* and *T* which would differentiate between dry and liquid measure. Therefore, we cannot argue in favour of either, but, at this stage, we cannot exclude their 'transaction' in liquid form.

[52] Levey 1956, 145.

[53] From stratum VI (beginning of the 3rd millennium) (Speiser 1935, pl. LXXIV); also from stratum XI-A, where social stratification seems to have reached an apogee (Tobler 1950, 158, pl. CXLII and CXLVI).

[54] Levey 1956, 146.

[55] Athanasia Kanta (1999) has made certain observations on 'primitive' methods of distillation, which are used at the modern village of Monastiraki in the Amari area of Crete.

possible why not make 'cumin water', 'fennel water', 'coriander water', just as orange-flower water or rose water is made today? In that case, sesame could be reduced to paste form, or even an oil. Coriander, on the one hand, just like the aromatics mentioned above, could have circulated as oil and/or some kind of coriander water (**MY Ge** series where quantities are rather smaller), or even in paste form, but, of course, these figures could also refer to seed crop. On the other hand, at Pylos and Knossos, large quantities were listed, and refer, rather, to the fruits. For coriander, perhaps four kinds of transactions would have been possible: aromatic oil of coriander or 'distilled coriander water', processed seeds reduced to paste or powder, the greens, and whole seeds. However, it is curious that the quantities referred to at Mycenae are so regular. It is as if a certain set amount is handed in as seed crop for the next year's planting. Could it be that section **MY Ge** also had responsibility for collecting and allocating good quality seed crop?

3. Perfume, Condiments and Dye Plants: Some Thoughts on Their Social Role

Perfumes, condiments and dye plants are not only tied to economic factors, but are potent with cultural, social and symbolic meanings.[56] Preferences for certain 'flavours' are bound by taboos, and to cultural 'areas' where the fondness for 'smell' (odours), 'taste', and 'sight' are not free from the bondage of social memory –in other words, of culture. We, generally, like the smell, taste and sight of what we are brought up with, and, generally speaking, people keep to these, particularly at times when geographical and social mobility were far more restricted than at present.

Greece being what it is, a country with a large number of aromatic herbs growing in all areas, one cannot believe that condiments would not have been used to preserve,[57] season and diversify people's otherwise bland diet. Yet, these herbs grew in the wild and were found practically everywhere, so what would have been the reason for keeping an inventory of items so widely available? It is, therefore, easy to understand that in Prehistory, the use of condiments was in some cases more of a necessity than a luxury, especially when it concerned preservation of foodstuffs.[58] Consequently, it could be claimed that in the Mediterranean or where the climate is hot, condiments used in food are an absolute necessity and belong to the population at large.

Perfumes, on the other hand, cannot be classified on the basis of the same needs. Perfumes are more of a luxury reserved for social elites, as they cannot be classified under items of necessity. However, we do know that perfumes did actually protect people from certain diseases, especially illnesses transmitted by, for example, fleas or other body bugs. We now know that perfumes can keep these insects at bay. One could classify them as proto-disinfectants.

Some dye plants would have fallen under the same logic as condiments in that they must have been widely available from very early times. One might assume the choice of colour and plant to have been strongly adapted to the local availability of plants, just as folk costumes of an area have a certain stereotype of colour and decoration, adapted to the local curation/tending of plants, but other 'exclusive' colour(s) must have been potent with cultural, symbolic meaning(s)

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[56] Sherratt & Sherratt, in their very important paper (1991, 354), state that 'perfumes are not just luxuries but embody concepts of value and purity which have a power which is more than just a consequence of their relative scarcity'. The same can be said for the burning of incense or the use of particular colours.

[57] It is believed that herbs (McGee 1998, 649) such as oregano help preserve foods from pathogens and would have been important for their longevity and, therefore, of paramount importance in the storage of foods in the prehistoric period.

[58] It has been observed that condiments such as salt, pepper (not in Prehistory) and other herbs such as thyme, oregano, and so forth, can retard the oxidation of foods and thus extend their preservation.

and related to religion, status, sex, probably age and/or wealth. The problem of dyes and colour is a very intricate one and is potent with semiotic meanings. Fabrics, beyond the necessity of dress, are a feature of display, and their function is to help differentiate the wearer from others (whether clans, tribes, and/or cultures). These are social signals, related to personal and communal identity, which differentiate a society at large from another society, belonging to another cultural *entourage*. They provide a point of reference of culture, of identity, of social order, and therefore, of survival *vis-à-vis* others. Perfumes belong to a much more subtle level of social stratification, and cultural identity. One might suggest that people would be much more prone to wearing the same perfume, even if they belong to different cultures, rather than to wearing the same type of clothes. Perfume, as being a luxury item which circulated widely, must have superseded cultural differences, and contributed towards uniting social classes intra-culturally. One might therefore claim that perfume –amongst other luxury items, which we shall not deal with here– existed to form some '*koine*', in social-identity terms, of wealth and symbol, transcending culture differences.[59]

4. Catalogue of the Perfume, Condiments and Dye Plants Referred to In Linear B: The Archaeobotanical and Ethnobotanical Data

CROC:[60] *crocus spp.* (*C. cartwrightianus* and *C. sativus*), the saffron crocus (Table 16). On the Theran frescoes, where crocus collecting is depicted *par excellence*, they have been identified as *Crocus cartwrightianus* for reasons explained.[61] However, we cannot exclude its cultivation in parallel with the collection of the wild species, for it seems to have been a very important plant of high economic value and religious symbolism. The saffron crocuses might have been used for dyeing,[62] in perfumery, as a condiment and also as a medicinal plant.

All we can say is that *C. cartwrightianus* seems to have been the progenitor of *C. sativus*, but this 'domestication' must have occurred very early on, as *C. sativus* has lost its ability to propagate by seed.[63] It only propagates by bulb, in other words vegetative propagation, which is a sign of a long period of domestication. Nowadays bulbs of *C. sativus* are planted in July, in well-tended fields, and the first harvest takes place more than a year later, in the autumn. For one

[59] This justifies the wide circulation of perfumes and incense in the Mediterranean at this period, which transcended cultural frontiers.

[60] Strangely crocus is referred to in three ways, **33* (Lejeune 1971, 155, note 50; *Documents*, 51), **144* and *ko-ro-ki-no*.

[61] Sarpaki 2000; Σαρπάκη 2001.

[62] The styles (orange) contain a pigment (yellow) that is soluble in water with a very high colouring potential as it colours 100,000 times its volume in water. However, the author is intending to carry out some dyeing experiments with Mrs Sophia Kana using various natural fibres. On the other hand stamens (yellow) today are excluded from best-quality saffron and are only left as inclusions in second-quality produce. At Akrotiri, however, both styles and stamens are nowadays kept and used together. We still do not know whether they were separated in Mycenaean times. However, it is interesting to note that in the wall-painting depicting a woman (priestess?) in the passage between room 4 and 5 of the West House, she is holding an incense burner in which are coals and a yellow substance, placed on top of the coals, which seems to resemble the yellow stamens in that they are like 'threads'. Morgan (1988, 29) also believes the priestess in Room 4 (West House) has stigmas of saffron over the brazier and it has been also observed by the present author that their colour is yellow and not dark orange. She is also wearing a yellow, crocus-colour, robe. Is this a coincidence or does it symbolise the fact that crocus stamens used to be burned as incense? Crocus smell, as I, personally, noted, resembles very much the sweet odour of honey. Would this be intensified with burning? It will be worthwhile to carry out the experiment.

[63] Zohary & Hopf 2000, 207.

stremma[64] 114,000 bulbs are needed.[65] It is said that 100,000 flowers[66] produce *ca.* 5 kg. of styles, which is reduced to 1 kg. after drying.[67] The styles contain a pigment (yellow-crocin) that is soluble in water with a very high colouring ability, as it colours 100,000 times its volume in water.[68]

No archaeobotanical traces of either crocus have been found and the chances of preservation are extremely low. The harvest of this plant does not permit archaeobotanical preservation, as only the flowers are picked in order to separate the styles (3 orange) and stamens (3 yellow) from the petals. This is done piecemeal, every day or whenever picking is conducted within the flowering period.[69] Theran crocus-picking as well as modern ethnographic observations from the Akrotiri area, Santorini have been recently recorded.[70] What is important to note is that all of the cleaning is nowadays conducted in the open air, generally in a shady place, near the harvesting area, as the styles and stamens need to be separated before the flower withers. These are the only botanical parts taken back to base/settlement, but they leave no visible potential archaeological evidence behind. Our only chance would be that, in areas where *C. sativus* is cultivated, we

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[64] The stremma, a measure of land used in present-day Greece, is equal to 1,000 sq.m.

[65] Ορφανίδης 1873, II, 312.

[66] Baumann (1993) claims that 100,000 to 140,000 flowers make 1 kg. of dried saffron. One presumes the number of flowers depend on their degree of maturity, as well as whether they are the product of the cultivated or the wild species.

[67] Cardon & du Chatenet 1990, 125.

[68] Cardon & du Chatenet 1990, 125.

[69] Nowadays at Akrotiri, Santorini the flowers are picked either very early before sunrise or late at sunset, yet Orphanides (Ορφανίδης 1873, II, 312) claims that they should be collected at *ca.* 10-11 a.m. after the dew has evaporated. Flowers hardly last for more than two days, on the plant itself. These are collected in containers and then poured into larger baskets (*κοφίνια*) and are transported immediately to where the styles and stamens are separated. He also stresses that on no occasion should the flowers (styles) of one day be left to be separated the next (Ορφανίδης 1873, II, 314). If the flowers remain unseparated for one-two days, then one should consider the product lost. The time needed to clean the styles is one hour for 20 dramia (where a dramion = 3.203 gr. in Greece; 1 kg. = 312 dramia) of 'fresh' crocus, so that in four hours each worker can separate 240 gr. of 'undried' crocus. In order to dry them, he remarked that they should be placed in a shady and draughty area and turned two-three times a day. When dry, the styles are five times lighter in weight. In order to store or transport them, they are transferred into wooden boxes of odourless wood and they should not be compacted as they can develop mould if they are still slightly humid, or, if totally dry, compaction can reduce them to dust! However, crocus can be falsified with *Carthamus tinctorius*, or *Calendula, Scolymus*. The production of crocus in its first year of planting is *ca.* 2/3 less than the second and third years. Generally, the plantation, after the first year produces *ca.* 2.58 kg. of crocus per stremma (Ορφανίδης 1873, II, 318). Another very important part of the plant which has economic value are its leaves, which should not be cut before the end of March/beginning of April, but afterwards and before they turn yellow, they can be used as fodder (Ορφανίδης 1873, II, 344), whereby 10 stremmata can produce *ca.* 700 kg. of leaves in the first year but more than 1,024 kg. in later years. After the collection of the leaves, the farmer needs to rake the soil, and this should be done again around the end of August and September, to weed the field. He should not dig deeper than 6-7 cm. for fields, which have two or three year crocuses but, if they are older, they should be weeded with the utmost of care as the bulbs are even closer to the surface. It is said that Pliny mentioned a renewal of the crocus plantation every eight years. This renewal of the crocuses should take place in June or July. Orphanides claims that saffron was sold *ca.* 60-65 francs per gram (*ca.* 1872) and could go as high as 300 francs. He calculated that crocus plantations could provide 180-250 drachmas for the Greek farmer per stremma per year and occupy a workforce for only a few weeks per year, which he considers a good return that would keep women and children occupied, for several months of the year.

[70] Τζαχίλη 1994; Sarpaki 2000.

might conceivably find a reserve of corms stored for the next planting in a jar or the like. As for the wild variety, it is archaeologically/archaeobotanically invisible.

Turning to the crocus mentioned in the Knossos tablets, we realise the huge collective effort needed to produce the quantity mentioned (*ca.* 3,726 gr.) which would have represented an area of *ca.* 2 stremmata of intensively cultivated *Crocus sativus*. This, in itself, is, I believe, another piece of evidence proving that wild crocus was collected. As it is fairly dispersed in the wild, one would expect that the area of collection must have been huge. However, an added problem occurs and that is its area of natural existence, which in Crete is today confined to the west of the island, especially to the Akrotiri peninsula of Chania.[71] Was the habitat of the saffron crocus (*C. cartwrightianus* and *C. sativus*) more extensive and did it cover much of central Crete? Were the Knossos archives also referring to the other two or three species (*C. tournefortii*, *C. cancellatus* and perhaps *oreocreticus*)? The first and third would probably have existed in Crete, in the east and the central parts respectively, but the second is absent today from the island. Was it the case then, too? There are many implications attached to each probable explanation, but none we could prove, at present. If the distribution of *C. cartwriaghtianus* was the same as today, the ramifications are enormous, as it would imply that the Knossos 'catchment area' extended to the west of the island, and, perhaps, as far as Thera to the north.

e-ti-we: henna (?), *ἔρτις*, *κρημνός*, *κύπρος* in Greek (Table 3). It has been argued, that the term is an adjective, describing an aromatic plant used in the oil;[72] in other words, it describes an odour. On the other hand, Shelmerdine[73] argues that it is rather a description of colour, and not of scent. In that case, *e-ti-we* could be a dye. It has been considered from a fairly early time that *κρῆμνος* was probably *Lawsonia inermis*, henna.[74] Henna is not a plant native to Greece, but existed in North Africa (Egypt), Arabia and India.

There are two varieties, *Lawsonia inermis L.* and the variety *L. inermis var. alba.* with white flowers. They are connected with cosmetics, dyeing and perfumery. The flowers are exceptionally odoriferous and are used to perfume unguents in Egypt. The flowers, though, need to be freshly picked and not dried in order to impart the scent, plus they would need to be imported in very large quantities; two reasons why Shelmerdine believes that it was impossible to import them for perfumery (fragrance). Dioscurides mentions that some 1,000 flowers would be needed for a recipe. On the other hand dried leaves of the plant could have been imported, as these are the source of an orange-red dye. A paste was made in ancient Egypt –and this is still used nowadays in Egypt– with which they dyed, and still do, the palms of their feet and hands, their nails, hair, and sometimes eyelashes. This decoction of the leaves was occasionally used to dye cloths.[75] Perhaps women depicted with red ears, on the wall paintings at Akrotiri, could have used henna. In Egypt several mummies have been found with henna on their hands, feet, and hair. An orange-red mummy wrapping from the 21st Dynasty was found to have been dyed with henna, probably mixed with a red colour, *Carthamus tinctorius*.[76] A perfume of unknown date was analysed and henna was found to be one of the several substances present. However most findings are dated to the Graeco-Roman period in Egypt.[77]

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[71] Mainly the Stavros area of the Akrotiri peninsula.
[72] See Duhoux 1993, 103.
[73] Shelmerdine 1985, 30.
[74] Shelmerdine 1985, 27.
[75] See Lucas & Harris 1999, 310.
[76] See Lucas & Harris 1999, 153.
[77] See de Vartavan & Amoros 1997, 151.

ka-da-mi-ja: *Cardamomum ssp.*, cardamom (Table 3). It was identified as *Lepidium sativum*, garden cress, by Duhoux[78] (**MY Ge 604**), who does not mention the possibility of it being cardamom at all. Although neither has been identified archaeobotanically in Greece, *Lepidium cf. sativum* has been found in Egypt from 3800-3500 BC.[79] *Καρδάμωμον* was mentioned by Theophrastus and Xenophon. The root of the name is said not to have an eastern origin,[80] although this annual plant seems to have had a Near Eastern derivation,[81] but could well have grown in Greece. It could have been used as a salad or a green vegetable, but its mention in the tablets is puzzling to us, as one would think it too humble a plant, economically, to warrant such mention. However, one could suggest that it would, rather, refer to *καρδάμωμον* (see Theophrastus) (cardamoms), which is *Cardamomum vulgare* or *Elettaria cardamomum*. In Egypt an ointment was prepared where, amongst other substances, cardamom was included,[82] but its area of origin is India and Ceylon. It is the seeds, which retain the delicate spicy essence but they retain it better if they remain enclosed in their capsule. These capsules are, therefore, harvested very carefully so that they do not spill the seeds; they are cut off with scissors before they are fully ripe and then dried slowly with the aim of preventing them from splitting open. The seeds are used as a condiment, for medicinal purposes, for chewing to sweeten the breath and in confectionery. Nowadays, they provide the flavour of certain liqueurs, and the oil can be used in perfumery. It is considered expensive and is second only to crocus[83] (see cinnamon and cassia, which were very expensive in Roman times).

ka-na-ko: *Carthamus tinctorius*, safflower, *ζαφαράνα*, *ψευτοζαφορά*, or otherwise 'false saffron' (Table 5). Shelmerdine[84] does not classify it under perfume crops but it might have been used as a condiment, dyes for foods, oil, dye (for textiles) and ointment. Kohl[85] is also extracted from its charred soot, but its use as dye for textiles is best attested.

The earliest finds to date –3rd millennium BC– come from the Syrian sites of Atij, Raqa'ι and Kerma (modern Syria). All of the three sites yielded a few whole seeds, named achenes and achene fragments but it is still difficult to assign them to species, although the archaeological specimens resemble, on morphological grounds, *C. tinctorius L.*[86] Nevertheless, at least one specimen from Tell 'Atij resembles *Carthamus tenuis (Boiss. & Bl.) Bornm*,[87] wild species of

[78] Duhoux 1993, 104, and *Documents*, 549. However, Palmer (1999, 476, 485), quoting Varias Garcia (1993, 198-201), refers to it as *Nasturtium officinale L.* (watercress). This last plant might have grown wild in Greece but has not been detected yet archaeobotanically.

[79] El Hadidi *et al.* 1996. For other sites see de Vartavan & Amoros 1997, 156.

[80] Hoffner 1974, 110.

[81] de Rougemont 1989, 231.

[82] Lucas & Harris 1999, 87.

[83] See Pliny for the prices of some spices, of his time.

[84] Shelmerdine 1985, 171-172.

[85] Present day Egyptian kohl is made of soot from the burning of the safflower plant (Lucas & Harris 1999, 82). This could also have been used in the Mycenaean period. Another important soot comes from oliban which is the frankincense of the *Boswellia ssp.* and *Commophora ssp.* (Lucas & Harris 1999, 91); Baum (1994, 28) claims it is made into an ink and is also used for cosmetics, for blackening the eyelashes and eyelids.

[86] McCorriston 1997.

[87] McCorriston (1997, 44) claims that the origins of safflower are unknown, whereas Zohary & Hopf (2000, 211) insist that the wild stock of safflower is 'well identified' and that the domesticant is interfertile with *C. persicus Willd.*, and *C. oxyacanthus M. Bieb* and, could, therefore, derive from them. Genetic research also points to the Euphrates basin as a possible place of origin for the crop and the closest modern genetic relatives grow today in the Syro-Palestine area. These are *Carthamus flavescens*, *C. oxyacanthus* and *C. palaestinus* (McCorriston 1997, 44). Kroll (1990, 41) identified *C. lanatus* in the Early Bronze Age at Feudvar.

safflower growing in Jordan today. This in itself indicates that there are still possibilities of finding other species of safflower in archaeological assemblages. From Syria too, other very early finds have been found in Early Bronze Age levels from Tell Hammam et-Turkman, dated to 2400-2000 BC,[88] where charred remains of *ca.* 65 flower heads from Tell Hammam et-Turkman were uncovered. This is, therefore, strong evidence that safflower was cultivated for its florets at this date. Archaeobotanical finds were also noted at Selenkahiye of the same period. Of course, this does not exclude its cultivation for its achenes as well, which are valued for their oil.

From Egypt, safflower achenes were found in Tutankhamun's tomb (*ca.* 1325 BC) and garlands of this plant were found adorning 18th Dynasty (*ca.* 1500 BC) mummies.[89] Other more recent finds come from Amarna[90] but there is as yet no evidence for their use there.[91] Evidence for its use as a textile dye in Egypt comes as early as the 12th Dynasty (*ca.* 1900-1700 BC). From the archaeobotanical findings in Egypt and Syria, as well as from the analyses of textiles, we can say that there is evidence for the growing of safflower for its dye.

Two types of dye can be extracted from the yellow-red florets. One can only be used as a condiment, as it is water-soluble. This is used instead of saffron for colouring foods yellow, and is, therefore, sometimes confused with saffron and named 'false saffron'. The other dye, carmine, is water insoluble[92] and was widely used to colour textiles orange, pink to red –depending on the preparation of the dye and the type of the textile– before the production of synthetic dyes. Today, in Egypt, the dried red florets are sold to tourists as 'saffron'.[93] Hence, it earned the name of 'false saffron', which may have been a falsification that started early in history, and may have been a falsifying product for the uninitiated, either sold alone or perhaps mixed with true saffron. These dried florets are also sold today in the '*souks*' (markets), as a source of dye in Egypt, but the quantities needed are great,[94] and the harvest is done piecemeal throughout the flowering period, which takes place in July and August, that is if the harvest is for the dye; otherwise, if it is for the oil, the plants are left to mature further after the withering of the flowers and until the seeds are fully grown. The flower heads are generally harvested when nearly withered, either in the very early morning and/or before sunset.[95] For a bright red, the quantity of dye needed was in the ratio of 1 to 1. However, it is unstable in light.

In Europe, the earliest finds are a single achene of safflower found in the Early Bronze Age levels at Feudvar (Vojvodina, Yugoslavia).[96] The importance of safflower for the Mediterranean is that it can grow in drought[97] conditions, but it favours and exploits humidity in the soil, as its root system goes quite deep (*ca.* more than 2 m. depth).[98] It favours marginal dry-farming

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[88] van Zeist & Waterbolk van Rooijen 1992.
[89] Zohary & Hopf 2000, 211.
[90] Samuel 1989, 281.
[91] de Vartavan & Amoros 1997.
[92] It becomes soluble in dilute solutions of alkali, such as natron, and has been employed recently for dyeing silk and for colouring starch to make rouge for toilet purposes (Lucas & Harris 1999, 153) (natron = GK nitron = sodium carbonate $Na_2CO_3.10H_2O$). Other mordants are chalk or kaolin, and, where available, potash alum was used. Potash alum could be produced by reducing plant matter into ash. It would be interesting to know whether the safflower plant, when and if burnt after harvest, would produce ash with a high potash content.
[93] de Rougemont 1989, 273.
[94] Cardon & du Chatenet 1990, 28.
[95] Cardon & du Chatenet 1990, 28.
[96] Kroll 1990.
[97] It can grow even with as little as 250 mm. of rain.
[98] Knowles 1955, 277, 280.

regions and does not fare well under irrigation or rainfall at maturation, although it would favour some rainfall in the spring and early summer, in the first stages of its growth.

Its achenes are white and, under dry land conditions, yield some 40-175 kg. per 1,000 sq.m. These produce 24-36% oil.[99] This explains the description of white for the achenes and red for the florets (Table 5). It makes sense that all the whites are measured in dry volume, which would be a practical way of noting the quantity of seed, but if oil was extracted from the safflower, larger quantities would definitely have been expected than the 1 and 2 litres as mentioned. It seems more likely that we are dealing with the seed kept for planting the next year's crop, especially as we know that safflower is an annual. Therefore, the standardised achene quantity might refer to the seed needed to grow safflower in a given size of field. The red, on the other hand, could well be the florets, dried and ready to be used as dye. They are then pressed into cakes. When they are thoroughly dried, they are packed into bales weighing *ca.* 45-90 kg. each.[100]

As has been noted, safflower is a summer crop and seems to clash with the typical Mediterranean agriculture whereby the traditional winter cereals and legumes would still be maturing at the planting time of the safflower –unless it was grown in fields, which were periodically left fallow and were rotated with cereals and legumes. In this manner, safflower would help control weeds and not deplete the soil as much as cereals. Deliberate planting of safflower would fit into a winter-crop/fallow/summer-crop rotation, which could have been implemented in Greece in the Bronze Age. This agricultural policy would have been ideal for Greece, especially in areas which are affected by the *meltemia* summer (July/August) winds where uncultivated ground, which is left fallow, would be exposed to undue erosion by the *meltemia*. This could have been avoided by planting summer crops on fallow fields, hence, the importance of safflower, which could be a further indication of even greater agricultural intensification at the end of the Late Bronze Age of Greece.

There seems to be something of a discrepancy between the seed produced[101] and the florets. Of course, the florets would have been very bulky but light when dry, so this amount seems to have been reasonable. However, the achene is more of a mystery. As it is mentioned in small quantities, could we be seeing the achene (best quality) provided for the next year's crop? For the quantity does not justify the oil explanation. In this case, we can perhaps claim that the administration controlled the base (the seed crop, and either planted it themselves or provided the rights to some farmer to do so and thus created a form of subordination to production) and the produce (red florets).

KAPO: This is a very controversial term (ideogram **127*) (Table 12), which has been interpreted in various ways. The original decipherers, Ventris and Chadwick, interpreted it as *καρπός*, fruit, and equated the *ka-po* to the monogram *KAPO*, with which Sacconi[102] disagrees. Another researcher, Gallavotti,[103] interpreted the monogram *KAPO* as the Greek *σκάφος*, which

[99] Gill & Vear 1980; but compare Καββάδας, 1805-1806, where he mentions that 50-54% of oil is extracted.
[100] Forbes 1953, 121.
[101] According to Knowles (1955, 286) under dry conditions the seed yielded in the range of 40 to 170 kg. per stremma, whereas the dried florets ranged between 5 to 19 kg. per stremma (Knowles 1955, 294). What seems important is that Knowles (1955, 294) claims that an achene crop can be obtained in addition to the flowers. I do not know how this would affect the dye, but I believe it would probably reduce the dye quality, as the florets would be dried/partly dried in the sun.
[102] Sacconi 1972.
[103] Referred to in Sacconi 1972, 23.

is a rare form of *σφάκος*, sage, *ἁλιφασκιά* in Cretan. Theophrastus refers to it as *φάσκον*. Shelmerdine,[104] however, does not accept Sacconi's interpretation for cinnamon. Bennett, instead, has interpreted *pa-ko-we*[105] as deriving from the Greek *σφάκος*. However, the objection of Sacconi rests on the fact that sage was not used as an ingredient in perfumery in Classical times and, therefore, she believes it would not have been used in the Mycenaean period either.[106] This, it is believed, is a dangerous assumption, as tastes in perfumes, much as in other things, would sometimes change through time and from culture to culture. Shelmerdine,[107] moreover, accepts sage as a perfume fragrance in Mycenaean perfumery. On the other hand, if, for the sake of argument, one accepts Sacconi's cinnamon interpretation, we should consider the long distance of the countries producing cinnamon, from the Mediterranean.

Cinnamomum zeylanicum, cinnamon, originates in South India and Ceylon. A tree of the same genus *C. cassia* (originating in China) is perhaps the *κασσίαν* mentioned by Theophrastus, and several species of cassia (probably *C. camphora*, *C. tamala*, *C. obtusifolium*, *C. pendunculatum*[108] were mentioned by Dioscurides. These exist in the Far East, which is the same general area where *Elettaria cardamomum* grows.

Cinnamon was used in making aromatics in Egypt,[109] but so far it is not possible to say which cinnamon species. *C. tamala* is said to be the base of malobathrum oil, which was the raw material extracted from the leaves of the cinnamon tree.[110] In Egypt, plant remains have been found of *Cassia absus* (seeds) and *C. senna* (wood charcoal and pollen).[111] As it was found in areas adjacent to Greece, there are great possibilities to find it as charcoal. Archaeologists working on sites in Greece, although they collect it to some extent, rarely give it to specialists to examine. This is the reason, it is believed, that many hidden treasures amongst the charcoal, which would provide great surprises in the field of imported materials, await discovery.

If *KAPO* is a product of the cinnamon genus of trees, we could be dealing with, broadly speaking, three products: cinnamon wood (*ca.* 10 denarii[112] per pound), cinnamon for which it is not clarified whether it is in stick or powder form (1,500 denarii per pound), and which seems to be the most expensive of the condiments, or cassia, which varied enormously and ranged between 5 to 50 denarii per pound. If we consider that myrrh –depending on the quality– was between 3 and 50 denarii per pound, and frankincense between 3 and 6, it is obvious that cinnamon must have been the most expensive of all, but what we do not know is whether this price hierarchy was the same for the Late Bronze Age. At Pylos, as *KAPO* is mentioned as 'transacted' in two ways, we could well be dealing with either the sticks (bark) or the wood which is calculated in primary units, and perhaps cinnamon powder as transacted in the measure of volume. However, the fairly large quantity (*ca.* 140 litres + units 9) from Pylos conflicts with

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[104] Shelmerdine 1985, 18.

[105] Sacconi 1972, 24.

[106] See Killen (1964, 172), who claims it is used in unguent preparations, but also see Killen 1987, where *ka-po* in **KN F(2) 841 + 867** refers to *κῆπος*, garden, a garden orchard (Palmer 1999, 479, note 63).

[107] Shelmerdine 1985, 38.

[108] Καββάδας, 1924-1925; Sacconi 1972, 26.

[109] Lucas & Harris 1999, 87, 333.

[110] Darby *et al.* 1977, 798.

[111] de Vartavan & Amoros 1997, 65-66, although from experience we know that for a charcoal and pollen specialist, it is, most of the time, impossible to put a species to a genus, in which case we would only be able to identify *Cassia sp.*

[112] These are the prices quoted by Pliny for his time (Groom 1981, 154).

its high price –if its status was the same in Prehistory– and, as *KAPO* is always mentioned together with substances used in perfumery, it must have had some connection with it. Are we, therefore, dealing with an oil perfumed with cinnamon and circulated as aromatic oil to enrich perfumes? Shelmerdine,[113] nevertheless, does not include it in her list of perfume plants. As a conclusion, we might say that *KAPO* needs to be reinvestigated and perhaps redefined, if and when new tablets are found with this product.

ki-ta-no: Melena[114] identifies it with turpentine, *Pistacia terebinthus L.*, *κρίτανος*, but it is believed, by the present writer, to represent another plant, the rockrose, *Cistus creticus L.* (Tables 4 and 15) The latter is mentioned as *κίσθος* by Theophrastus, which produces the ladanum or labdanum[115] (*λήδανον*[116] mentioned by Herodotus and Dioscurides, whereas ladano by Pliny), and *ladanu* in Assyrian. In Crete, the plant is commonly called *αλάδανος*, *λαδανιά*.[117] The ending, *δα-νος*, could well have changed from a dental stop to its middle[118] and transformed it to *ta-no* in *ki-ta-no*. However, as we do not know how the Mycenaeans pronounced certain letters, the transformation of *λη/λα* in *λάδανο/λήδανο* to *ki-* in *ki-ta-no* is still difficult to explain. Therefore, *ki-ta-no* might not refer to the plant, but mainly to its product, ladanum (*λαούντανο* in Greek), for reasons expanded more below.

Cistus creticus L.: This perennial bush grows abundantly in phrygana and maquis zones, especially on Crete, and the view that it is a product found in profusion in the Knossos archives[119] makes great sense, as this bush is widely found in Crete.[120] A true resin,[121] the

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[113] Shelmerdine 1985, 171-172.

[114] Melena 1974a, 1976a; *inter alia* Duhoux 1993, 106.

[115] This should not be confused with laudanum, called *λαούντανο*, which is a tincture of opium.

[116] Liddell & Scott, *s.v. λῆδον.*

[117] Φραγκάκι 1969, 32-35 for Crete of the 20th century.

[118] I would like to thank Dr Y. Tzifopoulos, Department of Philology of the University of Crete, for providing me with this information.

[119] The earliest literary mention of ladanum in Egypt is in the Bible, where it is stated that merchants carried it from the area of Gilead (Transjordan) into Egypt and that Jacob sent ladanum to Egypt as a present for his son Joseph (dated to *ca.* 10th century BC). The sending of ladanum from Palestine to Egypt, is indicative of the fact that this was a product in demand and not produced in Egypt (Lucas & Harris 1999, 94). It is interesting to note that *ki-ta-no* was the resin that Tuthmosis III imported from Syria-Palestine in annual quantities averaging 9,250 litres. Indirectly, it is an indication of the need of the Egyptians for this product, as it has been noted that indigenous sources of aromatic resins are virtually absent from this country (Serpico & White 2000, 884). However, only in Coptic times was evidence of ladanum detected (Lucas & Harris 1999, 95). The resin beads (Fig. 4) found in the tomb of Tutankhamun, as has been checked from the bibliography have not been analysed in order to detect the source of the resin, but could also be ladanum. A possibility is that ladanum, being cheaper than frankincense and myrrh, could have been used for daily use and for ordinary purposes, not connected to funeral occasions, and that most probably the material that has been studied so far is the one found in wealthy tombs. Lucas & Harris (1999, 97) claim that a brown resin (it is the right colour for ladanum) is found in all graves of all periods, and of all ranks. It is believed that not all the mysteries found in Egyptian tombs and excavations have been totally disclosed, and more information is yet to be expected, especially as regards the analysis of materials.

[120] The present author is researching together with Manolis Flouris the ethnobotany of this plant and collection of this resin.

[121] Gum (*κόμμι, γόμμα*) is the term used for any of numerous colloidal polysaccharide substances of plant origin that are gelatinous when moist (soluble in water) but harden on drying, whereas resins (*ρητίνη*) are solid or semi-solid organic substances that are either translucent/transparent or yellow to brown, and form

ladanum (Fig. 2), is collected from its fruits and leaves during the hottest days and the warmest hours of the day in July, and is still collected in Crete, though in very small quantities, nowadays. It was used for medicinal purposes and as incense, while it is presently used in aromatics and soap manufacture. Baumann[122] describes traditional ways of collecting ladanum in Crete,[123] Cyprus and Arabia.

In the 18th century, this resin was exported from the port of Larnaka, in Cyprus, in containers of 50 and 100 okades (64 and 128 kg.).[124] In both countries it is collected with a sort of 'flexible' comb-like implement, but the purest ladanum is collected from the beard and hair of browsing goats, which is also 'harvested'. This is placed in boiling water in order to make it melt.[125]

The usefulness of the resin is manifold. Its medicinal properties are said to guard against pestilence, diarrhoea, rheumatism, colds, and the evil eye (Fig. 4). Frangaki[126] claims that the plant was used in dyeing and gives a bordeaux red when dyeing cotton. However, its most common use must have been its use as ladanum (medicine) and as incense.

The quantities mentioned are fairly large and if **123*[127] (Table 3) is *ki-ta-no* (Table 15) we are dealing with amounts reaching over 45 tons. This would have meant that Knossos was recruiting

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especially in plant secretions and are not soluble in water, but only in ether or other organic solvents. The Mycenaean term *re-di-na-to-mo* (*ῥηδινατόμος*), André (1964, 88) believes, is indicative of a profession and must have been used to denote those that collected resins and also gums. However, the term could not be traced in *Index Généraux* but Aura Jorro & Adrados (1993) include it in their terms.

[122] Baumann 1993, 89-92.

[123] M. Pitton de Tournefort (1727, 86), the traveller, describes and includes a drawing of the instrument with which the Cretans of his time collected ladanum at the village of Melidoni. Pliny (XXXVII.73-76) also describes vividly the collection of the resin from the hair of the goats.

[124] Every oka has a special weight value; for example the Turkish oka is 1,282 grams, the Hellenic oka is 1,280 grams, and the Egyptian oka is 1,237 grams (*Εγκυκλοπαίδεια Πυρσός*, *s.v. ὀκά*). Therefore, 64 and 128 kg. are involved (Γεννάδιος 1914, 513).

[125] When it was heated on a low flame in water and was subsequently sieved in order to separate it from inclusions, a product was obtained called *poix de Bourgogne* (André 1964, 95). When it cools, the resin hardens and floats on the surface of the water. This 'automatic' separation makes it easy to process. If it was left to heat for a long time, the volatile oils were eliminated and were collected on fleece. The remainder was the vegetable tar, *πίσσα υγρά*, or *κώνα* (André 1964, 95). This was thickened with vinegar and was used to 'tar' pottery jars and in boat building, to 'tar' the wood. When this was re-heated it lost all the volatile oils and was reduced to real tar, *ξηρά πίσσα*, which is the product of the liquid tar, *υγρά πίσσα*. André (1964, 96) has a list of all the terms used in Greek and Latin for those substances. We need to note that tar (*πίσσα*) refers to (a) gum and (b) tar; *πίσσα ωμή* is the gum. However, from analysis of the Kyrenia wreck (4th century BC) (Beck & Borromeo 1990) it is evident that ancient pitch was made from resinous wood and not by the alternative method of heating pine resin alone. This pyrolysis of wood was conducted either specifically to manufacture pitch or was a by-product of charcoal manufacture. In addition, petroleum products were added to the pine pitch. A Late Bronze Age tin-covered conical cup from Chamber Tomb 1, Asine, provided evidence for rosin (colophony), made from pine resin for binding tin on vessels (Gillis 1994, 61). Colophony is also produced from the 'mastic' tree.

[126] Φραγκάκι 1969, 33.

[127] For **123* see Sacconi 1971; she argues that (a) *ko-ri-ja-do-no* is influenced by **123* and is measured in the same manner, (b) when **123* is mentioned together with coriander, the quantities are double those when it is mentioned alone. However **123* is also a substance that is transacted in large quantities alone. On p. 28 she claims that it is a substance, which is also transported as seeds. Having seen the way ladanum can be rolled into small 'balls', I believe, it is possible to 'trade' it in volume measure and it could, figuratively, be treated as a seed.

a work force from all areas of central and perhaps eastern Crete, and these people would have brought the produce in exchange for some other benefits, of which we have no evidence as yet. As we see from the above, Egypt imported *ca.* 10,000 litres of ladanum resin from Syro-Palestine, which, it is believed, could have been imported from the Mycenaean world, and especially from Crete. Melena[128] has drawn an interesting plan of the sites that are referred to as producing *ki-ta-no* in Crete and, interestingly enough, they are confined to the central part of the island, which is basically the area where this resin is collected nowadays.

ko-no or *ko-i-no* (Table 11): This has been variously interpreted, and has been a matter of debate. Some[129] believe it to be *Cymbopogon schoenanthus* (ginger grass) and others claim it could be *Acorus calamus L.*,[130] or the terebinth trees and equate *ko-no* to *ki-ta-no*.[131] If it is ginger grass, it would have been an imported plant from Arabia, India and Africa. Its importance is its oil, the oil of ginger grass, which would have been very valuable and expected to be transacted in small quantities and measured by volume. Kavvadas[132] believes that it might be the *σχῖνος* mentioned by Dioscurides and Theophrastus, but this does not automatically mean that the *σχῖνος* of their time would be the same plant, and the term today refers to the *Pistacia* tree.[133] It is, of course, possible that it could have referred to the same plant, which might have had a different name at Knossos (*ki-ta-no*) from the one used at Mycenae (*ko-no*), but *ko-no* is measured in primary units and *ki-ta-no* is mentioned in fairly large quantities (cf. Tables 11 and 15), but measured by volume. These points, I believe, argue against *ki-ta-no* being the same product as *ko-no*. Secondly, ginger grass, as producing oil, would have been very valuable and, therefore, expected to be transacted in much smaller quantities.

It is also believed to be turpentine, *Pistacia terebinthus* by Melena,[134] who thought it to be the *κρίτανος* of the ancients. Resin from *P. terebinthus*, *P. atlantica*, and *P. lentiscus* are noted as having been found at various sites in Egypt.[135] However, the finds from *P. atlantica* should be considered dubious, as the tree is native to the Canary Islands and is of no commercial use.[136] Yet, Zohary & Hopf[137] claim that nuts have been repeatedly found in Neolithic and Bronze Age levels of the Near East, and that today they are an arboreal constituent of the oak-park forests of the Near East arc. It has been claimed to be present at Sesklo, in the Aceramic/Early Neolithic (frequent), in the Proto- and pre-Sesklo phases (rare), and the Sesklo phase (5th millennium) (rare)[138] but this is a disputed identification.[139]

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[128] Melena 1974a, 52.

[129] Amongst others Maddoli 1967; *Documents*, 555.

[130] Wylock (1972) believes we could include *Acorus calamus L.* in the contested plants, but the present author thinks not, as it is a plant, which did not originally exist in Greece (*Flora Europaea* V, 268-269); it is presently only naturalized.

[131] See above for a different explanation for *ki-ta-no*.

[132] Καββάδας, 429.

[133] The term *σχοῖνος* refers to *Juncus sp.* or a type of reed.

[134] Melena 1974a, 1976a.

[135] de Vartavan & Amoros 1997, 206-207; Serpico & White 2000.

[136] De Rougemont 1989, 113. Contrary to this, Zohary & Hopf (1993, 197) claim that the nuts of *P. atlantica*, wild pistachio, are sold in the old-type markets and are therefore edible and they refer to the archaeological sites of Iran, Iraq and Turkey where it has been found (Zohary & Hopf 1993, 202-206).

[137] Zohary & Hopf 2000, 223.

[138] Zohary & Hopf 2000, 223.

[139] This has been identified by archaeobotanists (J. Renfrew and J. Hansen) as *Pistacia atlantica* at Sesklo and Franchthi (referred to by Zohary & Hopf 2000, 223) but identifications must be dubious and these

Pistacia terebinthus L., turpentine tree, *τερμινθίνη*[140] (Theophrastus and Dioscurides) in Greek, is a common plant in the maquis of Greece and the Mediterranean. It provides a true resin[141] from the sap of the wood, which is sold as amorphous crystals. Its fruits, named *τσίκουδα* in Greek, salted and baked are said to be quite palatable.[142] Gennadios mentions that they could also be eaten raw or in brine. If crushed and pressed, they produce an edible oil, the oil of terebinthus, mentioned by Dioscurides, but also used for lighting in the East. Galls, long and horn-like are formed in spring, on the leaves,[143] by aphids,[144] and are used for tanning.[145] The young shoots named *τσίκουδα* and *τσιτσιράφα* by the inhabitants of Pelio in Thessaly, Euboea, the northern Sporades and Skyros are prepared in brine and made into preserves.

The *Pistacia* tree produces fruit eight years after planting. An adult tree about twenty years old produces up to 30 okades (38.4 kg.) of fruit per year and is productive for over 100 years. This fruit matures at the end of August or beginning of September and is harvested by beating with a stick (a reed). The crop is then dried in the sun and stored. It was sold in Athens for 1½-2 drachmas per oka (1.28 kg.) at the beginning of the 20th century.[146]

Lucas & Harris[147] state that the true botanical source of the resin has not been identified and the question is how secure identifications of these resins could be possible nearly four decades after having been excavated. However, it has been identified as *Pistacia terebinthus L.*[148] and was found in *ca.* 100 jars of the Ulu Burun wreck.[149] This resin is semi-liquid but if boiled in water it rejects its oils, and turns milky colour and shiny. It is then sold in this solid form, in the shape of *μαγίδων*[150] which in Cyprus are called white tar or tar of Paphos.

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remains need to be re-studied. All references to Sesklo by Kroll (1991, 172-174) are referred to as *Pistacia sp.* This shows his understated dilemma in treating these finds at a species level. As for Franchthi, Hansen (1991, 43) has re-identified the material and claims that the archaeobotanical material is more likely to be *P. lentiscus* and not *P. atlantica.*

[140] Turpentine oil (*τερεβινθέλαιο*) is produced from various trees but in Greece it is nowadays produced mainly from *Pinus halepensis*, the Aleppo pine.

[141] Hepper (1992, 195) believes that it provides an insignificant yield of resin and that it would be useful to have field notes as to its productivity.

[142] Καββάδας, 3144; Γεννάδιος 1914, 785.

[143] Cardon & du Chatenet 1990, 276.

[144] Two species of aphids, *Pemphigus* and *Aplonema*, produce galls which contain a very rich source of tannin, especially for black dye (Cardon & du Chatenet 1990, 276). Some say they produce a red dye (Καββάδας, 3144) and others a yellow dye (Baumann 1984, 157, 159). Presumably it depends on the mordant and the chosen cloth.

[145] Gall nuts served a two-fold purpose, providing both a dye and a mordant (Faber 1938, 287). They contain some 50-60% of the same tannin as the leaves (Cardon & du Chatenet 1990, 276).

[146] Γεννάδιος 1914.

[147] Lucas & Harris 1999, 321.

[148] Identified by Hairfield & Hairfield (1990).

[149] It is believed that approximately a ton of terebinth resin was transported in these jars (Pulak 1998, 201). More evidence comes from the New Kingdom where many vessels from Amarna seem to have contained *Pistacia sp.* resin (Serpico & White 2000).

[150] *Μαγίς* (*-ίδος*) (commonly named *καντάρι*) is an ancient utensil, which is in the shape of a portable, round, table. Note, as an alternative, that in the tomb of Tutankhamun, what was identified, as 'frankincense', is believed (Lucas & Harris 1999, 92) to have been powdered incense made into balls. It is also interesting to note that resin lumps, large resin beads and ear studs were made from resin and thus could have circulated in these forms. Moreover a whole necklace made of resin was found in the tomb (Hepper 1990, 20) (Fig. 4).

I would, therefore, conclude that *ko-no* is not *ki-ta-no*. They both refer to large quantities and are probably products extracted from local plants. They could certainly have been products of resinous plants/trees. The **MY Ge** tablets refer to plants which are condiments (such as mint), dye plants (such as *ka-na-ko*) and 'exotic' products such as sesame but which could have been planted in Greece at that time (see *sa-sa-ma*), so we might have to revert to different plant identifications for *ko-no* as well.

P. lentiscus L., the lentisk tree, is also widely present in the Mediterranean maquis, and known as *σχῖνος* today, but is also known since Theophrastus' and Dioscurides' time. It also provides a good quality resin.[151] If the fruit (*σχινόκοκκα*) is pressed, 18-20% edible oil (*σχινέλαιον*) is extracted, which could also be used for lighting.[152] It also has other uses, as the wood is very good quality, often used to make charcoal,[153] and the year old twigs are often used for basketry. Its leaves (*σχινόφυλλον*), bark and galls are used for tanning and dyeing. One would expect the resin to have been used as incense too.

P. lentiscus var. chia, the mastic tree, produces the resin named *μαστίχα* in Greece. *P. atlantica* will not be dealt with as it grows in North Africa and the Canary Islands.[154] Today, the mastic tree grows in the south of the island of Chios, Greece. Orphanides[155] stated that he had successfully produced the same Chian mastic at Antiparos and Amorgos, and the same occurred in Attica. The same mastic was grown at the village of Komi tou Yialou in Cyprus where the children collected and chewed resin from the scarred branches.[156] This is an indication of a possible wider distribution for this plant in the past.

The 'mastic' tree grows and produces more in coastal, hot and airy places. The trunk is scarred in several places to let the resin flow and drop to be collected. This practice starts in July and continues until the end of September/beginning of October. Its characteristic is that the natural resin coalesces in teardrop form (*δακρυόμορφος*). Perikos[157] explains, in great detail, all the process of cleaning the tree and preparing for the scarring, as it takes place, traditionally, nowadays. The product is divided into 7 grades of mastic from large and clean drops to dust,[158] showing that nothing is wasted. Its price in 1939 was 222 drachmas per 1.28 kg., whereas today it is 2,500 drachmas per kilo. In the old days mastic was measured by weight[159] and calculated in staters (*στατήρας*), with 1 stater[160] corresponding to 44 okades (56.32 kg.). Could the Mycenaean *sa-pi-de* (Table 3) be some kind of measure, too, like *AROM*, stater, and *μαγίς*, in modern Greece?

In conclusion, I would say that *ko-no*, *ki-ta-no* and even *sa-pi-de* might refer to different resins, some in more semi-liquid or malleable form such as *ki-ta-no*, and others in a more solid state. Mastic is another ingredient, which, scarce as it is today, would have circulated in some quantity, as it is heavy, and would have been in great demand in neighbouring countries. Had the

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[151] All mastic is light coloured if freshly harvested and crystalline when broken and comes as a contrast to its 'dusty' surface (Baum 1994, 23).

[152] Baum 1994, 22.

[153] Γεννάδιος 1914, 783.

[154] de Rougemont 1989, 113; and does not grow in Greece (see among others Βαλαμώτη 2001, 32; Browicz 1987).

[155] Ορφανίδης 1873.

[156] Γεννάδιος 1914, 784.

[157] Περίκος 1990, 21-23.

[158] Περίκος 1990, 34.

[159] Περίκος 1990, 46.

[160] The stater (*στατήρας*) is also commonly known as *καντάρι*, and these figures are quoted from Perikos (1993, 45), although elsewhere the stater is calculated at 100 kg. (*Μεγάλη Ελληνική Εγκυκλοπαίδεια, s.v. στατήρ*).

mastic grown only in a limited area, as it does today, we would have expected the Mycenaeans to have controlled the monopoly of its circulation.

ko-ri-ja-do-no: Coriander, *κορίαννον* in Greek and identified as *Coriandrum sativum*. In Mycenaean it is referred to as *ko-ri-a$_2$-da-na/KO* (**MY**, **PY**), *ko-ri-ja-da-na* (**MY**) (plural), *ko-ri-ja-do-no* (**KN**)[161] (Table 7).

It is an annual umbellifer, cultivated for its dried seeds and fresh leaves. It is sown early in the autumn or in spring and harvested in July.[162] Every stremma needs some 2 okades of seeds (2.56 kg.).[163] These have a variety of uses such as for cooking, as a condiment,[164] and for medicinal purposes. The Egyptians refer to several recipes for a multitude of ailments[165] and from Linear B information one can assume that it was used as an aromatic in perfumery.

Its area of origin seems to be the Near East and the Mediterranean basin, as it grows wild in oak scrub and adjacent steppe-like niches. The earliest archaeobotanical finds[166] of coriander seeds come from Pre-Pottery Neolithic B (6500-6200 BC) Nahal Hemar cave, Israel.[167] In Syria, seeds were found in 2nd millennium Tell ed-Dar.[168] In Egypt, half a fruit has been found in Predynastic levels[169] but from the 18th Dynasty, fruits (*ca.* ½ litre) have been found from the tomb of Tutankhamun,[170] Deir el Medineh, and Amarna.

In Greece, the earliest appearance is from the Neolithic levels of the Franchthi Cave.[171] At Early Bronze Age Sitagroi seeds were also found.[172] In the Late Bronze Age, the site of Akrotiri on Thera has presented us with 46 seeds of coriander,[173] which were present, either as a contaminant of a *Lathyrus clymenum* (spanish vetchling) crop, or as a natural plant insecticide/ repellent.[174] In any case, it must be considered to have been a cultivated plant, even though, in the *Lathyrus clymenum* crop, it was merely a contaminant.

It is worth mentioning that three tablets recording coriander from Pylos (Table 7) produced 998.4 litres of coriander, whereas five tablets from Mycenae provided two-thirds of the quantity, namely *ca.* 624 litres. Knossos, on the other hand, with thirty-three tablets records some 23,040 litres (23 tons). It is obvious that coriander circulated in at least two forms, one in primary units which might represent containers (?), and the other in large measures of volume (Knossos,

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[161] Duhoux 1993, 105.

[162] Melena (1974b, 134) describes how the whole umbels are harvested in July by cutting. They are put in the sun for *ca.* 48 hours and when they dry they are then beaten to extract the seeds. In cultivation an average of 1,000 kg. per hectare is obtained.

[163] Γεννάδιος 1914, 538.

[164] As incense perhaps (Georgiou 1986, 8), as coriander was found in an incense burner.

[165] Manniche 1989, 94.

[166] A reservation as to whether they are archaeological is expressed by Zohary & Hopf (1993, 188) because these 15 fruits –all found in one stratum, strata 3 & 4– are not charred but desiccated. Kislev (1988, 80) also suggests that a C^{14} date is necessary.

[167] Kislev 1988, 77.

[168] Zohary & Hopf 1993, 188.

[169] de Vartavan & Amoros 1997, 85.

[170] Renfrew 1973, 171.

[171] Only four seeds were found (Renfrew 1973, 171).

[172] Renfrew 1973, 171.

[173] Sarpaki 1992, 225.

[174] Panagiotakopulu *et al.* 1995, 708. If Melena's assumption (1974b, 141) is correct –that is if shepherds were involved in the growing of coriander– perhaps it could be accepted as an indication of its use in the curing and the aromatising of meats and dairy products?

Mycenae and Pylos); the major unit might possibly have been *AROM T* 1 = 105.6 litres and was probably a third way which represented very much smaller quantities, still measured by volume (Mycenae and Knossos).[175]

Melena[176] discusses thoroughly all the problems related to the coriander tablets and develops theories about the incoming and outgoing quantities of this product in the Knossos tablets. On the basis of his calculations, the incoming would be calculated at *ca.* 10,000 litres and the outgoing *ca.* 3,000 kg. These figures clearly suggest the importance of the cultivation of coriander for economic purposes (perfumery), but it is also used for monthly rations[177] which gives it a 'monetary' value and is an indication of its wider use and importance, probably for culinary and preservative purposes as well.

ku-mi-no: Cumin is widely accepted as *Cuminum cyminum*, which points to a Semitic origin,[178] as it is called *ka-mu-nu* by the Babylonians and Sumerians (Table 8). The Hittite word is *kappani*.[179] Cumin has two varieties, the lighter coloured seeds and the darker seeds that are termed 'black cumin',[180] and it is sometimes confused with caraway (*Carum carvi*), which is said not to be cultivated in the Mediterranean.[181] Interestingly, Shelmerdine[182] does not include it in her list of perfume plants and, assuming she accepts the cumin identification, we should rather view it as a condiment, due to its slightly pungent smell. The Hittites sprinkled it on bread, in order to make use of its characteristic colour for analogic/sympathetic magic.[183] We cannot be totally sure, yet, that 'black cumin' was not *Nigella sativa*, which could also be grown in Greece.[184]

C. cyminum is an annual plant whose natural range covers an area from Turkestan to, probably, the eastern Mediterranean. However, it seems so far not to have been found archaeobotanically in Greece but this could well reflect inadequacies in our sampling strategies and the fact that these seeds would be stored in small pots/containers, which are, to date, rarely sampled for archaeobotanical data.

Cumin seeds have been found at some sites in the Mediterranean, such as Tell ed-Dar (2nd millennium BC Syria) and Deir el Medineh (New Kingdom, Egypt),[185] while 'black cumin' (*Nigella sativa*), an annual plant as well, has been found in Tutankhamun's tomb (1325 BC, Egypt) and several other sites mentioned by Germer.[186] These two plants could have been naturalised very early in Greece, although we have not yet found any tangible evidence.

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[175] These would represent seed crop, possibly recorded for planting set fields; or could it have been coriander oil (oil perfumed with coriander)?

[176] Melena 1974b.

[177] Melena 1974b, 159.

[178] Shelmerdine 1985, 136.

[179] Hoffner 1974, 103.

[180] de Rougemont 1989, 261.

[181] de Rougemont 1989, 260 and yet considered naturalised by Γεννάδιος 1914, 467 and Καββάδας, 1812-1814.

[182] Shelmerdine 1985, 171-172.

[183] Hoffner 1974, 104.

[184] Wylock (1972, 110, 113-114) believes it might be *Lagoecia cuminoides L.* or even *Pimpinella anisum L. anise*. The former has the taste and smell of cumin and does grow around the Mediterranean, whereas the latter does also grow in Greece. The question, though, is whether such plants would have been mentioned in archives whose prime purpose was economic. The only presence of anise (though this needs to be confirmed) was detected in an MM IA pottery vessel from Chamalevri (*Minoan and Mycenean Flavours*, 40) but the scholar (Beck) still needs to provide the degree of confidence of this find.

[185] de Vartavan & Amoros 1997, 89-90; Zohary & Hopf 2000, 206.

[186] Germer 1989, 61; Darby *et al.* 1977, 807.

Cumin seeds are used as a condiment in foods and drinks but also have medicinal properties. The plant is grown in spring and harvested in the autumn only for its seeds. At Mycenae, which is the only site we know where cumin is mentioned, it is obviously a 'transacted' good. The six tablets that mention cumin from Mycenae have very small quantities recorded, which could either mean that they refer to seed crop that would be allocated to the next year's farmers, or else could also be cumin oil and/or paste of cumin.[187] However, the evidence is still not conclusive and one could also argue that the term refers to another plant, caraway, *Carum carvi*. This latter plant would have been more likely to be mentioned amongst aromatic substances (**MY Ge** tablets) as it could be used for both perfumery and aromatising drinks. The chances of *ku-mi-no*[188] representing caraway are quite high but still hypothetical.

ku-pa-ro: Cyperus (Table 14). This must be a pre-Hellenic name, as *suadu* is the Assyrian name for the cyperus plants. It is also mentioned by Homer[189] and this author seems to differentiate between *Cyperus papyrus L.* (*βίβλινος*) and *Cyperus* (?) *longus*/*C. esculentus L.* (*κύπειρος*).[190] Wylock, Melena and Palmer[191] discuss extensively the cyperus plant and, unhesitatingly, include it in the list of plants used in perfumery.[192] An interesting insight for those studying the site of Akrotiri, Thera, is that Pliny[193] considers the island to be an area of cultivation/harvest of this plant, and perhaps gives an insight into the fact that Thera might have had some marshy areas in the sandy soil, as the *Cyperus* plants are all hydrophilous.

The edible species of cyperus is *Cyperus esculentus*,[194] (chufa / tiger nut) and the edible parts are the corms,[195] which can be eaten in a variety of ways. These can be eaten raw, as a vegetable, or roasted or even used as a source of starch for flour and of edible oil. In Spain, a well-known drink is made from it, called *horchata*.

Cyperus esculentus, chufa,[196] is a native of southern and central Europe, and is marketed as tiger nut in Britain. In Greece it is very little known, as *αμύγδαλο εδάφους* (ground almond)[197] or *μάννα του ουρανού* (manna of heaven).[198] It has been cultivated in the Mediterranean since very early times, but no archaeobotanical finds of this plant have been found, so far, in Greece. In Egypt it was considered a very important food plant[199] since predynastic and throughout dynastic times,

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[187] It could also be evidence for its importing rather than its local cultivation. At present the problem does not seem finally resolved.

[188] Could it be a coincidence that the Turkish word for caraway is *kiminion* (Γεννάδιος 1914, 468)?

[189] Moazzo 1983, 109.

[190] See Duhoux 1993, 107 for references.

[191] Wylock 1970, 128-133; Melena 1974c; Palmer 1999, 470-472.

[192] See also Shelmerdine 1985.

[193] Pliny, *Natural History*, XXI.117-118.

[194] For details about the plant see de Vries 1991.

[195] A wall painting in the tomb of Visir Rekhmire in Thebes, Egypt (18th Dynasty - 15th century BC) depicts the preparation of tiger nut, where it was ground, sifted, and then was made into a dough, after which honey was added to it. Subsequently, it was placed in a pan with fat and 'fried'. This must have been a type of biscuit and/or cake. In the same tomb, another wall painting depicts the measurement of the tiger nut crop with a type of container which looks like a *χόννος* (Negbi 1992, 65; Manniche 1989, 42, 98; see also Maddoli 1967 for *χόννος*).

[196] Palmer (1999, 485) identifies the edible cyperus (*C. esculentus L.*) as referred by *CYP+O*/*PYC+O*, *CYP+PA* (?), whereas other names (*ku-pa-ro*, *ku-pa-ro-we*, *CYP*/*PYC*, *AROM+PYC*, *CYP+KU*, *PYC+QA*) (Palmer 1999, 470) refer to aromatic cyperus.

[197] de Rougemont 1989, 331.

[198] Καββάδας, 2207.

[199] Zohary & Hopf 2000, 198.

and has even been found as early as the 5th millennium BC and into predynastic contexts, and, generally, throughout prehistory.[200] Its cultivation seems to have remained completely in Egyptian hands, as it has not been found elsewhere. There is a very long list of finds of chufa from archaeological contexts in Egypt.[201]

The other possible plant is *Cyperus rotundus L.* (Fig. 5), the nut grass, which is believed by Gennadios[202] to be the *κύπειρος* of Theophrastus. It is commonly known as *γαρούφαλλα του Άργους* and its odoriferous root is chewed, just like the mastic of Chios, in order to refresh the breath.[203] In Late Palaeolithic Egypt, *ca.* 16,000-15,000 BC tubers of this plant were found at Wadi Kubbaniya[204] and are present from the Old Kingdom onwards.[205] It would have played the role of carbohydrate staple in their diet, but later on, in Mycenaean times, it seems to have been used as an astringent,[206] as mentioned by Dioscurides. However, others believe that it was 'well known as a perfume ingredient throughout antiquity'.[207]

Cyperus longus L. is a common plant in the marshes and along the rivers in Greece. This plant, too, has rhizomes, which have a taste resembling walnuts and could be consumed dry and raw, as one would eat dried fruit.[208] In Egypt it has been identified since the 5th Dynasty.[209]

Cyperus spp. are known to have been used for making basketry, and ropes of various kinds, as well as, often, used for tying various crops. In Greece, the rhizomes of these plants might probably be found archaeobotanically, in charcoal samples, especially as Hather[210] has closely studied their rhizome anatomy, but charcoal studies are still not applied universally.

In the tablets, cyperus is mentioned in two ways, which, it is believed, refer to at least two species of cyperus.[211] One is a perfume ingredient and a second is as a food. A third commodity, **171* is connected with cyperus and it is believed perhaps to have been cyperus stem (see notes of Table 3 for discussion). The ideograms *PYC/CYP* also appear with different ligatures: *AROM+PYC*, *CYP+KU*, *PYC+QA*, *CYP+O/PYC+O*, *CYP+PA*. Of these, the ideograms and the first three ligatures are found on tablets from Knossos and Pylos listed together with aromatic plants used for perfumery. In this case, *C. rotundus* is most probably understood. On the other hand, the two last ligatures appear at Knossos, Pylos, Mycenae and Thebes 'on mixed commodity tablets and nodules which may be assessment or collection records, or inventories of foods for festivals'.[212] In this case, the species referred to would probably be the edible cyperus, *Cyperus esculentus L.*[213] but one cannot totally exclude *C. longus L.*

It is interesting to note that *C. rotundus* seems to be listed in larger amounts than *C. esculentus*. This is an interesting observation[214] that indirectly proves the bias of the palatial administration.

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[200] Darby *et al.* 1977, 649-650.
[201] See de Vartavan & Amoros 1997, 94-96.
[202] Γεννάδιος 1914, 587.
[203] Καββάδας, 2208.
[204] Hillman 1989.
[205] de Vartavan & Amoros 1997, 100.
[206] Shelmerdine 1985, contrary to Melena (1974c, 306) who believes that it was a perfume and food additive too.
[207] Melena 1974c; Palmer 1999, 471.
[208] Καββάδας, 2207.
[209] de Vartavan & Amoros 1997, 96.
[210] Hather 1993,116-123.
[211] Melena 1974c; Palmer 1999, 470.
[212] Palmer 1999, 470.
[213] *C. rotundus* also has edible rhizomes.
[214] Melena 1974c; Palmer 1999.

As one could easily guess, the administrative 'machine' was more interested in luxury items (perfumery ingredients) than in the staples which the *C. esculentus* or the *C. longus L.*[215] would have been.[216] This does strongly indicate that the staples which most probably existed in large quantities, too, were not referred to as the palace had a low interest in these, whereas the control of *C. rotundus*, an important ingredient in perfume manufacture, was of paramount importance. As all three are hydrophilous plants, one would expect to find them more or less in the same ecological zones, especially as Greece was an area with still many marshes in the Pre Second World War period.

A question, which occurs to us, is whether these *Cyperus spp.* were collected or deliberately cultivated. The large numbers, more than 10 tons at Knossos, induced Melena[217] to consider deliberate cultivation but Hillman[218] has reasons to believe that, if dug up carefully, it would be possible both to collect large amounts and to avoid destroying the swards. What we do know is that *C. rotundus* together with *C. papyrus* were deliberately planted in Egyptian gardens,[219] but it is reasonable to conclude that ecological zones needed for cyperus cultivation would have abounded in several parts of Greece, in the areas known as marshy ground.

ma-ra-tu-wo: Fennel, *μάραθο*, *Foeniculum vulgare*,[220] is the wild variety, and the cultivated one is *F. vulgare var. sativum* (Table 6). It is a biennial/perennial plant,[221] which is very easy to grow, and is cultivated for all of its parts –roots, stacks, seeds, leaves–, as it flourishes in stony and dry areas. Moreover, it can be planted from autumn to June, and would have been very well adapted to many areas of Greece. Its production has been calculated to 100-150 okades (128-192 kg.) per stremma. This product –it is not stated whether plant or seed– was sold at 60-80 lepta (0.6-0.8 of a drachma) per oka in the early years of the 20th century, prior to 1914.[222]

Its mention in rather small quantities of volume at Mycenae and Knossos is puzzling. It either refers to the seeds of fennel, which would have been used as a condiment, and for medicinal purposes;[223] or might we also infer a kind of 'primitive' distillation process[224] for the seeds (they contain *ca.* 5% of volatile oil)?

mi-ta: Mint, Greek *μίνθη* (Table 9). These are plants, which have a multiplicity of uses such as medicinal, aromatic (volatile oils), and as a condiment. In cultivation, mint can produce 2,500-3,000 kg., in fresh form, per stremma, whereas dry it is reduced by 1/2 to 1/3. The volatile oils produced are in the range of 0.2-0.3% of the dry weight.[225] The species that would have

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[215] One would tend to agree that *C. esculentus L.* is the most likely candidate because its production could be controlled by cultivation and not just collection.

[216] This could have circulated as potatoes do today and not as flour, I believe, due to the lower viability of flour compared to the whole rhizomes.

[217] Melena 1974c.

[218] Hillman 1989.

[219] Wilkinson 1998, 164.

[220] Duhoux 1993, 108.

[221] It is biennial but as the seeds fall from the umbels into the ground, the plant becomes established in the same spot and, consequently, can be considered a sort of perennial.

[222] Γεννάδιος 1914, 639.

[223] It is considered to be good for the production of milk in nursing mothers (Φραγκάκι 1969, 139), for the stomach, as a diuretic, for eye ailments, and it was used in several ancient civilizations as an antidote for snake bite (Manniche 1989, 106).

[224] Yet at this stage there is no way of knowing whether it is dry or liquid volume.

[225] Καββάδας, 2563-2566.

occurred in Mycenaean Greece are *Mentha pubescens*,[226] *M. aquatica L.*, *M. suaveolens*,[227] *M. microphylla*,[228] *M. longifolia*,[229] *M. spicata*,[230] *M. pulegium L.*[231] *ka-ra-ko*, now read *ka-]ra-to*,[232] pennyroyal,[233] is considered to be *Mentha pulegium*, for reasons not explained. Chadwick[234] seems to agree with this identification by Warren. The quantities, however, are puzzling, as they seem to be very small for such a common plant. The ideogram **154* (Table 3) is also believed by Palmer[235] to refer to pennyroyal,[236] which is now known as *Mentha pulegium.*

MU: It is an ingredient only found at Knossos and perhaps refers to myrrh[237] (see *murru* in Assyrian) (Table 3). Myrrh is derived from various species of *Balsamodendron* and *Commiphora* and occurs in yellowish-brown masses of gum resin,[238] whereas frankincense is yielded by the genus *Boswellia* and from *Commiphora pedunculata.* These trees still grow in southern Arabia, Somalia and parts of Ethiopia. Frankincense is a very good incense and myrrh is of particular value as a base for perfumes and unguents –hence, perhaps, its reference in Mycenaean texts. It is interesting to note the prices quoted by Pliny for these and other commodities, and the relative cheapness, weight for weight, of frankincense and myrrh in comparison with other luxury items is striking.[239] For example, various types of myrrh were sold at 11-16 denarii per pound and frankincense was even cheaper, at 3-6 denarii per pound, which should be compared with cinnamon,[240] sold at 1,500 denarii per pound, or balsam at 1,000 denarii per pint.[241]

pa-ko-we: Sage-scented, *σφακόεν* (Table 17). Although sage is not thought to have been used for perfumery in Classical times, we cannot exclude its use for this purpose in the Mycenaean period.[242] The oil of sage, as well as the tea (leaves) is produced by several species of *Salvia* such as *S. officinalis*, *S. triloba L.*, or *S. pomifera L.* However, these are plants that are also used for medicinal purposes, and in the villages of the Messara (Crete)[243] sage was said to be smoked, just

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[226] It exists in Thessaly.
[227] It exists in the whole of Greece and Crete.
[228] It exists in the whole of Greece and in Crete too.
[229] It is present in Crete.
[230] Warren (1970, 373) refers to *M. puperta* as mint, *mi-ta* (*μίνθη*) but so far as I could trace in botanical references, no such mint grows in the Mediterranean, unless he means *M. spicata*, which is the spearmint and is grown widely. *M. pulegium*, pennyroyal, is considered to be *ka-na-ko* for reasons which are not made clear. Chadwick (*Documents*, 561) mentions *M. viridis*, which is an older botanical name for *M. spicata*. *M. spicata* is presently grown in gardens –probably the *μίνθη* or *ἡδύοσμον* of Theophrastus.
[231] It is probably the *γλήχων/βλήχων* of Theophrastus.
[232] Baumbach 1986: **MY Ge 605 + 607 +** *fr.* **[+] 605a +** *fr.* **[+] 605b +** *frr.*
[233] Warren 1970.
[234] *Documents*, 550.
[235] Palmer 1999, 485.
[236] *Documents*, 226; Warren 1970.
[237] Sacconi 1969.
[238] Lucas & Harris 1999, 92.
[239] Groom 1981, 154-155.
[240] Cinnamon and cassia, which come from plants from the Far East, seem to have been among the most expensive commodities, at least, in Roman times.
[241] It is not clear, though, whether he is referring to the dry measure pint, the liquid measure or the British imperial.
[242] Duhoux 1993, 111.
[243] Φραγκάκι 1969, 202.

as tobacco, in the old days. Small, sweet, apple-like galls are produced at the tips of the young branches of the plant and are collected, unsystematically and eaten in parts of Crete (in the East of Crete, around the Palaikastro area).[244]

po-ni-ki-jo: It has been a much disputed term, judging from the many references to it in the bibliography (Table 13). If we trace its various interpretations through time, we see that Ventris & Chadwick[245] refer to it as a Phoenician spice[246] (red colour or Phoenician origin)[247] but did the Mycenaeans know Phoenicia by this name? Melena[248] disagrees that it had any connection with later Phoenicia. It is referred to as possibly deriving from *φοινίκη* palm-tree, 'palmette'[249] or referring to red.[250] Melena[251] believed that the palm-date interpretation was likely, as he thought it to be a food, drink additive, and provided as a ration to certain groups of workmen,[252] but it is not measured by volume as seed crops were, therefore, according to Melena it might be a processed matter. Dates do provide food (dried dates) and also a sort of wine, which was made in Egypt.[253] Date wine has even been mentioned from Crete, in an archaic inscription from Gortyn and it has been tentatively identified in Linear A by Best.[254] The date-palms (*Phoenix dactylifera*) could and would, most probably, have been present on Crete and in other parts of Greece, but it would have been growing just as an ornamental tree and would have been used only for industrial (e.g. fuel) and craft (e.g. woodworking)[255] purposes. The date palm requires a warmer and drier climate than Greece could provide. The high temperatures and the low humidity are particularly important for fruit setting and, mainly, ripening,[256] and these conditions do not seem to be provided in Greece. This is apparent as palm trees do grow, but they produce fruit, which never reaches maturity. This must have been the same in antiquity, where people seem to have been familiar with palm trees (see iconography), and we might therefore assume that they had an intimate knowledge of the tree but no actual remains of date stones have so far been found in Greece. The invisibility of the date (no stones found) is indicative of the similarity of the climate then and at present. Therefore, Melena's[257] interpretation stands only if they imported palm date pulp, which, in that case, would have been measured by weight and not by volume, like other seeds. This is the case for *po-ni-ki-jo* but the quantities are rather small and

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[244] Personal communication from farmers of Angathia village.

[245] *Documents*, 222.

[246] Murray & Warren (1976, 44) believe that it 'need not be an aromatic, but some other substance used in unguent production, or even something not unguent at all'. However, it is agreed that *po-ni-ki-jo* is either a plant or a plant product.

[247] Maddoli 1967.

[248] Melena 1973, 82.

[249] Duhoux 1993, 112.

[250] Murray & Warren 1976, 57-59; Foster 1977b.

[251] Melena 1973, 83.

[252] Melena 1973, 80; Erard-Cerceau 1990, 265, whereas Foster (1977b, 56) does not believe it to be a foodstuff.

[253] Darby *et al.* 1977, 614-615, 728-729.

[254] Best 1972, 32.

[255] Charred wood (unpublished by the author) has been found at the site of Palaikastro (East Crete) (LM III) and another find has come from Pseira (unpublished). The use of the date-palm for building material has been mentioned by Orlandos (Ορλάνδος 1955, 18, 28). He asserted that it is a soft but strong wood. Strabo (XVI.1.5) mentioned that it was used for beams and columns.

[256] Zohary & Hopf 1993, 157.

[257] Melena 1973, 84.

mostly in the range of 1-5 kg., which is minimal, if it referred to dates. This would not have been worthwhile even recording. Its common occurrence, though, with coriander and the common references to it in the tablets, would rather suggest a product that is produced/harvested locally but not a foodstuff.[258]

Murray & Warren[259] believe that it was rather a substance 'producing or consisting of red colour'.[260] One of their suggestions is cochineal, red dye from *Kermococcus vermilio*, an aphid which parasites on *Quercus coccifera L.*, kermes oak, but they believe it was unlikely to have been measured by weight as the insect has the size of a seed and was believed to have been the same in antiquity.[261] However, I believe the desiccated product could have been measured by weight, as very expensive products are (cf. saffron) but in rather smaller quantities perhaps.

Another relevant tree is *Pistacia terebinthus L.* on whose leaves an aphid is parasitic. These insects form horn-like galls that were used to produce a red dye, but if *ki-ta-no*[262] is this tree, as suggested by Melena,[263] this could not be equated to *po-ni-ki-jo*. Yet, another suggestion was the red dye from the Murex shells (*Murex trunculus L., M. brandaris, Thais haemastoma L.*) but Murray & Warren believe, rightly so, that it would be most incongruous for this to be mentioned in juxtaposition with a spice (coriander).[264] However, *po-ni-ki-jo* is measured by weight, so it must have been something fairly valuable (a powder, an incense, a dye) and perhaps we could turn to the finds of Ulu Burun for some suggestions. The thousands of *Murex opercula*[265] neatly stacked on the boat suggest that they must have been used as incense, when ground to powder. This is still used today, in many parts of the Arab world. In that case, the 'camouflaged' powdered form would not have been out of place when mentioned together with other aromatic plants, and would have been transacted by weight due to its –expected– high price.

A fourth suggestion by Murray & Warren is orchil, which is a red, violet or purple dye obtained from various lichens, such as *Roccella tinctoria*, *Lecanora tartarea*, *Roccella fucoides* and *Rytiphloea tinctoria*.[266] They were common on rocks on Eastern Mediterranean coastlines, and perhaps this fact alone discourages one from believing that a common product would have been so meticulously annotated and, therefore, of high enough price.

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[258] Foster (1977b, 53) also believes that it is not a foodstuff, nor a spice, but rather a plant product, which is used for industrial purposes. See Murray & Warren (1976, 43-44, 47) for a very detailed discussion of where –geographically– *po-ni-ki-jo* would have been produced; according to them, it was produced in northern Crete, at no great distance from Knossos. Later Melena (1983, 93) changed his earlier interpretation and suggested that it was dyer's madder. Whatever it was, it must have been expensive, but not as much as saffron, where the quantities transacted were much lower.

[259] Murray & Warren 1976, 47-54.

[260] See also Sinastra 1982 interpreting it as colouring material.

[261] Referred to as 'grains' (*Granum tinctorium*) (Forbes 1953, IV, 104). It is a dye used from very early times, as textile fibres were found at the Neolithic cave of Adaouste (Bouches-du Rhône, France) (Forbes 1953, IV, 102). It is more expensive (Forbes 1953, IV, 107) than *Rubia tinctorum*, so it is logical that the dyers would switch to a good steadfast dye and one that would not be overpriced. However, cochineal is unsurpassable in the bright red it can produce, which was described to me by Sophia Kana (a dyer who lives and works at Katsikia, near Hagios Nikolaos, Crete) as a bright, fiery and aggressive red.

[262] See *ki-ta-no* where it is suggested by the present author that it is *Cistus creticus L.*, the rockrose.

[263] Melena 1974a.

[264] Another reason, we believe, is that the dye from the *Murex* shells cannot be preserved for any great length of time, and therefore cannot be stored nor 'circulated', as the material rots. The dyeing process goes hand in hand with the dye extraction, so *po-ni-ki-jo* could not be the dye, but, of course, could be threads and/or cloth dyed with *Murex spp*. However, in that case should this product not have been mentioned with cloth?

[265] Bass 1997, 163.

[266] Abundant on the island of Amorgos.

Another two possibilities are *Alkanna tinctoria*[267] (*Anchusa tinctoria L.*) dyer's alkanet, *βαφόρριζα*, *βοϊδόγλωσσο*, and *Rubia tinctorum*, madder, *ριζάρι*. Both are common throughout Crete and both have roots that produce a red dye. Moreover, the roots of either plant would not be incompatible, as Murray & Warren[268] claim, with the weights recorded, and it makes more sense for roots to be weighed than to have their capacity measured.[269] The localities of collection of *po-ni-ki-jo* around the area of Knossos, and the existence of these plants in the same geographical zone, renders this possibility as effective, but for reasons such as the proximity of the produce and the bulky nature of the roots, one would have expected these products to have circulated in larger quantities, and moreover to have circulated outside the palace bureaucracy and not to have been mentioned in the tablets, as being highly available and therefore of not very high economic value. As a consequence, the hypothesis of the *Murex* opercula still remains the most likely of those discussed.

Alkanna tinctoria is a small plant, which does not grow higher than 10-30 cm. It flowers in April to June but the part used is its root (*αρμπαρρόριζα* in Greek) and specifically its epidermis, which is harvested in the spring and the autumn.

The epidermis contains, amongst other things, several pigments but the main one is alkannine, which provides the violet-red colour. However, this is insoluble in water and, nowadays, it is extracted by immersing the material (wool, cotton or silk) in a warm bath (*ca.* 40° C.) of alcohol (at *ca.* 35°), in which 65 gr. of dyer's alkanet is dissolved in 1 litre of water.[270] In an hour the fibres are dyed. It is, however, soluble in oil and fats.[271] The fabrics are rinsed and left to dry in the shade. The colour produced depends on the mordants. For example, if alum is used, the colours produced are violets and lilacs. If iron ore is used, the colours are grey and grey-violets. Unfortunately, the dye is fugitive, and unless they had invented a way to stabilize it, its price –unless, of course of symbolic value– should not have been very high, when account is also taken of the reasons mentioned above for the root.

Rubia tinctorum, madder, *ἐρυθρόδανο*[272] or *ριζάρι*, *αλιζάρι* is one of the most appreciated dye plants of south-west Asia and Europe as it was extensively grown for its rhizomes from which a brilliant red pigment (alizarin) was extracted.[273] It was widely cultivated in Greece.[274] Alizarin was widely used to colour linen, wool, and leather and, perhaps, even wood.[275] The dye gets

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[267] This is also regarded as a possibility by Foster (1977b, 64, 66) and Melena (1983, 93).

[268] Murray & Warren 1976; Foster 1977b, 66.

[269] There is strong evidence suggesting that it could have been a root/rhizome product due to its registration in weight. As we have said, roots decrease enormously in weight when dried. Sophia Kana claims that the weight is reduced to 1/3 when dry, but she also claims that root/rhizome products dye as a 1 to 1 solution, that is to say that the amount of dye needed is of equal weight to the textile to be dyed. Therefore, we could claim that the amounts referred to are rather small for the needs of administrations such as Knossos. This is difficult to explain at the moment.

[270] It would be worthwhile discussing the quantities of dye material used for dyeing, as this quantity of 65 gr. of dye to 1 litre of water seems to be very high, and would, therefore, have meant that the quantities in the tablets are very small compared to what they could dye.

[271] Cardon & du Chatenet 1990, 30.

[272] Mentioned as such by Dioscurides, though Herodotus (IV.189) named it *ἐρευθέδανον*. Dioscurides mentions that it is planted between olive trees. The Romans seemed to do the same (Forbes 1953, IV, 107).

[273] Zohary & Hopf 1993, 192.

[274] Ορφανίδης 1873, III, 317.

[275] *po-ni-ki-ja* on **KN Sd 4409 + 4481** + *frr.* (3).b, and *mi-to-we-sa* on **KN Sd 4415 + 4417 + 4469** + *frr.* suggest two distinct shades of red colour in the decoration of chariots (Murray & Warren 1976, 48).

fixed to the textile fibres, only after their treatment with a mordant (alum salts). Aluminium alum induces dark red coloration, iron alum results in a brown-red colour, and chromium alum produces red-violet colours. Pliny's description of dyeing in Egypt asserts that after mordanting the textile, it is plunged in a cauldron of boiling dye[276] and taken out the next minute fully coloured. It is remarkable too that, although the cauldron contains a uniform dye, the material extracted is of various colours –depending on the mordant used for a specified textile– and most important of all, these colours are never washed out.

Madder is a perennial herb, which grows in winter when the temperature is *ca.* 10-12° C., and flowers in June/July. The seeds are ripe in August. Its wild forms are native to south-west Asia and central Asia, but spontaneous populations thrive in the Mediterranean basin on waste ground, the margins of cultivated fields and hedgerows. Rhizomes or seeds propagate it in March or early April. In May or June the plants are thinned out and the soil covered with 2-3 cm. of soil. In November 5-8 cm. of soil covers the plants even more. The following May, the plants are weeded and in September they are harvested. The green part is cut to a height of 12-15 cm. from the ground and this is considered excellent fodder. In November, they are again covered to 5-8 cm. (always with soil from the area). These successive alluviations aim at fortifying and multiplying the rhizomes. If water is available in the summer, they are irrigated 3-4 times. The rhizomes are usually harvested the third year,[277] in October (in the previous September, the green parts of the plants, as before, up to a height of 12-15 cm. from the ground, are harvested for fodder). As for the rhizomes, they are collected and left in small piles to dry in a shady and airy spot,[278] without being cleaned. The production, of course, depends on the quality of the soil[279] but one stremma produces *ca.* 1,280 kg. of rhizomes,[280] which, after drying, are reduced to 1/3 of their weight and, therefore, *ca.* 400-450 kg. of dried rhizomes. Some plants are left for seeding and they are always harvested, after the third year, in October. This is how Gennadios[281] described the cultivation on Hellenic land.

After drying, a rather complicated treatment takes place whereby the roots are beaten, in order to remove the dirt and the outer skin, and then they are pulverised.[282] The rhizome contains the dye in the form of glucosides, in a red layer between the outer rind and the core of the woody particles.[283] The price of this dry root has changed a great deal depending on its demand. In the early 1800's in France (Avignon) it was sold at an astronomical price. 100 kg. were sold for 300 French francs, but in 1837 it went down to 45-75 French francs for the same weight. Its seed too can be sold at 1-3 francs per kg.[284]

The earliest evidence of the dye is said to come from samples of cotton from Mohenjo-Daro dating to the 3rd millennium BC.[285] From Egypt there is evidence found at Tell el Amarna

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[276] Apostolaki (Αποστολάκη 1952, 103) claims that ¼ of the weight of the dyed material is needed in powder form, for dyeing, but the quantity depends also on the desired hue of red. See Κερασσιώτη 1941, 30 where it is noted that ¼ of a *mna* of madder, which is roasted and cut into small pieces, is needed for 1 *mna* of wool.

[277] They are harvested from the age of 18-30 months.

[278] In Greece they are dried in the open air.

[279] It is cultivated in marshland, where there is a high percentage of clay, but it depletes the soil.

[280] It is also mentioned that 1 stremma can produce 350-500 kg. of roots (Ορφανίδης 1873, III, 376).

[281] Γεννάδιος 1914, 311.

[282] Apostolaki (Αποστολάκη 1952, 104) claims that in Crete, after drying the roots, they are cut into small pieces and reduced to powder with a rotary mill. They are then sieved through a fine mesh.

[283] Forbes 1953, IV, 106.

[284] Ορφανίδης 1873, III, 317.

[285] Barber 1991, 232.

(18th Dynasty - 1370 BC), from a red-coloured flax textile.[286] From Tutankhamun's tomb,[287] a dyed fabric was found to have been dyed with madder and *Carthamus tinctorius*.[288]

Other vegetable dyes which colour various hues of red are:[289] *Onosma echioides L.* (Greek *αμπελοφράχτης*), whose rhizome could be processed in the same manner as *Alkanna tinctoria*, and was used by the mountain tribes of the North of Greece;[290] *Rubia peregrina*, *Asperula tinctoria L.*, *Asperula odorata L.* (rare though in the Mediterranean), *Galium verum L.*, *Gallium mollugo L.*, *Galium aparine L.*, *G. saxatile L.*,[291] *R. patientia L.*, *R. crispus L.*, *R. obtusifolius L.*, *Rhamnus catharticus L.* (bark and fruits are used), *Rhamnus alaternus L.* (bark and green fruits are used), *Scorodorma foetidum*,[292] and *Hypericum perforatum L.* (flowers used). All the above plants could produce reds with the right mordanting.[293]

As a consequence of all this discussion, which leaves us more perplexed, I would still mention the strongest candidates which to my mind are *Murex* dye and/or opercula,[294] and not madder which would have been produced in larger quantities and does not justify its mention in quantities as small as those noted in the *po-ni-ki-jo* tablets. Moreover, *Carthamus tinctorius* is excluded as it has been considered to be *ka-na-ko*. However, it would be expected that *Murex* dye extraction would have existed hand-in-hand with leather craft as wèll as a textile-dyeing craft industry, due to the rapid rotting of the *Murex* gland material, and the fact that it would not travel far.[295] Due to the small quantities of *po-ni-ki-jo* and, therefore, its high value, one would expect that whatever substance it is, its weight would not have been increased by the addition of salt and so forth. As *Murex* dye, as far as we presently know, could not travel far on its own, due to its rapid rotting, it would lead us to conclude that *po-ni-ki-jo* could refer to thread dyed with *Murex*, if not the powdered opercula. This red thread could have been made from light material, which does not weigh much,[296] and a possibility worth investigating is silk thread from the saturniid, *Pachypasa otus*,[297] whose cocoon has been found in Late Bronze Age Akrotiri, Thera. This thread, dyed red with porphyra, might have been a product of two industries, silk and purple-dye production. Furthermore, this species produced silk in some parts of the Levant until last century, in the same geographical areas that porphyra dye was also extracted. Could this be just a coincidence?

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[286] de Vartavan & Amoros 1997, 226.

[287] Hepper 1990.

[288] Barber 1991, 227.

[289] Red-brown to yellow-brown hues are produced by soaking cloth in solutions of tannin, available from a wide range of leaves and bark (Barber 1991, 232).

[290] Cardon & du Chatenet 1990, 30.

[291] The *Galiums* serve to dye the Scottish tartans and are very steadfast colours (Cardon & du Chtenet 1990, 40). All plants whose parts are not specified as being used, have their rhizomes/roots used for dyes.

[292] Barber 1991, 232.

[293] Cardon & du Chtenet 1990, chapter III.

[294] We have seen that it is a traded product, not just locally but overseas. Every *Murex* produces one operculum, which could be reduced to powder and, therefore, conveniently sold by weight measure.

[295] Sophia Kana, herself a textile dyer using organic dyes (animal and vegetal), claims that *Murex* dye would not have travelled at all well due to fact that the material would have rotted away. Its length of life according to her would have been a matter of days, but this needs further verification, as its length of life could possibly have been extended through other means, such as by salting, drying in the sun etc. Experiments need to be carried out on the effect of these on the colour of the dye.

[296] We know that silk is exceptionally light, though strong compared to its bulk.

[297] Panagiotakopulu *et al.* 1997.

As has been seen, this substance still eludes us and we can just make hypotheses. However, it was thought to be a need to discuss all the possibilities, which have been suggested in the past, and give reasons why some seem more plausible than others, but none renders us totally satisfied. The silk thread dyed with porphyra seemed a wild but possible guess but the mention of *po-ni-ki-jo* together with other condiments negates this hypothesis. Another strong possibility is madder, especially the final product, such as the pulverized and sieved rhizome, which would justify the transactions in weight value. Could madder have been used to colour perfumes as well as used for dyeing? It is proposed instead of *Alkanna tinctoria*, as this plant has a fugitive dye.

sa-sa-ma: Sesame, *σήσαμον*, *Sesamum indicum L.* (Table 10). Sesame does not belong to the crops of the Near East and Mediterranean (no wild progenitors exist in these areas), but rather arrived from further east, south of the Sahara in Africa, and India.[298] Claims for its early introduction into Mesopotamia come from texts (Akkadian and Sumerian). The word *sa-ma-ma* (Hittite) was thought to mean sesame[299] but this is now in doubt. However, researchers have claimed[300] that the term denotes 'oil plant' in general and that it does not provide clear evidence for its cultivation in the 2nd millennium BC. Sesame is, therefore, excluded, and it is probably the word *sapsama* (Hittite), which refers to it.

The proposed progenitor of sesame has, recently, been thought to be *S. orientalis L. var. malabaricum Nar.*,[301] which has close morphological, genetic and phytochemical affinities with cultivated sesame. If this were the case, cultivation would have started in India. The oldest record of the cultivated sesame comes from Harappa in the Indus Valley and is dated to some time between 2250 and 1750 BC.

Sesame has two possible growing seasons,[302] one in April to June and harvested in late summer, which is the normal one, and another in mid-March (early planted) and harvested in mid-July. This second is the most likely to have taken place in the southern parts of Greece. It is imperative to have the harvest exactly on time, because if left for too long, the seed could fall out of the pods and become lost. As to processing the oil, there is still a need to observe traditional methods of extraction. Two methods have been shown to be used. One is pounding the sesame seeds in a mortar and the oil dripping from the resulting cake. This oil is thought to be the best. The second method is crushing the warmed seeds in a mill and extracting the sesame from the pulp. The oil cake is the residual substances after the oil has been pressed out, and this by-product is given as feed to cattle.

In Egypt pollen has been identified in Predynastic times, but a secure presence seems to date to the 18th Dynasty, when actual seeds were found.[303] From Bronze Age Greece, we have no actual archaeobotanical remains.

The quantities referred to in the tablets are fairly small, repetitive, and measured by volume. This, in some way, induces us to believe that, in Linear B, just as in other Near Eastern scripts, *sasama* has fallen into the trap explained for the other scripts, and that it does not refer to sesame at all but to an 'oil' –sesame oil perhaps, but not necessarily. In that case we would expect it to have been imported as a finished product and not as agricultural produce. Another

[298] Zohary & Hopf 2000, 140-141.
[299] Hoffner 1974, 126.
[300] Güterbock 1968.
[301] Bedigian & Harlan 1986.
[302] Stol 1985, 119.
[303] de Vartavan & Amoros 1997, 238.

point worth mentioning is that white safflower (Table 5) which is the achene from which safflower oil can be extracted, is also mentioned in the same manner, measure of volume and the same quantities or fractions of it.[304] So, if *sa-sa-ma* meant 'oil', could it also have referred to safflower oil, amongst others?

se-ri-no: Celery, *σέλινον*, *Apium graveolens* (Table 3). This is a biennial plant, which needs moist and rich soils, and it can therefore be assumed that it grew in row gardens in early summer (planted in March-April). It is a plant, which is most probably of Mediterranean origin, but does not like the scorching sun, and is therefore grown densely planted. Just like today, it must have been harvested both for its leaves and its root, which is also used as a condiment and for pharmaceutical purposes.

In Egypt, it has often been found adorning mummies,[305] hence its associations with death. Fruits, leaves and wreaths have been identified since Early Dynastic times.[306] In Greece there is mention by Pindar[307] of wreaths made from celery,[308] which suggests that the scent was also appreciated, although there is no mention of its use in perfumery, but it must have been consumed as a condiment in foods. Its medicinal and diuretic properties must have been appreciated since early times.

wi-ri-za: Iris root (?), Greek *ἴριδα* (Table 3). It seems to have been used for perfume manufacture in Mycenaean times.[309] Several irises grow in Greece but a few are of economic importance, such as *I. germanica* (yellow flowers, medicinal purposes, given to teething babies to alleviate pain), *I. florentina*, *I. pallida* (volatile oil) and *Iris illyrica*. *I. germanica subsp. floretina* (*I. florentina*) (aromatic rhizome, produces the so-called Orris root) were cultivated until recently in Tuscany and near Verona.[310] They are cultivated there in the same field for three years without any tending. However, in July roots are harvested and only one is left to grow. These are thoroughly washed and then left to soak for a few hours, before their skin is peeled off and they are washed again before they are laid to dry on wicker mats, in the shade in a well-ventilated place. From *ca.* 100 okades (128 kg.) of harvested roots, some 35-40 okades (*ca.* 45 kg.) is retained when cleaned and dried. These were sold locally for the equivalent of 1-1½ drachma for every 1.28 kg.[311] Kavvadas[312] referred to different cultivation methods, which, most probably, were applied in Greece, although he did not state it. He claimed

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[304] Compare the volumes of *ka-na-ko*, *ma-ra-tu-wo*, *ku-mi-no*, *sa-sa-ma* and some of *pa-ko-we* where measures of 1.6 litres are often noted. Since we know that the last is a liquid measure, could it be assumed that the others are too? So could it be oils or pastes aromatised with these condiments/herbs?

[305] Darby *et al.* 1977, 670.

[306] de Vartavan & Amoros 1997, 41.

[307] Wreaths were awarded to the winners of the games at Nemea, which were conducted in memory of the death of the king's son. He was bitten by a snake when he sat beside a celery. Therefore, one can say that, even in victory, it indirectly symbolised death. Celery needs to grow on soil, which is fertile (well-manured) and its stem is kept softer and whiter when covered by soil. This ability, to remain 'fresh' when buried, is probably what the celery symbolised and was probably the reason why mourners wore wreaths of celery and planted celery plants to decorate graves (Καββάδας, 501).

[308] Dalby 1997, 222.

[309] Shelmerdine 1985, 14.

[310] de Rougemont 1989, 303.

[311] Γεννάδιος 1914, 439.

[312] Καββάδας, 1699.

that the harvest was conducted in the second half of July, in the third year after planting, whereby rhizomes were collected but a few were left *in situ* for propagation purposes. After they were washed and dried, preferably in the sun –not in an oven as it damaged their quality– for eight days, they were stored in a dry place until they were sold. Their weight was reduced by 1/3 of their freshly dug weight. Their cultivation was fairly effortless, and *I. germanica* grows in the least fertile ground.

Iris pseudacorus (yellow flower) has tannins, and is used as a dye.[313] If mixed with alum, it produces strong yellows. Although it is sometimes used medicinally, its rhizome is poisonous.

Irises have been depicted in Aegean art (wall-paintings) but not in Egyptian art, whereas the only archaeobotanical evidence comes from Egypt and is dated to the Graeco-Roman period (a wreath found). It has been re-identified by Tächholm as *I. albicans L.*[314] Recently chemical analyses by Beck and Evans[315] have identified oil of iris from three MM IA pottery vessels from the site of Chamalevri, western Crete.

The issue whether *wi-ri-za* is iris, is still not decided and it is still a debated issue. Another interpretation is that it might be the lanolin at the root of the animals' hair.[316] The production of perfume and oils used for perfumery seems, however, to be a logical explanation, as Greece is within the environmental range where aromatics could be produced at their best, not too dry but hot enough to produce concentrated oily substances. However, it is interesting to see that this plant material –root– is calculated in primary units, and it is even more important to note that *wi-ri-za* is, if not the same plant as **157*, a product which circulated in the same manner and was calculated in the same primary unit, even in areas so far removed as Pylos and Knossos. This means that it was a product, which circulated internally and was probably important enough to propagate for external circulation as well.

wo-do-we: Rose, *ῥοδόεν*[317] (Table 3). It seems to have been very similar to the one described for Classical times. The same weight (1:1) in oil and in petals is needed[318] and these would be steeped in oil for several days.[319] In the meantime, they would be returned to each vat to stir the oil, strain out the spent botanical parts in order to use fresh batches of the aromatic source. It is difficult to say which roses the Mycenaeans used for their perfumery. It could have been several subspecies of the *Rosa* genus, such as *Rosa canina*, the dog rose,[320] and/or *R. gallica subsp., centifolia*,[321] cabbage rose, *μαγιανή* in modern Greek: just as in Mycenaean times this denotes a month, which would refer to the time of its harvest, being May. Both could be found in Greece but we have, so far, no tangible archaeobotanical data of this plant.

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[313] Cardon & du Chatenet 1990, 290.

[314] de Vartavan & Amoros 1997, 139.

[315] Pending full publication, it is impossible to verify the degree of confidence of these findings (*Minoan and Mycenaean Flavours*, 50-51).

[316] Chadwick & Baumbach 1963, or wool used to strain perfumes (Beck & Beck 1978).

[317] For the preparation of rose perfume see, *inter alia*, Wylock 1970, 128-129; Erard-Cerceau 1990, 269-270.

[318] Wylock 1970, 1972.

[319] Shelmerdine 1985, 46.

[320] *R. canina* was named the dog rose, after the belief that it cured rabies.

[321] Hurst (1967, 62) believes it is *R. gallica* or *R. sancta*; Goor (1981, 10) adds the qualification that there were four zones of growth and diversity of wild roses, one of which is the southern European zone, comprising the Balkans, Greece, Italy and central Europe. The chief species in this zone are *R. canina L., R. gallica L., R. rubra, A. alba L.*, and *R. centifolia L.*

Its use was not only to make perfume but the rose hip is used to make jams and syrups as well. As the seeds would be extracted from these preparations, the chance of finding *rosa spp.* is meagre. The flowers would have been harvested at dawn, when the coolness of the morning was still present, so as to collect the petals at their best.[322] Petals, of course, do not leave any evidence of their presence. The chances of the hips being caught in a charring environment would be greater, and in that case, it might be possible to identify their presence, if that occurred. However, art[323] and Linear B have given us proof of its existence in the Aegean, in contrast with ancient Egypt where no mention or depiction of it is made. It is, therefore, possible, and very probable, that the Mycenaeans exported this ingredient in perfume form to Egypt,[324] and it could well have been considered a luxury item.

The rose has many uses and many parts of it are useful, such as the flower (petals), the fruit, the leaves, the bezoar (galls), its water and oil. It was used as a medicine, in cosmetics, and as a perfume. Goor[325] claims that the petals can be pounded[326] and then strained through a 'linen cloth into a bronze vessel'; the juice is then heated on a slow fire until it is reduced to thick syrup, like honey. This rose juice is used for a multitude of ailments such as for the ears, mouth (tonsils, gums, sores), stomach, womb, headache, and rectal trouble and when used by itself or mixed with vinegar, it induces sleep and dispels nausea. On the other hand the burned petals are used as a cosmetic for the eyebrows and eyelashes.[327] The little galls or blisters[328] of the rose, it is believed, mixed with bear's grease, are a remedy for mange.[329] Hippocrates is also known to have prescribed rose-tinctured honey.[330] In ancient Greece and Rome rose water was added to wine, to flavour and colour it. In that case, it could not have been imbibed in olive oil or any other oil for that matter.

Goor[331] describes a method of preparing rose water[332] from the Talmud, which is extremely interesting and could very well refer to similar methods applied in the Bronze Age in Greece. It is said that in Persia petals were placed in water in a clean wooden vessel, which was left uncovered in the sunlight for several days. The drops of oil emerging from the flowers bubbled up to the surface and were sponged off with pads of cotton wool.[333] These were squeezed out and the resultant rose water was allowed to drip into a flask and then hermetically sealed until

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[322] Though this is contradicted by Goor (1981, 90), who claims that the best time to pluck petals is in the midday warmth, when the petals are most highly scented.

[323] Namely wall paintings.

[324] All the finds of roses in Egypt, however, are dated much later, to the Roman period (de Vartavan & Amoros 1997, 225).

[325] Goor 1981, 78-79.

[326] He believes that, in the beginning, oil and essential perfumes were 'milled' out of a variety of plants and herbs.

[327] The leaves were burned into powder-form and were used as a mascara for women's eyelashes and as an emulsion for inflamed eyes (Goor 1981, 90). This powder, if sprinkled on the body, prevented sweating.

[328] The bezoar or bedaguar –in French *bedegar*.

[329] This is a contagious skin ailment which is marked by eczematous inflammation and loss of hair. It affects both animals and humans, and is caused by a minute parasitic mite.

[330] Goor 1981, 83.

[331] Goor 1981, 89-91.

[332] Goor (1981, 91-93) claims that in Israel rose water is made from *R. damascena Mill*, the damask, *R. alba*, the white and *R. centifolia*, the cabbage rose, and claims that the earliest method of extracting the oil was by 'milling'. He claims that 1 kg. of oil was extracted from 500 kg. of roses.

[333] These, of course, could have been replaced by linen cloth or better still material made from goat's hair as this does not absorb the oil within its fibres.

needed. This process is thought to have been introduced by the Persians. Pliny on the other hand presented three ways of handling petals. One method is to plunge petals in oil or wine in glass vessels set in the sun,[334] with salt and/or aromatic herbs. Another method was to express the juice by crumbling the petals and collect the juice in receptacles of bronze and heat it on a slow fire until it thickened to the texture of honey. A third method was to lay a thin layer of animal fat and spread the freshly picked petals with the slightest imperceptible contact. The lard quickly absorbed the perfume of the petals and, after a day, the spent petals were swept away and a fresh harvest of petals was arranged. This took place day after day until the full aroma was soaked up. This product was moulded into little pellets or pins for ladies' use. However, in modern Iraq, sesame oil is mixed with rose petals with the same result. The present Arabic way of making rose perfume is to blend sesame oil with fresh rose petals, let the mixture stand for a few months and then drain off the sesame oil.

The commonest edible form of the rose was its jam and this could be sealed with wax. Stacking layers of petals with honey in between and warming the mixture so that rose oil would seep into the honey also made rose honey. After a time span of approximately one week, the petals were sifted out of the emulsion. However, in older times, rose water was included in several sweets, fruits and drinks, and was much more extensively used than at present.

5. Other Plants Of Economic Use Not Identified In Linear B But Important In Bronze Age Societies (Table 18)

Isatis tinctoria: Woad, *ἰσάτις* (Theophrastus, Dioscurides). Barber[335] refers to the Cottes, where it is claimed that woad was identified on some of the bast fibres from Neolithic Adaouste, while the inhabitants of one or more Neolithic sites are believed to have reportedly stored woad seeds,[336] though no details are given. However, woad is native to south-eastern Europe. The evidence of 'blues' which come from Egypt (5th Dynasty) and from Palestine, as well as the blue dyes in Egyptian texts are subject to question, and it is still not certain whether their source is woad or indigo (*Indigofera tintoria*), whose area of origin is India. Even more confusing, though, making analysis even harder, is the fact that more than fifty plants also contain the chemical indican.[337]

The pigment is extracted from the leaves, which are dried, powdered and fermented, a tedious and 'smelly' process,[338] but its positive point is that the colour is very permanent. From Greece to date we have found no archaeobotanical evidence.

Juniperus spp.: Junipers, *κεδραία*,[339] could have been trees whose products (resins) might have had a substance mentioned in the Linear B tablets but which has not been identified to date. *Juniperus oxycedrus subsp. macrocarpa*, *J. oxycedrus subsp. oxycedrus*, and *J. phoenicea sensu lato* are found in several areas of Crete, including the island of Gavdos. *J. oxycedrus* and

[334] It would have been a type of proto-maceration as maceration itself demands that blossoms are seethed in oil at temperatures of 65° C.
[335] Barber 1991, 227, 234.
[336] Barber 1991, 234.
[337] Barber 1991, 234.
[338] Zohary & Hopf 2000, 208-209.
[339] It is the *ἄρκευθος* of Crete.

phoenicea are also widespread in mainland Greece, and they could well have been imported, from both areas, to Egypt.[340] Was Asia Minor or Greece the exporter? Its usefulness is manifold. The wood is used in carpentry but would impart a delicate aroma to grilled food and could also have been used as fumigant. The berries had multiple uses in medicine,[341] as incense and as a condiment. After all, they have been identified in a tripod at Malia.[342] Their resinous flavour is used in foods and the distilled oil (found mainly in the little cones, the so-called in Greek *κεντρόμηλα*) is used today to flavour Dutch genever.

Juniper is also said, in an Egyptian text, to have been used for dyeing.[343] It is mentioned that 'fresh juniper' was used to dye a strip of linen in the cult at the temple of Dendara (Upper Egypt). When mordanted with alum, juniper berries produce a pale creamy-brown dye. In Egypt there is archaeobotanical evidence of *Juniperus spp.*, which is common. *J. drupacea*, first appeared in the Middle Kingdom, *J. oxycedrus*, in Predynastic times and up to the Coptic period, whereas *J. phoenice* is found from the 3rd Dynasty.[344] *J. oxycedrus* is a very good wood, which is not attacked by insects and can be polished and made into very fine objects, used for a multitude of things, such as flasks. It also has very fine oil, which is used for medicinal purposes, both for humans and animals, and can also be used for lighting. *J. macrocarpus* is a more xerophilic plant.[345]

Papaver somniferum: This is believed to be the *μήκων* of Homer and is now the cultivated poppy. The setigerum poppy is the progenitor (*P. somniferum ssp. setigerum*), because this diploid is interfertile with the somniferum cultivars.[346] The distribution of the wild poppy is in the western Mediterranean, all along the coast from Italy to Tunisia. Together with the early archaeobotanical finds from the 4th millennium BC lakeshore settlements in Switzerland, and contemporary sites in Germany, Late Neolithic Lagozza in north Italy, and Final Neolithic (*ca.* 3000 BC) Cueva de los Murciélagos, Spain,[347] these all suggest a western Mediterranean domestication.[348] In Greece, the earliest archaeobotanical find (*P. somniferum*) is dated to the Early Bronze Age, from the sites of Kastanas,[349] and Mandalo,[350] but another find of the same date was found at Thermi,[351] although the author did not mention that it was *P. somniferum*. For the

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[340] There is a relief, though, of the picking of juniper berries in the tomb of Niankhmum and Khnumhotep at Saqqara dating to the Old Kingdom (Manniche 1989, 111).

[341] It is an antiseptic, diuretic, and carminative.

[342] Georgiou (1986, 8) stated that the vessel was an incense burner. It is important to note that the pottery use was assumed from the organic remains alone, where juniper berries were found (species not identified) together with coriander and *Ferulago nodosa*.

[343] Manniche 1989, 112.

[344] de Vartavan & Amoros 1997, 143-146.

[345] Καββάδας, 1138, 1140.

[346] Zohary & Hopf 1993, 128-131.

[347] A fairly comprehensive catalogue of poppy finds is enumerated in Zohary & Hopf 1993. At Cueva de los Murciélagos, many opium capsules and a large quantity of seeds were found (Merlin 1984, 171).

[348] For detailed discussion of poppy finds in the western Mediterranean see van Zeist 1980; Bakels 1982; Merlin 1984, 176.

[349] Kroll 1991, 175.

[350] Βαλαμώτη 2001, 30.

[351] Lamb (1936, 27) published the Thermi find. This if proven correct would refute Merlin's (1984, 180) thesis that opium was only introduced to the eastern Mediterranean in the Late Bronze Age via the trade contacts between East and West and *vice versa*. However, this find needs to be restudied archaeobotanically.

Late Bronze Age the archaeobotanical data (seeds) come from Akrotiri, Thera,[352] Kastanas, Tiryns[353] and Assiros.[354] However, it is said[355] that a Sumerian clay tablet dated to *ca.* 2100 BC mentioned poppy. It is a fact, though, that opium (*ὀπός*,[356] *μήκων ὁ ὀπώδης* of Theophrastus) has not been recognised in Linear B, although it could, very probably, lurk under the unidentified spices/condiments/aromatics.[357] Hoffner[358] noted that in Hittite records, there is mention that pomegranate juice was combined with other ingredients to produce a substance, which congeals. Merlin[359] wonders whether one of the other substances was the sap of the opium poppy. This could produce a medicine, a hallucinogen or an 'alcoholic' drink, which would also have had intoxicating effects. The poppy is, therefore, both a remarkably beneficial crop, as well as a socially dangerous drug.

Although, surprisingly, textual evidence of poppy is lacking,[360] another source is profuse with data –the Mycenaean artistic records. Merlin, Kritikos, Kritikos & Papadaki[361] enumerate the artifacts and artistic records which are profuse with indicative evidence, but surely by now even more evidence would be available. A detailed discussion, however –and up to finds of the early 1960s in this category of data– (statuettes, pins, smoking paraphernalia, seal rings) is conducted by Kritikos & Papadaki for the Prehistoric and the Classical periods. The evidence points to the fact that in the Late Bronze Age the scarring[362] (Fig. 6) of the opium capsule[363] was known (pins with notches dated to LM III)[364] (Fig. 7) and that the sap was heated indicating that the opium

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[352] Sarpaki 1992.

[353] Kroll 1991.

[354] Jones *et al.* 1986.

[355] Merlin 1984, 155.

[356] *Ὀπός* is the latex which is expressed from the capsule, and *μήκων* is pressed from the leaves and the seeds and is less effective than the former.

[357] The interesting discussion, exchanged in the correspondence between Chadwick and Merlin, was provided, by the latter, in his book (Merlin 1984, 197-198).

[358] Hoffner 1974, 120.

[359] Merlin 1984, 201.

[360] No word for either poppy or opium has been identified in Sumerian, Akkadian, or Assyrian (Krikorian 1975, 103). Chadwick & Ventris (*Documents*, 130) claim that the identification by Sundwall as 'poppy-seed' is very improbable, 'especially in view of the large quantities involved'.

[361] Merlin 1984; Kritikos 1960; Κρητικός & Παπαδάκη 1963.

[362] Kritikos (1960, 72; Κρητικός & Παπαδάκη 1963, 141) claims that at first the capsule was scratched perpendicularly (see idol from Gazi, Crete). Also see several Mycenaean pins with notches.

[363] When the petals are fully mature they fall, and the capsule is, then, ready to be scarred while still on the plant. The multiple scarring is done vertically or horizontally (Γεννάδιος 1914, 656) and the sap (milky latex), which is air-dried, is emitted and the opium is collected in this tear-form the next day (Moazzo 1985, 63). This is then scraped by instruments and made into balls. They are left to dry, under the sun, for two-three days until the colour turns a yellow-brown. The person who collects this matter can fall into a deep sleep if he does not use an antidote, which consists of slices of onion on his forehead, as the smell neutralises the soporific action of the latex (Moazzo 1985, 63).

[364] The large terracotta 'goddess' idol from Gazi, Crete is dated to the LM III period, and as the notches are evident on the opium capsules, it is an indication that this method of extracting opium was known at least since that period. An interesting find from Egypt was an LM IB jug (Merrillees & Winter 1972) which had blackish-brown stains in the lower body and this material was submitted to Dr J. Winter for analysis (Merrillees & Winter 1972, Appendix, 128-130). He concluded that it was an aqueous material (beer or wine, rather than an oil) with the presence of small plant fragments. One hypothesis was that some species of plant seed, with a high lipid content (saturated fatty acids), such as grape seed, linseed, poppy seed and

was taken by inhalation of the vapours.[365] Before it was ready to be smoked, the opium, after collection, had to be submitted to a series of transformations. The material (opium) is made into *πλακούντες*, which are put in wooden boxes.[366] If these are kept in poppy petals, they develop a very special aroma. These baked 'cakes' are the 'brut' opium. In order to be prepared for smoking, it is submitted to a series of operations in special craft centres, some of which were well known in modern times, such as in Saigon and Batavia. These 'cakes' are sliced, put in water and left to macerate in bronze vessels and then heated until the substance acquires a syrupy consistency. This matter is made to concentrate until it turns into a brown molasse, the so-called *tshandou* or opium for smoking. However, before being traded it is submitted to beating so that it mixes with oxygen and it is also mixed with a moss, *Aspergillus niger*.[367]

Two types of 'pipes' for smoking are possible, (a) open 'pipes' (without bottoms) and (b) closed 'pipes' (these always have holes in the lower lateral section).[368]

The poppy[369] is a very useful, annual plant, which is extremely productive and grows in most climates and marginal lands. It can even be grown in areas where animals graze and does not need to be protected, as the animals do not graze upon it.[370] Several parts of it are also useful. Opium[371] is the sap of the poppy capsules. The leaves are also planted as a potherb or used as fodder. Its seeds can be pressed to produce comestible oil[372] or ground to make poppy flour and

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sesame could be considered a candidate. Olive oil and palm oil cannot be ruled out, but would be present more as the expressed oil rather than as ground plant material. However, it is likely that the material was Egyptian and (re)-using a Minoan pot, rather than Cretan material (Merrillees & Winter 1972, 107). It is an agreed fact that the Late Minoan pottery imports in Egypt are remarkably poor. The perishable ingredients, which would have been in demand in Egypt were saffron, a 'bean from Keftiu land' (imported perhaps from the Aegean) (Merrillees & Winter 1972, 110), *Lathyrus clymenum*, might have been an import from the Aegean to Tel Nami, Levant (Kislev *et al.* 1993, 151) (*Papyrus Ebers*, dated to the early 18th Dynasty). Other products could have been an aromatic lichen (*Parmelia furfuracea*), which did not grow in Pharaonic Egypt, and purple dye. Another exported legume/bean could have been the lupin, *Lupinus albus spp. graecus*, which is the progenitor of the domesticated *L. albus* and is native to the Aegean (Zohary & Hopf 2000, 122-123), although strangely enough, legumes are not mentioned in Linear B (*inter alia* Erard-Cerceau 1988). It would be important to examine all Minoan and Mycenaean pottery found in Egypt for their contents, as preservation would allow organic remains to be preserved.

[365] Evans (1964, IV, 145ff.) interpreted the tubular vessels (without bottoms) as water pipes whereas Kritikos & Papadaki (Κρητικός & Παπαδάκη 1963, 143) refer to them as 'pipes'. They explain the way the opium was smoked and show the utensils. Karageorghis (1976, 126) found a 'pipe' at Kition, Cyprus (*ca.* 1200 BC), which is believed to have been used for smoking opium.

[366] Their weight was *ca.* 70-80 kg. (*Μεγάλη Ελληνική Εγκυκλοπαίδεια, s.v. πλακούς*). It averaged 40-60% of good quality opium, 30-40% of medium quality and 3-10% of very average quality.

[367] Moazzo 1985, 63.

[368] See Κρητικός & Παπαδάκη 1963, 7; Merlin 1984, 243-244 for ways of inhaling vapours.

[369] The is the *P. somniferum L.*, the so-called 'black poppy' but there is also a white variety *var. album D.C.* These are named after the colour of their seeds and this distinction was recognised in Ptolemaic Egypt where reference is made to *μήκων μέλαινα* (the black poppy) and *μήκων λευκή* (the white poppy) (Crawford 1973, 232); here the black variety is more common, but the white is richer in morphine opium (Καββάδας, 3022).

[370] Καββάδας, 3022.

[371] Opium is the air-dried milky latex, which exudes from the incisions in the seedpod of the living plant, and meconium is obtained by infusing the whole of the cut plant. Opium seems to have been the most common substance, though both are referred to in the medical papyri (Crawford 1973, 231).

[372] Knapp 1991, 26 where he refers that cold-pressed oil is white, whereas it is reddish when hot-pressed.

sprinkled over dough for flavour. Even what is left after the pressing, makes excellent cattle cake.[373] Interestingly, 45%[374] of the weight of the seed is oil,[375] and this can be used for cooking and in lamps. It is said to burn for much longer than olive oil.[376] Ground, it is made into porridge or cake filling, as is still done in some countries such as Austria and Germany. Even the dried stalks form straw may also be used for fuel.

Large-scale cultivation requires intensive care in weeding, and was done by young boys in Egypt,[377] and thinning the young plants but the yield is good and it is a profitable crop in many parts of the world. The seeds can be sown in November but sowing has been reported also in February.[378] One needs *ca.* 0.340 kg. of seed to plant 1,000 square metres[379] (1 stremma) and the yields are in the order of 0.8-1.4 kg. of opium per stremma and 45 kg. of seed.[380] The harvest was in May-June[381] and when the capsules were beginning to turn yellow, these were harvested and left to dry in the hot sun for two-three days until they were completely dry. Then the capsule was beaten in order to collect the seed. If these were collected, in order to be used for oil, they were sifted, cleaned and, in Egypt, stored in the granary. In some places, after the harvest of the capsules, the stalks were collected and tied in bunches to be used as fuel.[382] Strangely enough, there is no mention of opium collection[383] but we must not disregard the fact that it was a crop primarily cultivated for oil.[384]

Rhus ssp.: One of the species is *Rhus cotinus*, *κοκκυγέα* (Theophrastus), and its wood is used in dye; the leaves contain tannins, whereas its sap is poisonous. The other species, sumach, *Rhus coriaria*, *ῥοῦς* (Dioscourides),[385] is used as a dye (black, brown and yellow) and the colour depends on which part of the plant is used, such as the leaves, the fruit, the root or the young plant. It is also used for mordanting leather, and for medicinal purposes.

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[373] Crawford 1973, 230.

[374] Cf. Crawford 1973, 230.

[375] Some 30% of clean white oil on a first cold pressing could be produced, which can be increased up to 50-60% on subsequent heated pressings.

[376] Merlin 1984, 91.

[377] All information on the poppy from Egypt comes from the 3rd century Zenon papyri and is preserved from the North Fayum area. It is questionable whether opium existed before that time in Egypt but Merrillees & Winter (1972, 127) argue that honey, in which opium would had been dissolved, may have been carried in base-ring juglets from Cyprus to Egypt, during the 18th Dynasty.

[378] This refers to Egypt, whereas, for Greece, Gennadios (Γεννάδιος 1914, 657) notes that the crop is planted after the first rains of autumn and not later.

[379] Gennadios (Γεννάδιος 1914, 657) notes that *ca.* 600 gr. of seed are needed for 1 stremma.

[380] From the Zenon archive, it is clear that poppy seed is recorded, measured in baskets, containers or *choinikes* (Crawford 1973, 234), just like the saffron crocus. However Gennadios (Γεννάδιος 1914, 657) claims that 1 stremma can produce as much as 250 kg. of seed, and the price is ½ drachma per 1.280 kg. Crawford 1973, 230.

[381] Or July-August, depending on the latitude.

[382] Γεννάδιος 1914, 657.

[383] Crawford 1973, 233.

[384] The contents of an LM IB jug (the Abbott vase) found in Lower Egypt were analysed (Merrillees & Winter 1972, 130) and it was suggested that an oil-rich plant seed was the source, one of the proposed plants being the poppy seed.

[385] In Akkadian *şipru* is a cognate of the Arabic *şafara*, 'be yellow'. Note how close it is to the term *safran*. Sumac was found in the Ulu Burun wreck (Bass 1997, 164) and is believed to have dyed the wax on which they wrote in the diptych, found in the wreck.

Styrax officinalis: storax, *στύραξ*, is a tree that emits a resin, the storax,[386] when incisions are made in the branches, and it is widely used in medicine, as incense and in perfumery. Its pounded fruit is also a narcotic and used for catching fish.[387] Today, it is used in the Roman Catholic Church for incense.[388] This tree is probably the Biblical stacte and the sweet storax.

This product circulated in three forms up to the beginning of the 19th century, that is (a) in solid tear-form, (b) in semi-solid form in a piece of cane, when it was called *στύραξ καλαμίτης* or (c) in small pieces (plain storax) in which form it was still found at the beginning of the 20th century.[389] In Cyprus, in the area of Karpasia, storax is still found in form (b).

EPILOGUE

We have tried to tie together textual, archaeobotanical and ethnobotanical information. Of course the textual and archaeobotanical information needs to be enriched, on the one hand, with more tablets, which might throw light on certain terms and uses, especially for the ideograms, which cannot be translated. On the other hand, more soil samples need to be examined for environmental data, and in our case, for enriching our present knowledge of plant use, preparation, and plant circulation. More ethnobotanical knowledge needs to be gathered, specifically to answer archaeological/archaeobotanical problems. This needs to be conducted as soon as possible, due to the massive loss of information, day by day.

As for plants in Linear B, we either accepted previous identifications, or else, if there were more than one, we set out our suggestions and excluded the ones which could be rejected due to botanical information. We have ventured four new suggestions for interpreting plants/plant material. One is the term *sa-sa-ma*, which has so far been translated as sesame. Yet, we might have to redirect linguistic research to this term and see all the new linguistic suggestions for the Hittite word *sa-ma-ma*. More recent research does not agree that it refers to sesame but applies it rather to oil. Which oil though? It is definitely not the oils which are referred to in Linear B, and as existing in the Mycenaean period, i.e. olive and, possibly, safflower oil (see *ka-na-ko* for discussions). The actual absence of sesame archaeobotanical finds in Greek archaeology, if not accidental, needs to be accepted as a *sine qua non*. This means that until we find it we should consider that sesame did not exist in the Mycenaean world but its presence in oil form cannot be excluded. However, if the term refers to 'oil', this does not deny the possibility of the word referring to sesame oil, but not excluding poppy oil and other oils such as *Juniperus spp.* as well.

The other term, which has been disputed, is *ki-ta-no* (see term) which, it is suggested here, belongs to the rockrose, and particularly, to its product, ladanum. So far, it has been identified with turpentine (*P. terebinthus L.*) but we suggest that *ko-no* is the term that refers more probably to the *Pistacia spp.* of plants. The third suggestion is for *sa-pi-de* (see under *sa-pi-de* in Table 3), which might refer to wooden boxes/cabinets filled with opium. Another term, which has been greatly studied, is *po-ni-ki-jo*, with a plethora of suggestions, some of which are more

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[386] This should not be confused with the liquid styrax (balsam) which is produced from *Liquidambar orientalis*. This tree is found in Asia Minor and some Aegean islands (e.g. Rhodes) and the liquid resin is produced by boiling and pressing the bark (Baum 1994, 39). However, the term 'olibanum' is used for many genera and species of plants, such as *L. orientalis*, and frankincense (*Boswellias*, *Commiphoras*).

[387] Γεννάδιος 1914, 924.

[388] Polunin & Huxley 1972, 143-144.

[389] Γεννάδιος 1914, 924.

plausible than others. They have been discussed in the relevant section. However, new suggestions have been proposed here, which is silk thread, dyed red with purple dye or *Murex* opercula powder.

Some interesting points emerge from this study, especially as all condiments, aromatics and dye plants were viewed as a whole, from all sites providing us with a Linear B archive. Our aim was to 'touch upon' social and economic information. We were able, we believe, to perceive some specialisation in the centres of Pylos and Mycenae, on the one hand, and Knossos, on the other. The first two have a certain emphasis on condiments and aromatics which are imported from areas further afield than the Aegean (henna, cardamom, cinnamon?, sesamum?), implying that we are dealing most probably with a 'consumption' site which has an 'urbanised' population, eager to consume such exotic goods. This urbanisation is stressed even more with the recording of common (for the Aegean) plants such as celery and mint, emphasizing even further the 'urban nature' of Mycenae, where either there was not enough space even to grow garden plants, or the occupation of the inhabitants in other industrial pursuits did not permit their involvement in farming activities.

Knossos, at the other end of the scale, seems more of a 'production' centre, where aromatic plants, resinous plants and dye plants are of special interest to its centre of control. Plainly put, it is as if Knossos exported, while Mycenae and Pylos imported. The implications of this statement for the Mycenaean world, if verified by archaeological research, are enormous. Does this mean that even imports found at Knossos, on the whole, were first deposited at the other centres before reaching the Cretan metropolis? This would give an insight into the possible different organisation of secular and religious power inter-regionally and intra-regionally. Unfortunately, here we were only able to raise questions to which research in the forthcoming years might, we hope, provide answers.

Another area of interest is the dyes that the centres control, i.e. safflower (red-orange depending on the mordant used), henna (dark orange-red) (Mycenae), Alkanna tinctoria (red)/*Murex* dye[390] and/or opercula, and saffran (yellow) (Knossos). In other words, these two colours, red and yellow, seem to have a special symbolic *semeiosis*, probably of power, and most probably are also connected to religion.[391] A stimulating article by Edens[392] was written about the 'symbolic capital' of power, the legitimation found in colour, which was implemented in Kassite,[393] Babylonia, and which, I believe, is of immediate relevance to our case. There the king 'expressed divine approval for his rule by displays of colour, and in the hands of others, the political power of colour appealed to the symbolic figure of the king'.[394] He claims, therefore, that 'colour operated as a hierarchical structure of reference, the pivotal element of which was the just king'. The king symbolised all that was ordered and just and divinely approved. Hence, we assume that red must have symbolised social order, just as in Mesopotamia. Perhaps, the red colour on the plaster of the throne room at Knossos was a display of such order and sovereignty. On the other hand, yellow is connected to divinity, so it might have been reserved for those who

[390] The fact that *po-ni-ki-jo* is an exclusively Knossian product, if our proposal is correct, fits well within the framework of Knossos being an important industrial centre for textiles and dye.

[391] We cannot doubt the power of colour in either secular or religious functions. It is a well-known fact that Roman emperors wore purple-red cloaks and that the blue, indigo blue, worn by the Virgin Mary is an explicit expression of the power of colour in religious symbolism.

[392] Edens 1994.

[393] Kassites refer chronologically to the Late Bronze Age.

[394] Edens 1994, 219.

came into contact with the divine. We should remember that the saffron collector at Xeste 3, Akrotiri, Thera, namely the one emptying the basket full of crocuses in front of the blue monkey was wearing a saffron-yellow coloured top. The same holds true for the so-called priestess drawn on the east doorjamb of the door leading from room 4 to room 5 of the West House, Akrotiri, Thera. Again, divinity or proximity to divinity is marked by yellow, perhaps symbolising the power and the light of the sun, the source of life (light, warmth), of stability, and of eternity.

Table 2. Plant products from the Linear B archives[1] which are weighed, measured by volume, and/or counted.[2]

PLANTS	COMMON NAME AND GREEK NAME	MYCENAEAN NAME/SIGN	ARCHIVE
Carthamus tinctorius L.	Safflower/κνήκος	ka-na-ko e-ru-ta-ra: red, re-u-ka: white[3]	MY (6 tablets)
Foeniculum vulgare Miller	Fennel/μάραθο[4]	ma-ra-tu-wo, MA	MY (5 tablets), KN (3 tablets)
Coriandrum sativum L.	Coriander/κορίανδρος	ko-ri-ja-do-no, ko-ri-ja-da-na, ko-ri-a_2-da-na, KO, AROM+KO	MY (5 tablets), PY (3 tablets), KN (29 tablets)[5]
Mentha spp.	Mint/μίνθος	mi-ta, MI[6]	MY (4 tablets)
Sesamum indicum (?)	Sesame/σουσάμι	sa-sa-ma, SA/*31	MY (5 tablets)
Pistacia lentiscus/ Cymbopogon cf. schoenanthus	Terebinth/ginger grass/ σχίνος (?)	ko-no,[7] ko-i-no, e-ne-me-na (abbrev. to E)[8]	MY (4 tablets) KN (1 tablet)
Salvia spp. cinnamomum (?) cf. cassia	Sage (?) cinnamon/ κανέλλα, rush (?)	KAPO[9]/*127	PY (4 tablets), KN (1 tablet)

[1] The plants mentioned are those which demonstrate that they are not treated as agricultural products *per se* (e.g. grain) but have a 'higher' transactional status.

[2] All the tablets from Tiryns, Thebes and Mycenae have been checked in *TITHEMY*. Knossos have been checked in *CoMIK*, Pylos in *PTT*.

[3] Discussion about *ka-na-ko* and *po-ni-ki-jo* as referring to the same plant is conducted by Murray & Warren 1976, 54-55, and they conclude that this is not possible. They explain the reasons thoroughly.

[4] *MA* (Lejeune 1971, 163).

[5] Cf. Palmer 1999, 484 mentions only 12 citings.

[6] *Documents*, 105.

[7] *ko-no* is a controversial term whose translation has not been decided yet. On the one hand, it is recognised as *σχῖνος* (look at Olivier 1969, 51ff. for two species of *σχῖνος* –not to mistake with *σχοῖνος*– and Wylock 1972 recognises it as *Acorus calamus L.*) and, on the other, it is thought to be a *χόννος = δοχείο* (Maddoli 1967); cf. *ko-i-no* (**MY Ge 606 +** *fr.*). Palmer (1999, 485) prefers the *Acorus calamus L.* identification, and mentions terms *DE*, and *e-ne-me-na E*. However, it is important to say that *A. calamus L.* does not seem to be present in Greece, for it is not mentioned in *Flora Europaea* and other floras for Greece. Only Sibthorp referred to its existence (Καββάδας, 183) and its presence is therefore disputed, whereas Gennadios (Γεννάδιος 1914, 36) believes it had been mentioned by Dioscurides as 'acorus wine', which was wine scented by *Acorus sp.*

[8] *Documents*, 226, 545.

[9] **127* = cinnamon (Sacconi 1972); see term *KAPO* under plants for discussion.

Table 2. (Continued).

PLANTS	COMMON NAME AND GREEK NAME	MYCENAEAN NAME/SIGN	ARCHIVE
Cyperus[10] spp. (cf. C. rotundus, C. esculenta and C. longus L.)	Chufa/tiger nut grass, galingale/κύπειρος	CYP+O, CYP+PA (?), PYC+QA, CYP+KU, AROM+PYC, ku-pa-ro, ku-pa-ro$_2$, ku-pa-ro-we, PYC+O; CYP+O	MY (2 tablets), PY (7 tablets), TH (1 tablet), KN (23 tablets)
Cuminum cyminum L.	Cumin/κύμινο	ku-mi-no, KU[11]	MY (6 tablets)[12]
Alkanna tinctoria/ Anchusa tinctoria	Alkannet/φοινίκιο, βαφόρριζα	po-ni-ki-jo	KN (25 tablets)[13]
Cistus creticus L.	Rock-rose/κρίτανος	ki-ta-no/*123[14]	KN (2 tablets)
Crosus spp. (C. cartwrightianus & C. sativus)	Saffron/κρόκος[15]	CROC/*144, *33, ko-ro-ki-no	KN (43 tablets)
Salvia spp.	Sage species	pa-ko-we, PA/OLE+PA	PY (19 tablets)
Rosa spp.	Rose	wo-do-we	PY (6 tablets)

[10] In Assyrian cyperus is mentioned as *suadu*, so *ku-pa-ro* might be a pre-Hellenic name. Palmer (1999, 485) separates the edible cyperus (*C. esculentus L.*) as referred to by *CYP+O*/*PYC+O*, *CYP+PA* (?).

[11] *KU*, I believe, refers more to *ku-mi-no* because it is more with the condiments, which one expects to find *ku-mi-no* with (i.e. *ma-ra-tu-wo*, *sa-sa-ma*, *re-u-ka*, etc.). The quantities, as well, are within the range expected for *ku-mi-no*.

[12] Palmer (1999) refers to 5 citings.

[13] Palmer (1999) refers to 20 citings.

[14] **123* = condiment; Lejeune 1971, 161 (Table: 160) and also p. 162: '*coriandre et d'autres épices!*'; see Sacconi (1971, 27, 29) who identifies it as a spice, namely *ki-ta-no*.

[15] **33* = safran (Lejeune 1971, 155, note 50).

Table 3. Quantities of condiments, perfume and dye plants of the Mycenaean period, which are debated and/or unknown as to their identification in the Linear B tablets.

PLANT	COMMON NAME	MYCENAEAN NAME/SIGN	TYPE OF TRANSACTION (C), (M), (W)[1]	TABLET	MYCENAEAN QUANTITIES
Rosa spp.[2]	rose	wo-do-we[3]	(MI)	PY Fr 1203[4]	S 1 V 2
		wo-do-we	(MI)	PY Fr 1204	Z 1
		wo-do-we	(MI)	PY Fr 1207	V 1[
		wo-]do-we	(MI)	PY Fr 1208[5]	S 2 V 4
		]wo-do-we-qe	(MI)	PY Fr 1223	S 2
		wo-do-we	(MI)	PY Fr 1238	S 1
Lawsonia inermis L.[6]	henna	e-ti-we[7]	-----[8]	PY Fr 343	-----
		e-ti-we	(M)	PY Fr 1209 [+] 1211	V[
		e-ti-we	(M)	PY Fr 1224	Z 2
Several plants[9]	myrrh	MU[10]	(C)	KN Og(1) 8038	units 46
Cardamomum ssp.	κάρδαμο	ka-da-mi-ja	-----	MY Ge 604	-----
Apium graveolens	celery	se-ri-no	(W)	MY Ge 604	M 2

[1] (C) = count; (M) = measure –as in volume for dry or liquid measure, a capacity measure; (W) = weight as in balance (*σταθμά*); measured by weight; (BA) = basket, (Cu) = cup; (BUN) = (?) bundle/*δεμάτι* (*E* in *ko-no*); (BU) = bunch/*δέσμη* (Mycenaean *PE*); *μονάδα αγαθού* = primary unit, whereas it is mentioned as 'whole numbers' by Chadwick & Ventris (*Documents*, 55).

[2] Among the roses, which could have existed, are *R. gallica*, *R. sancta* (Hurst 1967, 63), *R. canina* (Baumann 1993), also, perhaps, *R. centifolia* (Warren 1970, 373). Probably rose-oil, or any other volatile oil produced from plants could have been extracted in a simple *bain marie*, if a metal container was used or else even pottery could have been employed (see Kanta 1999).

[3] It is interesting to note that *wo-do-we* is always mentioned together with *OLE* (olive).

[4] It is preceded by *PO* 1, which is ligatured with oil (*Documents*, 572). For this commodity we can be sure that it was quantified in liquid measure (see Hooker 1994, 86), and, of course, the (*S*) measure qualifies liquids.

[5] *PO* 3 precedes it.

[6] If identification is correct (Duhoux 1993, 103), it would have been an imported plant (see *e-ti-we*); see also ideogram **23*.

[7] Shelmerdine (1985, 136) refers to **ertis* as henna (?), where she presents some interesting references for the reasons she equates ertis with henna; also see Duhoux (1993, 103).

[8] When the type of transaction for the particular commodity is unreadable, and/or destroyed, the equivalent Mycenaean quantities are left blank and the dotted line denote this. Asterisks mean that we do not know the quantity of the primary unit. This convention is going to be used in all tables.

[9] It could refer to Frankincense and myrrh, which are gum resins. Frankincense comes from trees of the genus *Boswellia* (such as *B. sacra*, *B. carteri*, *B. papyrifera* etc.) (Groom 1981, 232) and myrrh comes from different species of *Commiphora*. In Rome myrrh, which was used as a base for perfumes and unguents, was two-three times more expensive than frankincense (an incense) (Groom 1981, 154).

[10] Dots under *MU*. *MU* could stand for *murru* (Assyrian for myrrh) (Shelmerdine 1985, 23).

Table 3. (Continued).

PLANT	COMMON NAME	MYCENAEAN NAME/SIGN	TYPE OF TRANSACTION (C), (M), (W)	TABLET	MYCENAEAN QUANTITIES
Unknown plant/ plant-material		sa-pi-de[11]	(C)	MY Ge 602	units 6[13]
		sa-pi-de	(C)	MY Ge 602	units 6
		sa[-pi-de	-----	MY Ge 605 + 607 +[12]	-----
		]sa-pi-de	(C)	MY Ge 605 + 607 +	units 12
		sa-pi-de[	-----	PY Vn 19	-----
		sa-pi-de[	-----	PY Vn 19	-----
		sa-pi-de	(C)	PY Vn 19	200[
		sa-pi-de	(C)	PY Vn 19	80[
		sa-pi-]de	(C)	PY Vn 19	60
		]sa-pi-de	(C)	PY Vn 19	40
		sa-pi[-de	-----	PY Vn 19	-----
		]sa[-pi-de	-----	PY Vn 19	-----
		*132[14]	(MI)	PY Un 2	S 2
		*154[15]	(C)	PY Un 592	21 units
		*154	(C)	PY On 300[16]	≥ 46 units
		*154[	----	PY On 375	-----
		*154/ra-ka	(C)	PY Un 592[17]	units 21
		da-ra[ ]	----	MY Ge 603 + frr.	-----

[11] It is believed, by some (*inter alia* Killen 1964, 172; Sacconi 1971, 31) to be a condiment, or an aromatic, as it is mentioned together with them, namely with coriander, cumin, safflower, fennel, mint and sesame. The interpretation of it as being a box (*σαρπίδες*) (Hooker 1994, 269; Killen 1964, 172) is not very satisfactory, and it could rather be a commodity, which is counted in 'containers' (*Documents*, 227, 581) [cf. 'mastic' which is calculated in 'staters' (*στατῆρες*)]. However, opium is kept in wooden boxes in set weights (see section below on *Papaver somniferum*).

[12] When a tablet ends in (+) it refers to other fragments not mentioned here.

[13] For all of the *sa-pi-de* I have made no calculations regarding the quantities they represent.

[14] This is thought to be a plant and/or plant produce –transacted in liquid measure– as it is mentioned together with processed products such as flour, honey, wine, dried (?) fig and cyperus, in tablet **PY Un 2**. Of course products such as molasses from the grape and the carob have not been suggested with the exception of Scafa (1995) but the author believes it is a possibility worth examining. Recently, the carob has been detected in pollen just after Minoan times (Bottema & Sarpaki in press), and wood has been found from Late Bronze Age Mochlos (Schoch in press) and Kommos (Shay *et al.* 1995).

[15] Palmer (1999, 485) refers to it as pennyroyal (see *Documents*, 226 and also Warren 1970 who refer to *ka-ra-ko* as pennyroyal).

[16] **PY On 300.**2 (10 units and 6 units); **300.**3 (5 units and 3 units); **300.**4 (**154*[and 3 units); **300.**5 (**154*] and 3 (?) units); **300.**6 (3 units); **300.**9 (just **154*); **300.**10 (2[units and 3 units); **300.**11 (units [ ]2 and units 3); **300.**12 (2 (?) 3 units).

[17] Lejeune (1971, 160) mentions for **PY Un 592** [20 units?][*ra-ka*]. In *Documents*, 578 *ra-ka* is said to probably be **154*.

Table 3. (Continued).

PLANT	COMMON NAME	MYCENAEAN NAME/SIGN	TYPE OF TRANSACTION (C), (M), (W)	TABLET	MYCENAEAN QUANTITIES
		*171	(C)	PY Aq 64	30 units[23]
		*171[18]	(C)	PY Un 1414	4 units
		*171	(C)	KN Ga(1) 519	2 units
		*171[19]	(C)	KN Ga(3) 464	4 [units
		*171[20]	(C)	KN Ga(3) 464	4 units
		*171	(C)	MY Ge 606 + fr.	11 units
		*171[21]	----	MY Ge 608a + frr. +	-----
		*171	(C)	TH Wu 46	30 units
		*171	(C)	TH Wu 56	30 units
		*171[22]	(C)	TH Wu 59	36 units
		*171	(C)	TH Wu 76	30 units
Iris ssp. (cf. illyrica)	Iris	wi-ri-za[24]	----	PY Un 249	-----
		]wi-ri-za	(C)	KN Od 2026[26]	-----
		wi-ri-za	(C)	KN Od 8202 + fr.	-----
		wi-ri-[	(C)	KN X 44[27]	-----
	?iris	*157[25]	(C)	PY Un 267	units 16[28]
		*157	(C)	PY An 616	units 28
		*157	(C)	PY Un 249	units 10

[18] Palmer (1999, 467) also mentions it as an aromatic and on p. 470 states that 'this commodity is connected to cyperus by context' and perhaps indicates the cyperus stem, as it had already been claimed by Melena (1974c). The interpretation has been accepted by Palaima (1989).

[19] It is mentioned together with cyperus.

[20] The same also mentioned together with cyperus!

[21] It is also mentioned with cyperus but with a group of other aromatics such as coriander, fennel, sesame, safflower, mint, and an unknown aromatic. **171* has also been mentioned first by Melena (1974a) to have been a fodder plant and has been pursued by Palaima (1989, 112), but Palmer (1999, 474-475) rightly believes that it is most unlikely. One would not expect a transaction of fodder to have been annotated in the records.

[22] On another tablet (**TH Wu 71**), cyperus is mentioned too! This could not, just, be a coincidence, I believe.

[23] **PY Aq 64.**2 (3 units); **64.**5 (6 units); **64.**6 (3 units); **64.**7 (12 units); **64.**13 (6 units).

[24] *wi-ri-za* = iris root *–Iris illyrica–* (Cardon & du Chatenet 1990). *Iris pseudacorus* = dye. The ideogram **157* consists of an infinity sign surmounted by *WI* (Shelmerdine 1985, 18: *wi-ri-za* = substance measured in units rather than by weight or volume; see also Foster 1974, 117-118). Melena (1983, 115) refers to it as an unknown substance and Lejeune (1971, 161) states that *WI* is understood in the ideogram **157* and, perhaps, refers to *wi*(*riza*). Other plants have useful roots such as *Rubia tinctoria* (in modern Greek *ριζάρι*), which could be, yet, another possibility. As it is mentioned together with *LANA*, I would favour the identification of *R. tinctoria*, which is used to dye wool and not *Iris* which would have been a very costly oil reserved only for perfumes. On the other hand, it has been claimed by Palmer (1963) that the ideogram **145b* is the root of the iris but it has been much disputed by Chadwick & Baumbach (1963) that it could refer to the root of the wool, which is rich in natural grease and lanolin and appropriate for unguents. See also Beck & Beck 1978.

[25] See *wi-ri-za* (note above). Dots under **157* and under 16.

[26] Mentioned together with wool.

[27] It most probably refers to *wi-ri-*[(*KT*[5]).

[28] Dots under **157* and under 16.

Table 4. Quantities of plant material (**123*) which has not been identified, but which is believed to be an aromatic/spice.

LINEAR B	TYPE OF TRANSACTION (C), (M), (W)[1]	TABLET	MYCENAEAN QUANTITIES	MODERN EQUIVALENCES
*123 AROM[2]	(M)	KN Ga(1) 680	AROM 1 + T[	> 105.6 lt.
	(M)	KN Ga(1) 680	AROM 10[	960[lt.
	(M)	KN Ga(1) 680	AROM[	> 96 lt.
	(M)	KN Ga(5) 1536 + 5776	AROM 34[	3,264 lt.
	(M)	KN Ga(1) 677 + 7769	AROM 5	480 lt.
	(M)	KN Ga(2) 422	AROM 1	96 lt.
	(M)	KN Ga(2) 416	AROM 9 + T 2	883.2 lt.
	(M)	KN Ga(2) 419 + 5806[3]	AROM 1	96 lt.
	(M)	KN Ga(2) 423 + 7366[4]	AROM 2	192 lt.
	(M)	KN Ga(1) 675	AROM 10[6]	960 lt.
	(M)	KN Ga(5) 1530 + 1531	AROM 58	5,568 lt.
	(M)	KN Ga(5) 1530 + 1531	AROM 31	2,976 lt.
	(M)	KN Ga(5) 1532	AROM 35	3,360 lt.
	(M)	KN Ga(5) 1533	AROM 12	1,152 lt.
	(M)	KN Ga(5) 1534	AROM 5[7]	480 lt.
	(M)	KN Ga(5) 5780	AROM 30	2,880 lt.
	(M)	KN Ga(5) 5020	AROM 4	384 lt.
	(M)	KN Ga(1) 7365	AROM 20	1,920 lt.
	(M)	PY An 616[5]	AROM 21	2,016 lt.
TOTAL				27,868.8 lt.

[1] See Table 3, note 1.

[2] See Table 15. It has also been identified as a unit of measure by Chadwick, E. Bennett and Geiss (see Sacconi 1971, 21 and note 10), who do often identify **123* with *ki-ta-no*, and *ko-ri-ja-do-no* and more rarely with *ku-pa-ro* (see note under Table 1). As mentioned in this paper, I would prefer to identify it with *ki-ta-no*. It is interesting to note that this substance is a solid and, therefore, calculated in dry measure.

[3] Coriander is also mentioned in this tablet.

[4] *po-ni-ki-jo* is mentioned in the same tablet.

[5] It is mentioned together with the name of a liquid (*me-po*) (*Documents*, 560), cinnamon (?) (*KAPO*), and coriander.

[6] It is [[*KO*]] *pe-ma AROM* 10, so could this be coriander, seed *AROM* 10?

[7] Dot under 5.

Table 5. Quantities of condiments, perfume and dye plants of the Mycenaean period, as seen in the Linear B tablets: *Carthamus tinctorius.*

LINEAR B ka-na-ko (e-ru-ta-ra) (re-u-ka) *128[1]	TYPE OF TRANSACTION (C), (M), (W)[2]	TABLET	MYCENAEAN QUANTITIES	MODERN EQUIVALENCES[3]
e-ru-ta-ra[	-----	MY Ge 602	-----	-----
e-ru-ta-ra	-----	MY Ge 602	-----	-----
ka-na-ko[	-----	MY Ge 602	-----	-----
e-ru-ta-ra	-----	MY Ge 602	-----	-----
ka-na-ko	(W)	MY Ge 602	M[	1[kg.
ka-na-ko	(W)(M)	MY Ge 603 + frr.	M 2 + cup 1[5]	2 kg. + ?
ka-na-ko	(W)(M)	MY Ge 603 + frr.	M 1 + cup 1	1 kg. + ?
e-ru-ta-ra	(W)	MY Ge 603 + frr.	M 1	1 kg.
e-ru-ta-ra	(W)	MY Ge 603 + frr.	M 1	1 kg.
re-u-ka[4]	(M)	MY Ge 603 + frr.	V 1	1.6 lt.
e-ru-ta-ra	(W)	MY Ge 604	M 1	1 kg.
ka-na-ko	(W)	MY Ge 604	M 1	1 kg.
e-ru-ta-ra[	-----	MY Ge 604	-----	-----
e-ru-ta-ra	(W)	MY Ge 604	M 3	3 kg.
ka-na-ko	(W)	MY Ge 605 + 607+	M 2	2 kg.
e-ru-ta-ra	(W)	MY Ge 605 + 607+	M 3	3 kg.
re-u-ka	(M)	MY Ge 605 + 607+	V 1	1.6 lt.
e-ru-ta-ra	-----	MY Ge 605 + 607+	-----	-----
re-u-ka	(M)	MY Ge 605 + 607+	Z 2	0.8 lt.
e-ru-ta-ra	(W)	MY Ge 605 + 607+	M 2 + P 1	2 kg. + 20 gr.
re-u[-ka	-----	MY Ge 605 + 607+	-----	-----
re-u-ka	-----	MY Ge 605 + 607+	-----	-----
e-ru-ta-ra	(W)	MY Ge 606 + fr.	M 3	3 kg.
re-u-ka	(M)	MY Ge 606 + fr.	V 1	1.6 lt.
KANAKO	(W)	MY Ge 608a + frr.+	M 3	3 kg.
TOTAL:				
e-ru-ta-ra	(W)			24.2 kg.
re-u-ka	(M)			5.6 lt.

[1] Most probably referred to red florets, whereas white refers to the seeds of the same plants (*Documents*, 58).
[2] See Table 3, note 1.
[3] The weights are approximate as we do not know the exact equivalences: i.e. *L* = talent = ±30 kg., *M* = double mina = ±1 kg., *N* = ±250 gr., *P* = ±20.8 gr., *Q* = 3.4 or less. Chadwick (*Documents*, 57, 394) notes that the unit for dry measure is 96 lt. (instead of 120 lt. which was used before) and *T* = 9.6 lt.; *V* = 1.6 lt., *Z* = 0.4 lt.
[4] Where there is no distinction, is it the red type, which is mentioned?
[5] Ideogram **155*^{VAS}. See Fig. 8.

Table 6. Quantities of condiments, perfume and dye plants of the Mycenaean period, as seen in the Linear B tablets: *Foeniculum vulgare*.[1]

LINEAR B	TYPE OF TRANSACTION (C), (M), (W)[2]	TABLET	MYCENAEAN QUANTITIES	MODERN EQUIVALENCES
ma-ra-]tu-wo	(M)	MY Ge 602	V 1	1.6 lt.
ma-ra-tu-wo	(M)	MY Ge 602	Z 1[ ]	0.4[ ] lt.
ma-ra-tu-wo	(M)	MY Ge 602	V 1	1.6 lt.
MA[3]	(M)	MY Ge 603 + frr.	V 1	1.6 lt.
MA	(M)	MY Ge 603 + frr.	V 1	1.6 lt.
MA	(M)	MY Ge 603 + frr.	V 1[ ]	1.6[ ] lt.
MA	(M)	MY Ge 603 + frr.	Z 2	0.8 lt.
MA	(M)	MY Ge 604	V 1	1.6 lt.
MA	(M)	MY Ge 604	Z 2	0.8 lt.
ma-ra[-tu-wo	-----	MY Ge 605 + 607 +	-----	-----
ma-ra-tu-wo	(M)	MY Ge 606 + fr.	V 1	1.6 lt.
MA	(C)	KN Ga 5672	units 2[5]	***
MA	(C)	KN Ga 7496	units 2	***
MA	(C)	KN Ga 7496	unit 1	***
MA	(C)	KN Ga 953 [+] 955	units 3	***
MA	(C)	KN Ga 953 [+] 955	units 2	***
MA[4]	(C)	KN Ga 953 [+] 955	units 2	***
TOTAL				13.2 lt. + units 12

[1] Most probably identified as *Foeniculum vulgare*, fennel, as I disagree with Erard-Cerceau (1990, 262-263) in classifying fennel as *Pimpinella anisum*, which is another condiment, anise. However, an early mention of aniseed in Greece comes from Vickery (1936, 27, 51) and has been noted as found at Therasia, Thera. Renfrew (1973, 178) states this same reference as well. As the material was never identified by an archaeobotanist, we would need more evidence to consider it as belonging to this genus. This organic material, unfortunately, has not yet been located by the present author and it is not known whether it is lost, misplaced or had been wrongly identified.

[2] See Table 3, note 1.

[3] *ma-ra-tu-wo* abbreviated *MA* (*Documents*, 105).

[4] Dots under *M*, which makes it not terribly secure and it has an extra stroke, which distinguishes *LANA*. Probably it is an error (*CoMIK* I, 397).

[5] We do not know whether this is a liquid or dry transaction, and consequently there is no way of knowing whether 1 unit = 96 litres or 28.8 litres (Chadwick 1976, 104-108; *inter alia* Palmer 1999, 471).

Table 7. Quantities of condiments, perfume and dye plants of the Mycenaean period, as seen in the Linear B tablets: *Coriandrum sativum* (*ko-ri-ja-do-no*, *KO*).

LINEAR B	TYPE OF TRANSACTION (C), (M), (W)	TABLET	MYCENAEAN QUANTITIES	MODERN EQUIVALENCES
ko-ri-a_2-da-na	(M)	PY Un 267	AROM 6	576 lt.
ko	(M)	PY Un 592	AROM 4 T 4	384 lt. + 38.4 lt.
ko-ri-jo-da-na[1]	-----	PY An 616	-----	-----
TOTAL				998.4 lt.
KO AROM	(M)	MY Ge 603 + frr.	AROM T 2	96 + 19.2 lt.
KO	(M)	MY Ge 603 + frr.	T 2	19.2 lt.
KO	(M)	MY Ge 603 + frr.	T 2	19.2 lt.
KO	(M)	MY Ge 603 + frr.	T 2	19.2 lt.
KO	(M)	MY Ge 603 + frr.	T 2	19.2 lt.
KO	(M)	MY Ge 603 + frr.	T 2	19.2 lt.
ko-ri-a_2-da-na	(M)	MY Ge 605 + 607 +	T 2	19.2 lt.
ko-ri-a_2-da-na	(M)	MY Ge 605 + 607 +	T 2	19.2 lt.
ko-ri-ja-da-na	(M)	MY Ge 605 + 607 +	T 2	19.2 lt.
[ ]na[2]	(M)	MY Ge 605 + 607 +	T 2	19.2 lt.
AROM+KO	(M)	MY Ge 606 + fr.[5]	AROM T 2	19.2 lt.
ko AROM	(M)	MY Ge 608a + frr. +	AROM T[	105.6[lt.
ko AROM[3]	(M)	MY Ge 608a + frr. +	AROM T 1	105.6 lt.
ko AROM[[4]	-----	MY Ue 652 + 656	AROM T[	105.6[lt.
TOTAL				≥ 624 lt.
KO	(M)	KN Ga(2) <34>	T 5	48 lt.
ko-ri-ja-do-no[6]	(M)	KN Ga(2) 415	AROM 1 T 6	96 lt. + 57.6 lt.
	(M)	KN Ga(2) 416	AROM 9 T 2	864 lt. + 19.2 lt.
ko-ri-ja-do-no	(M)	KN Ga(2) 417	AROM 1	96 lt.
ko	(M)	KN Ga(2) 417	V 1[	1.6[lt.
ko-ri-ja-do-no	(M)	KN Ga(2) 418[7]	T 5	48 lt.
ko-ri[-ja-do-no	(M)	KN Ga(2) 419 + 5806	AROM 1[8]	96 lt.
ko-ri-ja-do-no	(M)	KN Ga(2) 419 + 5806	AROM 1	96 lt.

[1] Dots under *-ri-jo-da*.
[2] Melena and Olivier (*TITHEMY*, 61) believe it is likely to be *ko-ri-ja-da-na*.
[3] Dots under *ko*. *ko AROM* taken as *AROM T* 1 = 105.6 lt. perhaps should be assumed to be the largest quantity for that specific product.
[4] Dots under *ko* and *AROM*.
[5] According to this document, coriander would have been planted near Mycenae (Erard-Cerceau 1990, 258).
[6] Melena (1974b, 140) claims that it refers to coriander but coriander is not mentioned.
[7] Could it be the one Erard-Cerceau (1990) mentions as **KN Ga(1) 518**, for it does not seem to refer to coriander? It could be a misprint.
[8] Melena (1974b, 140) refers to *AROM* 1 for **419.**1 and *AROM* 1 again for **419.**2.

Table 7. (Continued).

LINEAR B	TYPE OF TRANSACTION (C), (M), (W)	TABLET	MYCENAEAN QUANTITIES	MODERN EQUIVALENCES
ko-ri-ja-do-no	(M)	KN Ga(2) 421	T 5	48 lt.
ko-ri-ja-do-no	-----	KN Ga(2) 422	-----	-----
ko-ri-ja-do-no	(M)	KN Ga(2) 423 + 7366	AROM 2[13]	192 lt.
ko-ri-ja-do-no[	-----	KN Ga(2) 673	-----	-----
ko-ri-ja-do-no	(M)	KN Ga(1) 674	AROM 10	960 lt.
[[KO]][9]	(M)	KN Ga(1) 675	AROM 10	960 lt.
ko-ri-ja-do-no	(M)	KN Ga(1) 676	AROM 6	576 lt.
]ni-jo[10]	(M)	KN Ga(1) 677 + 7769	AROM 5	480 lt.
ko-ri-ja[11]	(M)	KN Ga(1) 678 + fr.	AROM 5	480 lt.
]-do[12]	(M)	KN Ga(1) 679	AROM 6	576 lt.
]ja-do	(M)	KN Ga(1) 680	AROM 1	96 lt.
ko-ri-ja-do-no	(M)	KN Ga(1) 685	T 2	19.2 lt.
ko	(M)	KN Ga 738	AROM[	≥ 96 lt.
ko	(M)	KN Ga 953 [+] 955	T 1[	≥ 9.6 lt.
ko-ri[	(M)	KN Ga 953 [+] 955	T 4	38.4 lt.
[14]	-----	KN Ga 5672	-----	-----
]ja	(M)	KN Ga(1) 7365	AROM 20	1,920 lt.
ko-ri-ja-do-no	(M)	KN Ga(2) 7367 + 7368 +	[[T 6]]	[[57.6]] lt.
KO	(M)	KN Ga 7496	T 2[	19.2 [lt.
KO	(M)	KN Ga 7496	T 4	38.4 lt.
]ko[15]	(C)	KN G 7525	unit 1[16]	96 lt.
]ko	(C)	KN V(2) 7527	units 4	384 lt.
KO	(C)	KN F 7542	units 25	2,400 lt.
KO	(C)	KN Ce 8279	units 130[[17]	12,480 lt.
KO	(C)	KN Ce 8346 + 8644 + 9111	units 80[	7,680 lt.
TOTAL[18]				7,988.8 lt. + units 240 = 23,040 lt.

[9] As it is erased it will be mentioned here but will not be included in total sum.

[10] This is stated as coriander in Melena (1974b, 135).

[11] Dots under *ko* and *ri* (*CoMIK* I, 678).

[12] Probably]*ja-do* where dots under *ja*.

[13] Dots under 2 so maybe wrong numeral but, at least, we know it is more than *AROM* 1.

[14] Melena (1974b, 153-154) claims it refers to coriander but the word is probably understood.

[15] *KT*[5], 216: possibly *KO*.

[16] From the Mycenae tablets we assumed that the largest unit is *AROM T* 1 = 105.6 lt. So the problem here is whether we should calculate the same for Knossos or just the 96 lt. It is not improbable for the major unit at Mycenae to have been different from the major unit at Knossos for that particular product. For example in the Mediterranean world grams and dramia represented slightly different measures.

[17] Dots under 130. According to Melena (1974b, 157) this refers to enormous quantities of coriander in the range of 12,480 litres.

[18] Erard-Cerceau (1990, 259) refers to **KN Ga 7307.1** as referring to coriander but I could not see the term mentioned, or could it have been a typing error instead of **KN Od 7307**. The same goes for **KN Sd 4401 + 8718 +** *fr.* (Erard-Cerceau 1990, 263), as *po-ni-ki-jo* is referred to, but again the term for coriander could not be traced.

Table 8. Quantities of condiments, perfume and dye plants of the Mycenaean period, as seen in the Linear B tablets: *Cuminum cyminum L.*

LINEAR B[1]	TYPE OF TRANSACTION (C), (M), (W)	TABLET	MYCENAEAN QUANTITIES	MODERN EQUIVALENCES
ku-mi-no-jo[	-----	MY Ge 602	-----	-----
KU	(M)	MY Ge 603 + frr.	V 2	3.2 lt.
KU	(M)	MY Ge 603 + frr.	V 1	1.6 lt.
KU	(M)	MY Ge 603 + frr.	V 2	3.2 lt.
KU	(M)	MY Ge 603 + frr.	V 1	1.6 lt.
KU	(M)	MY Ge 603 + frr.	V 2	3.2 lt.
KU	(M)	MY Ge 603 + frr.	V 1 Z 2	1.6 lt. + 0.8 lt. = 2.4 lt.
KU	(M)	MY Ge 604	V 1	1.6 lt.
ku-mi-na	(M)	MY Ge 605 + 607 +	V 1	1.6 lt.
ku-mi-no	(M)	MY Ge 605 + 607 +	Z [	-----
ku-mi-no	(M)	MY Ge 605 + 607 +	Z 2	0.8 lt.
ku-mi-no	(M)	MY Ge 605 + 607 +	Z [	-----
KU	(M)	MY Ge 606 + fr.[2]	V 1	1.6 lt.
KU	(C)	MY Ui 709	units 900	***
TOTAL				20.8 lt. + units 900[3]

[1] It is not mentioned as a perfume ingredient, neither in Shelmerdine's (1985) book nor in Foster (1977a) and Wylock (1970). It is, also, mentioned only as a condiment in Hoffner 1974, 103, therefore, I would rather favour the condiment use for those reasons but also for the fact that it is mentioned, in Linear B, together with ingredients which would be rather used as condiment i.e. sesame, mint, fennel and so forth. Many medicinal uses, as referred to it in Egypt (Darby *et al.* 1977).

[2] According to the document, cumin was cultivated in the Argolid (Erard-Cerceau 1990, 258).

[3] This is difficult to interpret as the quantities of that commodity are fairly small which makes us unable to be sure whether its circulation is in dry or liquid measure. On the other hand, if it was in liquid 900 x 28.8 = 25,920 lt. and in dry 900 x 96 lt. = 86,400 lt., both calculations provide unusually high figures.

Table 9. Quantities of condiments, perfume and dye plants of the Mycenaean period, as seen in the Linear B tablets: *Mentha spp.*

LINEAR B	TYPE OF TRANSACTION (C), (M), (W)	TABLET	QUANTITIES
mi-ta	(C)	MY Ge 602	PE 2[2]
mi-ta-qe	(C)	MY Ge 603 + frr.	PE 20[3]
[ka-]ra-to[1]	(C)	MY Ge 605 + 607 +	cup 1[4]
mi-]ta	(C)	MY Ge 605 + 607 +	PE 1[5]
mi-ta	(C)	MY Ge 605 + 607 +	PE 1[6]
mi-ta	(C)	MY Ge 606 + fr.	PE 2[7]
TOTAL			PE 26 + 1 cup (?)

Table 10. Quantities of condiments, perfume and dye plants of the Mycenaean period, as seen in the Linear B tablets: *Sesamum indicum* (?).

LINEAR B	TYPE OF TRANSACTION (C), (M), (W)	TABLET	MYCENAEAN QUANTITIES	MODERN EQUIVALENCES
[[sa-sa-ma]]	-----	MY Ge 602	-----	-----
sa-]sa-ma	(M)	MY Ge 602	V 1	1.6 lt.
sa-sa-ma	(M)	MY Ge 602	Z 2	0.8 lt.
SA	(M)	MY Ge 603 + frr.	Z 2	0.8 lt.
SA	(M)	MY Ge 604	V 1	1.6 lt.
SA	(M)	MY Ge 604	Z 2	0.8 lt.
SA	(M)	MY Ge 604	V 1	1.6 lt.
]sa-sa-ma	(M)	MY Ge 605 + 607 +	Z 2	0.8 lt.
sa-sa[-ma	-----	MY Ge 605 + 607 +	-----	-----
sa-sa-ma	(M)	MY Ge 606 + fr.	V 4	6.4 lt.
TOTAL				14.4 lt.

[1] Probably *ka-ra-ko* (*Documents*, 226, where it is related to pennyroyal, *Mentha pulegium*). I believe we cannot be so precise as to give the species name but we could say that it could refer to the *Mentha spp.*

[2] (*BU*) = bunch. In *TITHEMY*, 59, *PE*. Varias Garcia (1993, 218-219) claimed it had a value of 10 units of mint. Palmer (1999, 477, note 54) refers to it as identified by Killen as an abbreviation for the unit of weight known as the *πέλεκυς* with a value of 10 *mina* or *ca.* 5 kg. Would mint, in this case, be fresh or dried as 10 kg. of dried mint would be fairly bulky. Here I will not try to make calculations, as this issue is still not unanimously accepted.

[3] *mi-ta-qe* 20 = *mi-ta ?qe* 20.

[4] Describes it with **155*^{VAS} which is the one-handled cup.

[5] Also described with *PE* (*Documents*, 227).

[6] Same *PE* as previous.

[7] Quantity in *PE* too.

Table 11. Quantities of condiments, perfume and dye plants of the Mycenaean period, as seen in the Linear B tablets: (?) *Pistacia lentiscus*/(?) *Cymbopogon schoenanthus*.

LINEAR B[1]	TYPE OF TRANSACTION (C), (M), (W)	TABLET	QUANTITIES
ko-no-a-po-te-[.][2]	-----	MY Ge 602	-----
ko-no[3]	(C)	MY Ge 603 + frr.	units 10[5]
ko-no	(C)	MY Ge 603 + frr.	units 10[6]
ko-no	(C)	MY Ge 603 + frr.	units 12[7]
no-ko[4]	(C)	MY Ge 603 + frr.	units 10[8]
ko-no	(C)	MY Ge 603 + frr.	units 10[9]
ko-no	(C)	MY Ge 603 + frr.	DE 1
ko-no	(C)	MY Ge 604	units 2[10]
ko-i-no	(C)	MY Ge 606 + fr.	DE 1
ko-no[11]	-----	KN Ga 953 [+] 955	-----
TOTAL			units 44

Table 12. Quantities of condiments, perfume and dye plants of the Mycenaean period, as seen in the Linear B tablets: (?) *Cinnamon*/(?) *Salvia spp*.

LINEAR B	TYPE OF TRANSACTION (C), (M), (W)	TABLET	MYCENAEAN QUANTITIES	MODERN EQUIVALENCES
KAPO	(C)	PY An 616	KAPO 4	***
KAPO[12]	(M)	PY Un 249	T 6	57.6 lt.
KAPO	(M)(C)	PY Un 267	KAPO 2 T 5	48 lt. + ***
KAPO	(M)(C)	PY Un 592	KAPO 3 T 4	38.4 lt. + ***
KAPO	-----	KN F(2) 841 + 867	-----	-----
TOTAL				144 lt. + ***

[1] Check note 7 under Table 2.
[2] Melena and Olivier (*TITHEMY*, 38) claim that it could be divided as *ko-no a-po-te-ra*.
[3] See Table 2, note 7.
[4] *no-ko* is a misspelling of *ko-no*.
[5] After 10 the word *e-ne-me-na* 1 is mentioned, and according to Chadwick (*Documents*, 543, 226) *e-ne-me-na* describes a form of *ὀχῖνος* (see *ko-no*) and it is abbreviated to *E*. Also Melena (1974b, 154) states that it is measured in *MA* units (?).
[6] It is followed by *E* 1.
[7] Same as previous!
[8] Followed by *DE* [ ].
[9] Followed also by *E* 1.
[10] Followed by *DE* 1.
[11] Mentioned three times on the same tablet but with no quantities.
[12] Dots under *KAPO* (**127*) treated as cinnamon (Sacconi 1972). It is found with perfume ingredients (Melena 1974b, 160) and estimated in dry weight (*T*) and unit. Could it refer to the powder form in volume and the sticks (bark) when in unit? See also Palmer (1999, 485) who refers to it as rush or a sort of *Cyperus*.

Table 13. Quantities of condiments, perfume and dye plants of the Mycenaean period, as seen in the Linear B tablets: *po-ni-ki-jo.*

LINEAR B	TYPE OF TRANSACTION (C), (M), (W)	TABLET	QUANTITIES	MODERN EQUIVALENCES
po-ni-ki-jo	(W)	KN Ga(2) 425	M 1	1,000 gr.
po-ni-ki-jo	(W)	KN Ga(2) 426	M 4 N 1	4,000 + 250 gr.
po-ni-ki-jo	(W)	KN Ga(2) 427 + 8102	N[ ]	
po-ni-ki-jo	(W)	KN Ga(2) 427 + 8102	M 8 N[ ]	8,000 gr. + [ ]
po-ni-ki-jo	(W)	KN Ga(2) 427 + 8102	M 1 N 1	1,000 + 250 gr.
]-ni-jo[1]	(M)	KN Ga(1) 677 + 7769	AROM 5	480 lt.
po-ni-ki-jo[	(W)	KN Ga(2) 1335	-----	-----
po-ni-ki-jo	(W)	KN Ga(2) 7425	M 2	2,000 gr.
po-ni-]ki-jo	(W)	KN Ga(2) 7426	M 14[	14,000 gr.
po-]ni-ki-jo	(W)	KN Ga(2) 7429	M[	≥ 1,000 gr.
po-]ni-ki[-jo	-----	KN Ga(2) 8439	-----	-----
po-]ni-ki-[jo	-----	KN X 9735	-----	-----
po-ni-ki-jo	-----	KN Bg 1020	-----	-----
po-ni-ki-jo	-----	KN Bg 1021 + 7428	-----	-----
po-ni-ki-jo[	-----	KN Bg 1040 + frr.	-----	-----
po-ni-ki[-jo	-----	KN Sd 4401 + 8718 + fr.	-----	-----
]po-ni-ki-jo[2]	(W)	KN Bg 5584 + 7427 + fr.	M[	≥ 1,000 gr.
po-]ni-ki-jo[	(W)	KN Bg 834[3]	M 34	34,000 gr.
po-]ni-ki-jo[	-----	KN Bg 8438	-----	-----
po-ni-]ki-jo	-----	KN Bg 9297	-----	-----
po-]ni-ki-jo[	-----	KN Bg 9298 + 9388	-----	-----
po-ni-ki-jo	-----	KN Bg 992 + 8582 + frr.	-----	-----
po-ni-ki-jo	(W)	KN Ga(2) 417	M 5	5,000 gr.
po-ni-ki-jo	(W)	KN Ga(2) 418	M 3	3,000 gr.
po-ni-ki-jo [	-----	KN Ga(2) 420 + fr.	-----	-----
po-ni-ki[-jo[4]	-----	KN Ga(2) 423 + 7366	-----	-----
po-ni-ki-jo[5]	(W)	KN Ga(2) 424	M 5	5,000 gr.
TOTAL				79,500 gr. + 480 lt.

[1] Melena 1976b, 135.

[2] Referring to *po-ni-ki-jo* given to 30 men. Dots under the *po* (*CoMIK*, 330), therefore, interpretation not very secure.

[3] This quantity was given to an unknown number of women. Godart (1970, 387) believes that due to the high number it must be a special document (referred as **KN Og 834**).

[4] Dots under *-ki* (*CoMIK*, 155).

[5] Dot under *-ni* (*CoMIK*, 155).

Table 14. Quantities of condiments, perfume and dye plants of the Mycenaean period, as seen in the Linear B tablets: *Cyperus spp.* (cf. *rotundus* and *C. esculentus*).

LINEAR B	TYPE OF TRANSACTION (C), (M), (W)	TABLET	MYCENAEAN QUANTITIES	MODERN EQUIVALENCES
CYP+O[1]	(M)	MY Fu 711	T 1 [[5]]	9.6 lt. [[48]][2]
CYP+O	(C)	MY Ue 652 + 656	units 7	672 lt.
CYP+KU	(C)	MY Ue 652 + 656	units 5	480 lt.
TOTAL				1,161.6 + [[48]] lt.
CYP+O	(M)(C)	PY Fa 16	units 8 T 2 V 1[[ ]]	768 lt. + 19.2/1.6
CYP+O	(C)	PY Ua 434	units 13	1,248 lt.
CYP+PA	(M)	PY Un 2	V 5	8 lt.
CYP+PA	(M)	PY Un 2	T 1 V 3	9.6 lt. + 4.8 lt.
CYP+O	(M)(C)	PY Un 47	units 3 T 4 V 1	288 + 38.4 +1.6 lt.
ku-pa-ro$_2$[3]	(M)	PY Un 249	AROM[5] 2 T 5	192 lt. + 48 lt.
ku-pa-ro$_2$	(M)	PY Un 267	AROM 6	576 lt.
ku-ro-ro$_2$[4]	(M)	PY An 616	AROM 13 T 5	1,248 lt. + 48 lt.
ku-pa-ro-we	-----	PY Fr 1203	-----	-----
TOTAL				4,499.2 lt.
PYC+O	-----	TH Wu 71	-----	-----
PYC+O[6]	-----	TH Wu 81	-----	-----
CYP+KU	(M)(C)	KN F(1) 157 + fr. [+]	5 T 3	480 lt. + 28.8 lt.
CYP [+?]	(C)	KN F(1) 157 + fr. [+]	unit 1	96 lt.
CYP	(C)	KN Uc 160	unit 1[	96[lt.
CYP+O	(C)	KN F(2) 852 + 8071 + fr.	12[7	1,152[lt.
CYP+KU	(M)(C)	KN F(2) 5043 + fr.	2 T 2	192 lt. + 19.2 lt.
PYC+O	-----	KN F(2) 7050 + 7342	-----	-----
CYP+O	(C)	KN F(1) 5079 + 8259	units 6	576 lt.

[1] *CYP/PYC* is believed by Palmer (1999, 470) *inter alia* to be perfume; whereas *CYP+O/PYC+O* to be food.
[2] It is the dry measure.
[3] The use of *ku-pa-ro* or unligatured sign *CYP/PYC* was used to denote *C. rotundus L.* (Palmer 1999, 471).
[4] Probably error for *ku-pa-ro* (*Documents*, 558).
[5] *AROM* 2, where dot under two.
[6] Dots uder *PYC+O*.
[7] Dot under one.

Table 14. (Continued).

LINEAR B	TYPE OF TRANSACTION (C), (M), (W)	TABLET	MYCENAEAN QUANTITIES	MODERN EQUIVALENCES
CYP+O	(C)	KN F(1) 5079 + 8259	units 5	480 lt.
CYP+O	(C)	KN F(1) 5079 + 8259	units 5	480 lt.
ku-pa-ro	(M)***	KN Ga(1) 517	AROM + PYC 1	96 lt. PYC 1
?[8]	(M)***	KN Ga(1) 518	AROM + PYC 10	96 lt. PYC 10
ku-pa-ro	-----	KN Ga(1) 519	-----	-----
ku-pa[-ro	-----	KN Ga(3) 454	-----	-----
PYC	(M)	KN Ga(3) 456	T[	≥ 9.6 lt.
CYP	(C)	KN Ga 461	units 10	960 lt.
PYC	(C)	KN Ga(3) 464	units 15	1,440 lt.
PYC	(C)(M)	KN Ga(3) 464	PYC 26 T 3	PYC 26 + 28.8 lt.
ku-pa-ro	(M)	KN Ga(3) 465	T 1	9.6 lt.
PYC [ ]	(M)	KN E 842	T 2	19.2 lt.
PYC+O	(C)	KN G 7509 + 7879	6[[9]	576[lt.
PYC[	-----	KN Ga(3) 8005	PYC[	PYC[
PYC	(M)	KN Ga 1058 + 5671	T 1	9.6 lt.
PYC+QA	(C)	KN Ga 5088	units 9	864 lt.
]PYC	(M)(C)	KN Ga 7344	PYC 4 T 2	PYC 4 + 19.2 lt.
PYC	(C)	KN Ga 7347	units 2	192 lt.
PYC	(C)	KN Ga 7347	units 3	288 lt.
PYC	(C)	KN Ga 7347	units 6	576 lt.
PYC (?)[10]	(C)	KN G 7352	units]3 T 2[	]288 lt. + 19.2 lt.
PYC+QA	(C)	KN Ga 7358	units 3	288 lt.
TOTAL				9379.2 lt.[11] + PYC 42

[8] *ku-pa-ro* is intended? It is not at all clear. Erard-Cerceau (1990) wrongly perhaps includes it in her list of coriander tablets.

[9] Dot under six.

[10] *PYC* perhaps understood (Palmer 1999, 484).

[11] Melena (1974c, 324) calculates their quantity to 8,688 litres.

Table 15. Quantities of condiments, perfume and dye plants of the Mycenaean period, as seen in the Linear B tablets: *Cistus creticus L.* (?).[1]

LINEAR B ki-ta-no *123[2]	TYPE OF TRANSACTION (C), (M), (W)	TABLET	QUANTITIES	MODERN EQUIVALENCES
AROM[3]	(M)	KN Ga(5) 1530 + 1531	AROM 58	5,568 lt.
[ki-ta]-no	(M)	KN Ga(5) 1530 + 1531	AROM 11 + 1[5]	1,056 + 96 lt.
ki[-ta-no[4]	(M)	KN Ga(5) 1530 + 1531	AROM 10 + 2	960 + 192 lt.
ki[-ta-no	-----	KN Ga(5) 1530 + 1531	-----	-----
AROM	(M)	KN Ga(5) 1530 + 1531	AROM 31	2,976 lt.
ki-ta-no	(M)	KN Ga(5) 1532	AROM 13	1,248 lt.
ki-ta-no	(M)	KN Ga(5) 1532	AROM 11	1,056 lt.
AROM	(M)	KN Ga(5) 1532	AROM 35	3,360 lt.
TOTAL				16.224 lt. + 288 lt.

Table 16. Quantities of condiments, perfume and dye plants of the Mycenaean period, as seen in the Linear B tablets: *Crocus spp.* (probably *C. cartwrightianus* and *C. sativus*).

LINEAR B	TYPE OF TRANSACTION (C), (M), (W)	TABLET	QUANTITIES	MODERN EQUIVALENCES
CROC	(W)	KN Np(1) 85 + 5047 +[6]	QI[7] 6	-----
CROC	(W)	KN Np(1) 267	RO[	-----
CROC	(W)	KN Np(1) 268	RO 1	-----
CROC	-----	KN Np(1) 269	-----[8]	-----
CROC	(W)	KN Np(1) 270	P 2 QI 4	40 gr. + ?
CROC	(W)	KN Np(1) 271	QI 1 RO 1	~ 3 gr.+ ?

[1] Foster (1977a, 33) does not believe we could identify it as a perfume ingredient, because it is nowhere mentioned together with perfumes, and as is mentioned in the text, I believe, it could be ladanum, *Cistus creticus L.* which is an incense, amongst other things.

[2] Sacconi (1971, 29) identifies it as *ki-ta-no*, and see Table 4.

[3] I am leaving the *AROM* in this table, although they have also been included in Table 4, in order to show their connection to tablets where *ki-ta-no* is mentioned.

[4] Dots under *ki*.

[5] Owed 1 and the next are owed 2.

[6] It also includes **7938 + 8057** (*CoMIK*, 44). However, it is possible that crocus is understood in several more tablets of the **KN Np** series but these tablets are not included here.

[7] *QI* and *RO* are weights smaller than 3.4 gr. and will not be mentioned here. The reader can refer to Bennett 1950.

[8] *QI* 1 or *RO* 1 are possible (*CoMIK*, 112).

Table 16. (Continued).

LINEAR B	TYPE OF TRANSACTION (C), (M), (W)	TABLET	QUANTITIES	MODERN EQUIVALENCES
CROC	(W)	KN Np(1) 272 + 7419 + fr.	Q 1	~ 3 gr.***
CROC	(W)	KN Np(1) 273	P 5 [[9]	100 gr.
CROC	(W)	KN Np(1) 274	N 1 P 1	250 + 20 gr.
CROC	-----	KN Np(1) 276	CROC[	-----
CROC	(W)	KN Np(1) 277	QI 4	-----
CROC	(W)	KN Np(1) 278 + 7436 + fr.	P 2	40 gr
CROC	(W)	KN Np(1) 286	N [	≥ 250 gr.
]CROC	(W)	KN Np(1) 5013	P 1	20 gr.
]CROC[	-----	KN Np(1) 7422	CROC [	-----
CROC[	(W)	KN Np(1) 7423 + 7641 [+]	CROC [ ] N2	-----
]CROC[	(W)	KN Np(1) 7424	]CROC[	-----
CROC[	-----	KN Np(1) 7923 + 8461 + fr.	CROC[[10]	-----
CROC[	-----	KN Np(1) 8458	-----	-----
]CROC	(W)	KN Np(1) 8459	P	≥ 20 gr.
]CROC[	(W)	KN Np(1) 9112	]CROC[	-----
CROC	-----	KN Np(2) 1000 + 5004	N[	≥ 250 gr.
]CROC	(W)	KN Np(2) 5002	N 1	250 gr
CROC	-----	KN Np(2) 5721 + 5945 + frr.	CROC N [	> 250 gr.
CROC	(W)	KN Np(2) 5725 + 5886 +	N 1	250 gr.
***	(W)	KN Np(2) 5982 + fr.	N 1	250 gr.
CROC[	-----	KN Np(2) 7417	CROC[	-----
]CROC	(W)	KN Np(2) 7418	N 1	250 gr.
CROC[	-----	KN Np(2) 7420	P[[11]	-----
CROC[	-----	KN Np(2) 7421	-----	-----
***	(W)	KN Np(2) 7439	N 1	250 gr.
]CROC	-----	KN Np(2) 7442 + fr.	-----	-----
]CROC	(W)	KN Np(2) 8249	N [	≥ 250 gr.
CROC	(W)	KN Np(2) 855 + 7434	P 3 P 6[12]	60 + 120 gr.
CROC	(W)	KN Np(2) 856 + 7915 + 7917	N 1	250 gr.
CROC[	-----	KN Np(2) 857	CROC[	-----
CROC[	-----	KN Np(2) 858	CROC[	-----
CROC	(W)	KN Np(2) 859	P 9	180 gr.
CROC	(W)	KN Np(2) 860	P 4	80 gr.
CROC	(W)	KN Np(2) 860	P 2[13]	40 gr.
CROC	(W)	KN Np(2) 861	N 1	250 gr.
CROC[	-----	KN Np(2) 9362 + fr.	-----	-----
CROC[	-----	KN Np(2) 9676	-----	-----
CROC	(W)	KN Np 2138	N[	≥ 250 gr.
ko-ro-ki-no-[	-----	KN X 974 + 5742	-----	-----
TOTAL				3,726 gr. + CROC

[9] Dot under 5 (*CoMIK*, 113).
[10] Dots under *CROC*.
[11] Dot under *P*.
[12] *P* 6 is a due.
[13] Quantity is due.

Table 17. Quantities of the condiment of the Mycenaean period, as seen in Linear B: *Salvia spp.* (sage).[1]

LINEAR B	TYPE OF TRANSACTION (C), (M), (W)	TABLET	MYCENAEAN QUANTITIES	MODERN EQUIVALENCES
pa-ko-we	-----	PY Fr 1200	-----	-----
pa-ko-we	(M)	PY Fr 1202	PA 5 S 1 V 4	28.8/9.6 + 6.4 lt.
OLE+PA	(M)	PY Fr 1205	S 2 V 4	25.6 lt.
OLE+PA	(M)	PY Fr 1206	PA 5 V 4	28.8 + 6.4
pa-ko PA[2]	(M)	PY Fr 1216	PA 1 + V 2	28.8 + 3.2 lt.
pa-ko-we	(M)	PY Fr 1217	V 1	1.6 lt.
pa-ko-we PA[3]	(M)	PY Fr 1220	V 4	6.4 lt.
OLE+PA	(M)	PY Fr 1220	S 1	9.6 lt.
OLE+PA	(M)	PY Fr 1222	V 1	1.6 lt.
pa-ko-we	-----	PY Fr 1223	S 2[4]	19.2 lt.
pa-ko-we	-----	PY Fr 1224	Z 2	0.8 lt.
pa-ko-we PA[5]	(M)	PY Fr 1226	V 3	4.8 lt.
OLE+PA	(M)	PY Fr 1228	V 1	1.6 lt.
OLE+PA	(M)	PY Fr 1229	V 1	1.6 lt.
pa-ko-we PA	(M)	PY Fr 1232	S 1	9.6 lt.
OLE+PA	(M)	PY Fr 1233	V 1	1.6 lt.
pa-ko[-we	-----	PY Fr 1235	PA 1	28.8 lt.
pa-ko-we PA	(M)	PY Fr 1235	V 3	4.8 lt.
OLE+PA	(M)	PY Fr 1236	S 1 V 1	9.6 lt. + 1.6 lt.
pa-ko[-we	-----	PY Fr 1240	-----	-----
]-we PA	(M)	PY Fr 1246	S[	≥ 9.6 lt.
TOTAL				≥ 250.4 lt.

[1] *pa-ko-we* (see list) probably refers to any of the sage species. It is measured in liquid weight (*S*).

[2] *PA* is referred as a shortened form of *pa-ko-we* (Hooker 1994, 248). It is mentioned as *OLE+PA* 1 *V* 2 which, possibly, indicate the quantity of 'saged' oil needed for 1 primary unit of oil. Could it mean that to one primary unit/whole number of 'plain' oil, a quantity of 2 lt. of 'saged' oil was added? It is therefore, probably, not referring to the quantity of sage but to saged oil (after all it is a liquid measure –see *S* measure), which has an unknown quantity of sage macerated in it. It should be remembered that *pa-ko-we* is an adjective, which denotes mixture with sage (Hooker 1994, 121). However, it might give an indication of the quantities in which 'saged' oil was circulated.

[3] *OLE+PA* again *V* 4.

[4] Dot under *S*.

[5] *OLE+PA* again *V* 3.

Table 18. Some[1] plants, which are believed to have been used as condiment, dye and/or perfumery during the Mycenaean period, but which have not been identified, as yet, in the tablets.

PLANT NAME	COMMON NAME	USES
Allium cepa L.	onion - κρόμμυον[3]	condiment
A. sativum	garlic - σκόροδον	condiment, preservative
Anethum graveolens	dill - άνιθο	condiment
Cistus creticus L.[2]	rockrose - αλδανιά/κίστος	perfumery, medicinal/incense, dye[4]
Juniperus spp.	junipers - κεδραία	incense, wood, dye[5]
Papaver somniferum	poppy - μήκων	narcotic, condiment, medicinal
Rubia tinctoria	madder - ερυθρόδανον	dye
Isatis tinctoria	woad - ισάτις η βαφική	dye
Styrax officinalis	storax - στύραξ	incense, condiment
Rhus coriaria	sumach[6] - ρούς	condiment, dye & tanning, perfumery
P. lentiscus var. chia	mastic tree - μαστιχόδεντρο	resin, unguent
Pinus halepensis	aleppo pine - πεύκο	resin, wood
Pinus pinea	pine nuts - κουκουναριά	condiment

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[1] Only some have been chosen here and these are the ones that, it is believed, might have had an economic significance and would, probably, have been mentioned with transacted quantities. Otherwise, the dyes, and condiments used in the Mycenaean period are thought to be innumerable but not all would have been mentioned on the tablets, due to their high availability, and hence their economic insignificance.

[2] See *ki-ta-no*, for discussion as, I believe, it is ladanum.

[3] There is another version, which is *κιδαρό* (**KN E 842.**3 - *ki-da-ro*) (*CoMIK*, 842).

[4] Frangaki (Φραγκάκι 1969, 33) mentions that it has been used for dyeing cotton and produces a cherry colour (*βυσσινί*).

[5] See above under *Juniperus spp.*

[6] It was found in the Ulu Burun wreck (Heldane 1991, 215; Bass 1997, 164), and one of its uses would have been for colouring wax in order to write in the wooden diptychs (books).

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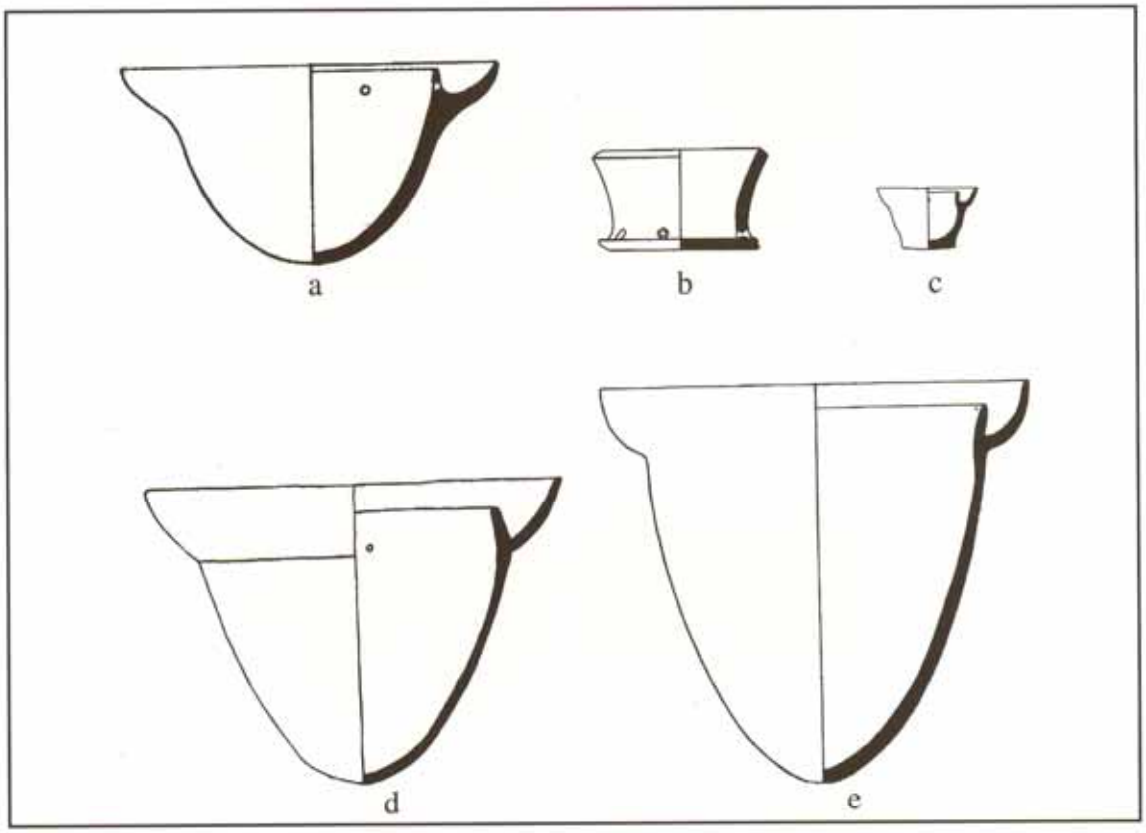


Fig. 1. Clay vessels (distillation apparatuses?) from Tepe Gawra. (a): It is attributed to stratum XI-A, 'Gawran', dated to the 4th millenium BC. (Tobler 1950, fig. 346). (b): It has eight holes disposed around the sides, which are expanded to a plain rim. Found in stratum VI which is dated to the 3rd millenium BC. (Speiser 1935, fig. 203). (c): It is from stratum XI-IX (dated to 4th millennium - beginning to middle). It was found in a grave which probably explains the fact that it is a fraction of the size of the others. (Tobler 1950, fig. 407). (d & e): Although these vessels are encountered in stratum XI-A they become more common later in stratum XI. Probably it is no coincidence that this stratum is distinguished by forthright social stratification (large houses, fortified town). [All drawings are 1:5 in scale].

Fig. 2. Ladanum (resin) from *Cistus creticus* (photo by Manolis Flouris).

Fig. 3. *Pistacia lentiscus var. chia*: the mastic *gu* (photo from the front cover of Perikos 1993).

Fig. 4. Beads made from resin from the tomb of Tutankhamun (Hepper 1990, 20).

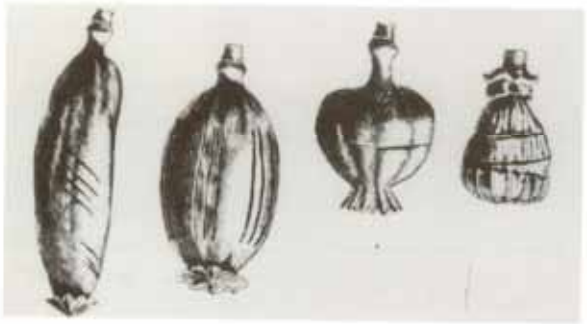


Fig. 6. Opium: types of scars on poppy capsules (Κρητικός & Παπαδάκη 1963, 141).

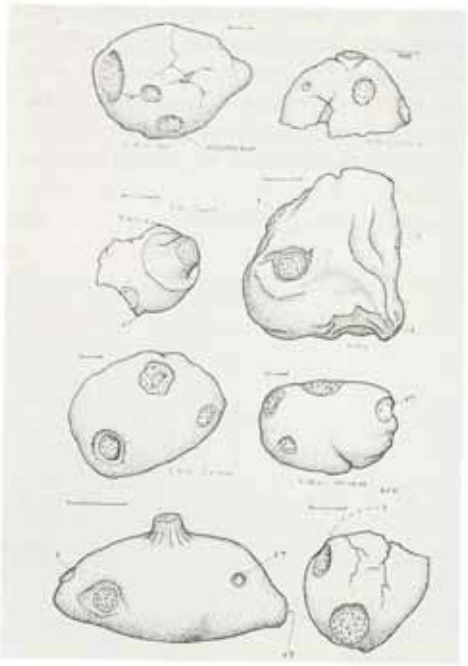


Fig. 5. *Cyperus rotundus* found at Wadi Kubbaniya, Upper Egypt (from Hillman 1989, 212, fig. 13.1).

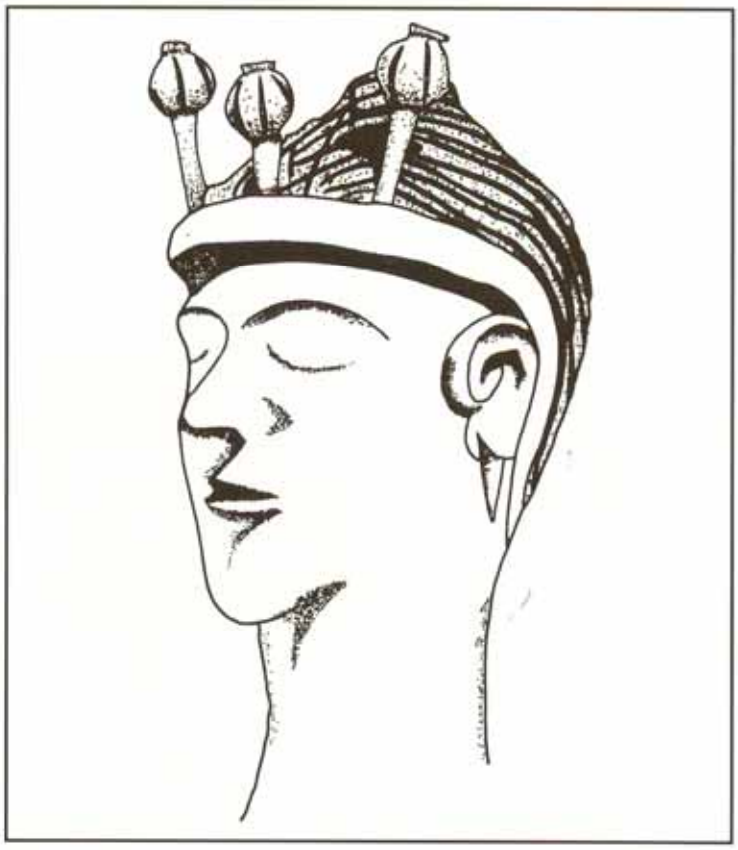


Fig. 7. Profile of the 'Poppy Goddess' from Gazi, Crete (drawing of the head only from Merlin 1984, 241, fig. 86).

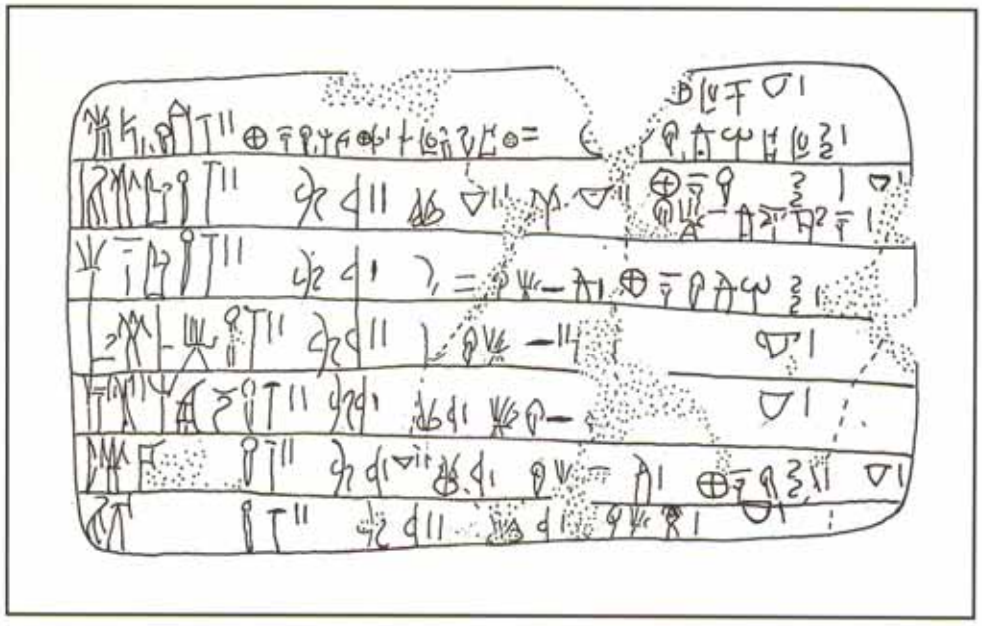
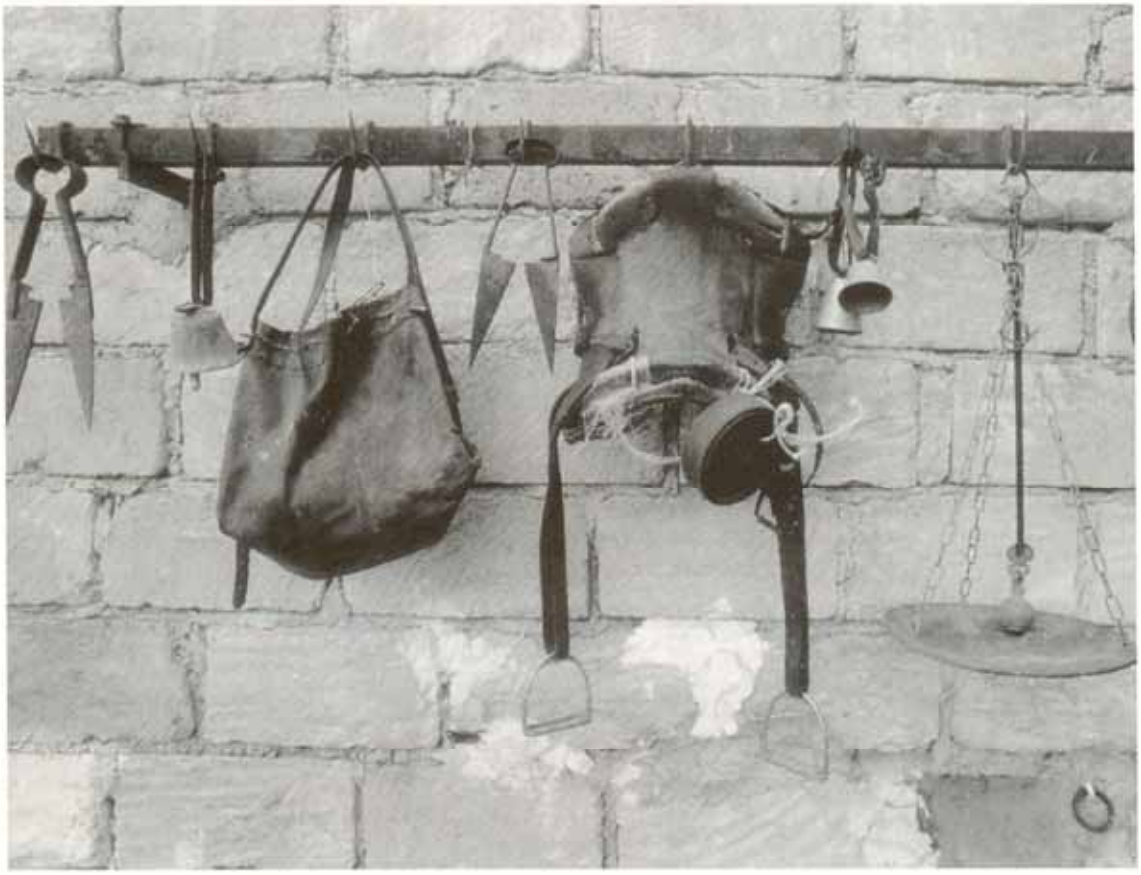


Fig. 8. Tablet **MY Ge 603** where ideogram **155* is portrayed as a measure of accounting (drawing from Sacconi 1974, 50).



Sheep shears, animal bells of various sizes, a leather bag, a leather saddle, and a balance for weighing animal products (ethnographic evidence from Sardinia).