Studies

ANCIENT HISTORY

CINNAMON, CASSIA, AND ANCIENT TRADE

Abstract: There is a widespread assumption that ancient "cinnamon" and "cassia" were the same as the spices now known by those names; that is, products obtained from trees of the genus *Cinnamomum*. This article argues that this is not the case, but that the "cinnamon" and "cassia" of ancient writers very probably came from plants native to northeast Africa, as several early writers actually state. Possible African sources of ancient "cinnamon" and "cassia" are suggested. The most probable principal source is identified as *Cassia abbreviata*. It is also argued that alleged identifications of cinnamon or cassia at archaeological sites in the Mediterranean region are questionable. It is shown that cinnamon and cassia did not figure in Southeast Asian and Chinese trade at an early period, and that Austronesian settlement of Madagascar occurred after the Classical period, probably during the second half of the first millennium CE, too late for Southeast Asians to have played any major role in trade with the Roman Empire. There is no good reason to believe that cinnamon and cassia were traded to the western Indian Ocean and the Mediterranean region at any very early date.
Keywords: *cinnamon, cassia, trade, Pliny, Dioscorides*

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The writing of history is rarely straightforward. Apart from any other considerations, the historian often faces the problem of understanding questions which require specialist knowledge outside her or his principal area of competence. This is perhaps never more obvious than when history becomes entwined with issues relating to plants and plant products. Few indeed are the historians who have had sufficient knowledge of botany and related topics to deal competently with such matters. This is not at all surprising, for the world of plants is extremely diverse, and the uses to which plants are put are similarly numerous. It is estimated that there are more than 350,000 species of plants.[1] The exact number can probably never be known, as more species are still being discovered, and the status of species described in the past is always open to revision. It is particularly relevant here to note that the naming of plants is very complex, requiring a set of rules which is regularly revised,[2] and also that identification of plants is often similarly problematic. Even when an experienced botanist has a specimen, or specimens, of a plant to work from, identifying it correctly may well be very difficult.[3] In the not very distant past, botanists were often greatly hampered

[1] ROYAL BOTANIC GARDENS, KEW/MISSOURI BOTANICAL GARDEN 2013. All accepted names of plant species appearing in this paper are those given by this source. Synonyms are also noted whenever it has seemed helpful to do so. For those unfamiliar with botanical nomenclature, a useful introduction is GLEDHILL 2008.

[2] The current rules are enshrined in INTERNATIONAL ASSOCIATION FOR PLANT TAXONOMY 2011.

[3] For a discussion of the complexities of biological systematics, see MORSE 1974, 29–33. See also SCOTLAND 2002, 2–3; and, on some of the difficulties of identifying plants in the field, WOOD

by the limited availability of plant material, which could easily result in misidentifications. As recently as 1840, it was unclear what plants were the sources of the cassia bark then available in commerce.[4]

The use of vernacular names for plants is not governed by any rules and is consequently chaotic. The same plant may be known by many different names, while the same name may be applied to several different plants. An example of the former is the marsh marigold, *Caltha palustris* L., which has some 90 British names, as well as more than 140 German names and 60 French. The name "bluebell" means something different to people from different places. It is *Wahlenbergia saxicola* (R. Br.) A.DC in New Zealand, but *Hyacinthoides non-scripta* (L.) Chouard ex Rothm. in England, *Campanula rotundifolia* L. in Scotland, and other plants elsewhere.[5] The fact that the same name was sometimes applied in the past to different plants and plant products is certain: Sanskrit *karpasa* means cotton, but the Latin *carbasus* and Greek *karpasos* (κάρπασος) usually refer to flax.[6]

These opening remarks are intended to provide some background to the following discussion, to give an indication of the caution which must be exercised when dealing with the identification of plants in historical sources. The fundamental point is that names alone are never very useful. Other information is always necessary to allow anything more than very uncertain identification. It is all too easy for anyone with little knowledge of botany to fail to appreciate the enormous diversity of the plant world, and to overlook possibilities when making identifications. For a very long time, there has been argument and confusion surrounding the identities of the ancient aromatics[7] known as *cinnamomum* or *kinnamômon* (κιννάμωμον) and *cassia* or *kasia* (κασία). It has often been suggested that they were not identical with the spices now known as cinnamon and cassia, which are the bark of tree species of the genus *Cinnamomum* Schaeff.[8] Most recently, however, consensus has generally been that the ancient and modern products are the same.[9] This requires a concomitant belief that aromatics from southern India and probably Sri Lanka, and very possibly also from Southeast Asia and China, somehow made their way to the Mediterranean region at a very early date. Almost half a century ago, J. Innes Miller created the concept of the "Cinnamon Route".[10] The existence of this trade route was envisaged as an explanation for the fact that "cinnamon" and "cassia" were known in the ancient Mediterranean world, and were often reported to come from Africa. It was supported by the fact that Madagascar is populated by speakers of an Austronesian language (of the West Malayo-Polynesian branch).[11] It was thus postulated that these Austronesian people had established themselves in Madagascar in the course of regular trade directly across the Indian Ocean from Southeast Asia, and that they had been the carriers of cinnamon and cassia from the East (either Southeast Asia or China, or possibly both) to the coast of East Africa, from where these products had made their way to the Red Sea and so to the Roman Empire. Although doubts about this hypothesis were soon expressed,[12] it has obtained a degree of acceptance and continued to be developed.[13] Even those who rejected the "Cinnamon Route" hypothesis still often believed that "cinnamon" and "cassia" were carried to Red Sea ports and Egypt from as far away as Southeast Asia and even China.[14] Some went further, making such assertions as:

Cinnamon (*Cinnamomum zeylanicum*) and cassia (*Cinnamomum cassia*), natives of Sri Lanka and Burma respectively, were first mentioned as spices in China around 2500 BCE – at about the time the Chinese acquired cassia from Burma. Roughly a thousand years later, cinnamon was passed westward as far as Egypt, where it was used in embalming, and perhaps as a foodstuff as well.[15]

All of this is highly questionable. There is no extant Chinese text which dates from 2500 BCE. Not even the Shang oracle bones are anywhere near as old as that, but date from no earlier than about 1200 BCE.[16] The date of 2500 BCE is a traditional one assigned to the mythical author of an early Chinese pharmacopoeia.[17] The Chinese certainly did not acquire *Cinnamomum cassia* from Myanmar (Burma), where it does not occur.[18] It is native to China.[19] The identification of cinnamon in ancient Egypt is very much less than certain (see below). Almost nothing in this passage is correct.

At this point, it seems necessary to examine exactly what cinnamon and cassia are, and where they originate. These are other questions which have not been given sufficient attention. Both these terms are, in fact, ambiguous. In contemporary usage, a great deal of what is sold in shops as cinnamon might more accurately be called cassia. Much more seriously, "cassia" refers not only to the tree *Cinnamomum cassia* (L.) J. Presl (synonym *Cinnamomum aromaticum* Nees) in the family Lauraceae, but also to the genus *Cassia* L. in the family Fabaceae (Leguminosae). This is an important issue, which will be discussed further below. In modern usage, "cinnamon" and "cassia" refer to the inner bark of several species of tree of the genus *Cinnamomum*. This is a large genus of more than 250 species, but only a few of these yield cinnamon or cassia. Another tree of the same genus, *Cinnamomum camphora* (L.) J.Presl, is an important

2002, 11.

4 WIGHT 1840, 179–185.

5 GLEDHILL 2008, 1.

6 YULE/BURNELL 1903, 158; BULLIET 2010, 146 note 15.

7 I do not use the word "spices" here, as the modern sense of this word does not match the uses made of ancient "spices". Cinnamon,for example, was not used in cooking in the ancient Mediterranean world (CASSON 1984, 231; PARKER 2002, 42–43).

8 For a concise overview of recent discussions of this question, with further references, see VAN ALFEN 2002, 47–48.

9 CASSON 1984, 225–239, argues this at some length. This view has gained wide currency because it is repeated in his edition of the *Periplus Maris Erythraei*, which is now the standard edition of this important work (CASSON 1989, 17, 18 note 18, 123).

10 MILLER 1969, 153–172.

11 ADELAAR 2009, 717.

12 "There is thus no support for Miller's circuitous cinnamon route" (SHERIFF 1981, 559); CASSON 1984, 243 note 35, describes Miller's hypothesis as "a bit of fantasy that has managed to trip the unwary". No one has yet fully refuted Miller's theory, however: it has simply been rejected.

13 See, for example, discussion in PEARCE/PEARCE 2010, 71–74; and in ADSHEAD 2000, 30–31.

14 See, for example, CASSON 1984, 233–234.

15 KIPLE 2007, 44.

16 KEIGHTLEY 1978, 171–176, 228 Table 38.

17 The *Shen Nong bencao jing*, "Classical Pharmacopoeia of the Divine Husbandman"; in reality, this text as it now exists is probably no more than two thousand years old. For a discussion of the history of this work and its transmission, see SHANG 2008, 1–5.

18 KRESS/DEFILIPPS/FARR/DAW 2003, 276.

19 WU/RAVEN/HONG 2001, 186.

source of camphor. What is often considered to be "true" cinnamon is obtained from the species *Cinnamomum verum* J. Presl (synonym *Cinnamomum zeylanicum* Blume), a native of Sri Lanka and southern India. Apart from *Cinnamomum cassia*, other species yielding cinnamon or cassia bark include the Indonesian *C. burmannii* (Nees & T.Nees) Blume, and *C. tamala* (Buch.-Ham.) T. Nees & Eberm. from India, principally the lower Himalayan region up to about 2,400 m altitude. A few other Indian species, such as *C. impressinervium* Meisn., *C. bejolghota* (Buch.-Ham.) Sweet, and *C. sulphuratum* Nees are also involved.[20] In order to avoid confusion, from here onwards I shall use "cinnamon-cassia" as a general term for the bark of *Cinnamomum* species used as a spice and for medicinal purposes. "Cassia" will refer solely to plants of the genus *Cassia* and products derived from them, unless specifically indicated otherwise (thus, "Chinese cassia" will refer to bark of the Chinese and Vietnamese tree *Cinnamomum cassia*).

There have also been claims that cinnamon-cassia has been positively identified at archaeological sites, dating from very early periods. The earliest date so far advanced, as far as I am aware, is the early Iron Age, about 1000 BCE. It is alleged that this "raises the possibility of Levantine trade with South East Asia" at this very early time.[21] The evidence is not very convincing, however. It is an unfortunate fact that scientific evidence is often regarded, especially by non-scientists, as more or less irrefutable. This is not the case. Science can be wrong. It is possible for tests to return false results, for a variety of reasons. It is also often necessary for results to be interpreted, at least to some degree. There is plenty of scope for error and exaggeration. Historians should beware of allowing themselves to be "blinded by science". A salutary example of how science can delude is the case of the traces of nicotine and cocaine found in Egyptian mummies, which resulted in the claim that ancient Egypt could have been involved in transatlantic trade (as tobacco and cocaine originate from the Americas). Careful evaluation of this evidence, however, suggested that the nicotine was found at levels which indicated a dietary source, rather than smoking or chewing tobacco. Nicotine occurs in a number of plants other than tobacco: in the case of ancient Egypt, the source may have been celery (*Apium graveolens* L.). As for cocaine, the amounts found were so small that they approached the limits of sensitivity of the method of testing. The results might therefore be considered negative. Moreover, traces of both nicotine and cocaine might have resulted from modern contamination.[22]

Cinnamaldehyde has been identified in early Iron Age flasks from archaeological sites in Israel. However, it is certainly legitimate to wonder how this organic and biodegradable compound could have survived for so long in unsealed flasks buried in the ground. Some of the flasks in which traces of cinnamaldehyde were found were even broken. The suggested explanation for this, that it resulted from the adsorption of the cinnamaldehyde into the ceramic material of the flasks, "the adsorbed cinnamaldehyde molecules being more stable than the non-adsorbed molecules", is not particularly convincing. Although two of the flasks which produced positive results for cinnamaldehyde had never been touched by human hands, this does not rule out all possibility of contamination. They were touched by metal tools and stored in plastic bags.[23] Cinnamon oil and cinnamon bark powder (which contain cinnamaldehyde as a major constituent) are commonly used in many products, including soaps and cleaning products, toothpaste and mouthwash, beauty care products and occasionally in perfumes, as well as in foods.[24] It is therefore entirely possible that traces of cinnamaldehyde might have been present on things which touched the flasks, whatever they were, or might simply have been absorbed into the flasks from the air. The effect of microorganisms on the contents of the flasks is also potentially significant. Microorganisms are almost universally present in soil and in the air. It is very likely that they would have played some role during the course of three thousand years. This possibility is completely ignored in this study of the flasks.

However, even if the cinnamaldehyde was not the result of modern contamination or microbial action, but had really survived in the flasks for some three thousand years, it does not necessarily indicate that the flasks had ever contained cinnamon-cassia. It has been claimed that cinnamaldehyde is "a direct biomarker" for cinnamon-cassia,[25] and that no plant native to the Levant contains more than negligible amounts of it.[26] This is inaccurate and misleading. A number of plants known in the Mediterranean region in ancient times, and relatively easily accessible to the Levant, contain cinnamaldehyde. For example, myrrh (an oleogum resin from species of *Commiphora* Jacq.) is reported to contain cinnamaldehyde.[27] In some of the flasks, benzoic acid was found as well as cinnamaldehyde.[28] This perhaps suggests that the flasks may originally have contained storax. Storax is said to contain cinnamic acid, cinnamic alcohol and cinnamates (though not cinnamaldehyde *per se*), as well as benzyl alcohol.[29] Benzyl alcohol can be oxidized to benzoic acid. The process is reported not to occur easily,[30] but over the course of a few thousand years, it is not inconceivable that a process of oxidation might have taken place. The flasks have thick walls and a narrow neck,[31]and were clearly designed to contain some kind of liquid. Levantine storax (obtained from *Liquidambar orientalis* Mill.) is a viscous semi-liquid, which is often stored with a layer of water over it to prevent the evaporation of volatile ingredients.[32] The flasks, with their narrow necks and thick walls, would have been ideal containers for storax, covered with a little water in the neck. At any rate, it can reasonably be asserted that there are other possibilities than cinnamon-cassia that could explain the presence of cinnamaldehyde in these flasks.

It must also be noted that a single chemical compound

[20] RAVINDRAN/SHYLAJA/NIRMAL BABU/KRISHNAMOORTHY 2004, 14–22.
[21] NAMDAR *et alii* 2013, 1.
[22] COUNSELL 2008, 209–215.
[23] NAMDAR *et alii* 2013, 3–4 Table 1, 10, 12.
[24] KRISHNAMOORTHI/REMA 2004, 314, 319.
[25] GILBOA/NAMDAR 2015, 269.
[26] NAMDAR *et alii* 2013, 13.
[27] KHAN/ABOURASHED 2010, 460.
[28] NAMDAR *et alii* 2013, 7–8 Table 2.
[29] KHAN/ABOURASHED 2010, 579.
[30] SATO/TAKAGI/AOKI/NOYORI 1998, 7549.
[31] NAMDAR *et alii* 2013, 2.
[32] KHAN/ABOURASHED 2010, 579.

cannot provide an adequate basis for the identification of any particular plant or related group of plants. It has been suggested that cinnamaldehyde (cinnamic aldehyde) is "widespread in the plant kingdom".[33] The chemistry of many plants has never been analyzed. It is well known in only a comparatively few cases, usually when a commercially important substance is concerned. An example is camphor. Camphor can be obtained from numerous different plants, one of which is a tree of the same genus as cinnamon-cassia. Much of the camphor imported into China from Southeast Asia at an early date was obtained from *Dryobalanops sumatrensis* (J.F. Gmel.) Kosterm. (synonyms *D. aromatica* C.F. Gaertn.; *D. camphora* Colebr.).[34] At a later date, the Chinese discovered a native source of camphor, the tree *Cinnamomum camphora* (L.) J. Presl. The extraction of camphor from this tree relies on distillation,[35] and is not reported in Chinese sources until about1500.[36] Two centuries earlier, Marco Polo refers to "trees of those which make camphor" in the vicinity of Fuzhou.[37] These would certainly have been *Cinnamomum camphora*. Possibly this mention by Marco is the earliest reference to extraction of camphor from *C. camphora*, but he says nothing of distillation, and might perhaps have been referring to camphor wood. Another important commercial source of camphor is a species of basil.[38] Various other plants which contain significant amounts of camphor include species of the genus *Tanacetum*,[39] *Blumea balsamifera* (L.) DC,[40] and rosemary, *Rosmarinus officinalis* L.[41] The case of the last is interesting, as there are clear differences in the chemicals found in plants of rosemary from different areas. Three or four basic chemotypes are generally recognized, but there are variations within these.[42] It is, in fact, also the case that the chemistry of *Cinnamomum* species is variable within the same species.[43] Analyses of the chemicals occurring in plants of the genus *Achillea* L. growing in Hungary revealed that the chemical content of plants of the same species sometimes varied considerably, depending on the locality where they grew.[44] This probably results from different growing conditions (climate, soil, etc.). Clearly, any one chemical is unlikely to be characteristic of any single plant species, or even plant genus.

A further claim has been made of identification of a flower of *Cinnamomum cassia* at the archaeological site of Heraion on the Greek island of Samos, dating from about the seventh century BCE. This has been said to be an "unequivocal botanical attestation of a South Asian spice in the West",[45] although, in fact, it is admitted that the identification is uncertain: "Die Bestimmung … darf nicht als sicher angesehen werden (The determination … should not be considered certain)".[46] (It must also be noted that *C. cassia* is not native to South Asia, but originates from China.)[47] In any case, the possibility of identifying a species of plant of the family Lauraceae from a single, damaged and incomplete flower[48] is simply out of the question:

> The Chinese species of Lauraceae remain poorly known and difficult to identify. The main reason for this is that for a substantial number of species the fruits or flowers are not known. This makes generic placement of such species uncertain, since most genera are defined by floral characteristics. A second problem is that characters of both flowers and fruits are used in most generic keys and since specimens almost never bear both flowers and fruits, identification is often almost impossible. … The three genera *Machilus*, *Persea* and *Phoebe* cannot be identified adequately by floral characters; they have been separated traditionally by the fruit characters listed … .[49]

It is further stated that vegetative characters are of some use in identifying genera. Indeed, it would be normal for a plant species to be identified on the basis of specimens including at least one complete inflorescence and leaves attached to a stalk. Even then, identification may not be straightforward. Some plant species are highly distinctive and easily identified, but many are not. The family Lauraceae is very large, including about 45 to 50 genera and at least 2,000 species, widespread in tropical and subtropical regions, mainly in Southeast Asia and the Americas.[50] As stated above, the separation of species and genera within the family Lauraceae is often more or less impossible. "Lauraceae are, in respect to classification and species numbers, poorly known".[51]

In spite of a well-defined family circumscription, generic relationships within Lauraceae are very poorly understood. … Van der Werff and Richter … recently proposed a suprageneric classification based only on inflorescence structure and wood and bark anatomy, since other characters adopted for earlier classifications (e.g. number of anther cells, number of stamens, the presence or absence of cupule, and, if present, to what extent the cupule develops) were found to be variable and of little use for determining relationships.[52]

In other words, the characters of individual flowers

[33] SENANAYAKE/WIJESEKERA 2004, 92.
[34] SCHOFF 1922, 355–358; WHEATLEY 1959, 101–105.
[35] NIRMAL BABU/RAVINDRAN/SHYLAJA 2004, 211, 216–222; OISHI 1884, 353–354.
[36] *Zhang nao* (*Zhang* is *Cinnamomum camphora*) first appears in Chinese records in a pharmacopoeia completed in 1505; LIU et al. 1982, *juan* 17, 490. A large and famous pharmacopoeia dating from the late sixteenth century describes the process of distillation in detail; LI 1982, vol. 2, *juan* 34, 1968–1969. It has been suggested that a reference to a distilled camphor product in a ninth-century Arabic source might relate to *Cinnamomum camphora*; DONKIN 1999, 64. This is very improbable.
[37] MARCO POLO 1938, vol. 1, 351. The Latin text of the Zelada manuscript reads: "multe arbores de quibus camphoram faciunt"; MARCO POLO 1938, vol. 2, lv.
[38] LOWMAN/KELLY 1945, 153–154.
[39] HÜSNÜ CAN BAŞER/BETÜL DEMIRCI/TABANCA/ÖZEK/GÖREN 2001, 195–196.
[40] BHUIYAN/CHOWDHURY/BEGUM 2009, 107–109.
[41] CHALCHAT *et alii* 1993, 613, 616.
[42] CHALCHAT *et alii* 1993, 617; NAPOLI/CURCURUTO/RUBERTO 2010, 660–661; PINO/ESTARRÓN/FUENTES 1998, 111–112. Cuban rosemary oil was found to have a particularly high camphor content of almost 35%.
[43] SENANAYAKE/WIJESEKERA 2004, 80.
[44] HÉTHELYI/DÁNOS/TÉTÉNYI 1989, 629–636.
[45] GILBOA/NAMDAR 2015, 272.
[46] KUČAN 1995, 53. A number of Kučan's claims are dubious. For example, it is not certain that okra, *Abelmoschus esculentus* (L.) Moench, originated in Africa, nor that it was "in Indien zu einer wichtigen Nutzpflanze domestiziert" (KUČAN 1995, 33). Okra may have been first domesticated in Egypt, but this is uncertain (DÜZYAMAN 1997, 42; SIEMONSMA 1982, 243).
[47] WU/RAVEN/HONG 2001, 186.
[48] KUČAN 1995, 52–53, Fig. 36b.
[49] WU/RAVEN/HONG 2001, 102.
[50] WU/RAVEN/HONG 2001, 102; HEO/VAN DER WERFF/TOBE 1998, 296.
[51] VAN DER WERFF/RICHTER 1996, 409.
[52] HEO/VAN DER WERFF/TOBE 1998, 296.

of species of the family Lauraceae are of little use for determination of the circumscriptions of genera. The form of the inflorescence is an important diagnostic character in the family,[53] but of course a single flower is useless in this respect. Because of this, and since stamens and anthers, as well as tepals, are more or less completely missing from the flower from Samos, this claimed identification of *C. cassia* cannot be accepted. No clear explanation of how this identification was made is given, only that it was based on morphological characters.[54] Precisely what these were is not stated. It would be much more reasonable to suggest that this flower might be tentatively identified as belonging to a species of the genus *Cinnamomum*, or of a plant of the family Lauraceae. It is most likely to be a flower of *Laurus nobilis* L., the common and widespread Mediterranean species of the family Lauraceae.

In complete contrast to these claims of cinnamon-cassia at archaeological sites, it has been reported that none has been identified at the sites of Roman Myos Hormos or Berenike. "The absence of ginger, cardamom and cinnamon at Roman levels is striking, especially as all three are mentioned in the Alexandrian Tariff and cinnamon (in the form of cassia and cinnamon leaf) also in the *PME* [*Periplus Maris Erythraei*]". Cinnamon-cassia was not found at Islamic levels, either, although ginger and cardamom were. An attempt is made to explain this: "Cinnamon bark and the oil extracted from the leaves (*malabathrum*) are … difficult substances to recognize during excavation unless found in a container".[55] "Oil extracted from the leaves" is probably out of the question, however: malabathron was not oil, but dried leaves. Oil could only have been extracted by a process of distillation. Why cinnamon bark should be difficult to recognize is unclear. The fact almost certainly is that cinnamon-cassia was not there. If "cinnamomum" and "cassia" were present, they were probably not recognized because they were not the same as cinnamon-cassia. It is also clear that more or less all the exotic spices found at Myos Hormos/Kusayr originated from India, not from Southeast Asia or China. A possible exception is what is identified as "fagara", a name which seems to have a variety of applications.[56] Here, the plant concerned has been "tentatively identified as cf. *Tetradium ruticarpum* (A. Juss.) T. G. Hartley".[57] From the published description and photographs of the material so identified, I would suggest that it might belong to a species of *Melicope* J.R. Forst. and G. Forst. It is admitted that the carpels do not match the identification as *Tetradium*.[58] This cannot readily be explained. It is a significant feature from a botanical point of view, and ought to rule out such an identification. The seeds are also stated to be about 4.5–6.2 mm long, significantly larger than those of *Tetradium ruticarpum*.[59]

My own view is that no species of *Tetradium* appears to match the archaeological material very well. There are several genera of the family Rutaceae similar to *Tetradium* Lour., which have often been confused in the past. They include *Euodia* J. R. Forst. and G. Forst., *Fagara* L., *Zanthoxylum* L. and *Melicope* J.R. Forst. and G. Forst. *Melicope lunu-ankenda* (Gaertn.) T.G. Hartley has, at various times, been assigned to the genera *Euodia*, *Fagara*, and *Zanthoxylum*.[60] It is described as having seeds 3–6 mm long, and otherwise seems to resemble the material found at Quseir al-Qadim closely, as far as it is possible to tell from the published description and photographs. This species of *Melicope* is widespread in India and Southeast Asia, from Kerala to Sri Lanka and Nepal, and eastwards across both mainland and island Southeast Asia.[61] Its occurrence close to the Malabar coast (Kerala) would make its presence in the trade between India and the Red Sea entirely plausible.

A document from the Cairo Geniza contains a reference to "*fāghira*', which has been translated "Abyssinian cubeb", although, oddly, it is explained to be "a pungent berry of a Javan shrub".[62] A recent discussion of *fagara* and its etymology[63] does little to clarify the situation. Indeed, it rather adds to confusion. For no very good reasons, it rules out at an early stage all possibility that *fagara* might be anything other than *Zanthoxylum*, and then asserts that only Chinese species of *Zanthoxylum* could be involved. The claim is made that the word *fagara* might have been derived from Chinese *huajiao* 花椒, meaning Sichuan pepper (*Zanthoxylum* spp.). This is supported by citing Chinese dialect pronunciations such as Cantonese *fajiu*. This is utterly fallacious, for these dialect pronunciations are modern, and can have had nothing to do with a borrowing which took place about a millennium ago. During the thirteenth century, the pronunciation of *huajiao* was *xwatsjɛw*.[64] A few centuries earlier, in about 900 CE, it was *xwa:tsiaw*.[65] There is clearly very little similarity to *fagara* or *fāghira*. It can be asserted with a high degree of confidence.that the word *fagara* was not borrowed from Chinese. It is unlikely that *fāghira* was Sichuan pepper, or any other Chinese plant product.

The documents found at the site of Kusayr refer to pepper (Arabic *fulful*, *filfil*) a number of times, but other aromatics and spices are only rarely mentioned. Overall, this "leaves no impression of large-scale trade", even in pepper.[66] There is, then, little indication that aromatics and spices from further east than Sri Lanka were reaching Arabia and the Mediterranean region at any very early date. It is possible to postulate various routes from more distant regions by which they might have travelled, but there is little to suggest that they actually did so. Mention has already been made of the alleged "Cinnamon Route", a direct maritime route across the Indian Ocean from Southeast Asia to Madagascar and the east coast of Africa, from where, it is proposed, cinnamon-cassia could have reached Arabia and the Red Sea, and eventually Egypt and the Mediterranean

[53] WU/RAVEN/HONG 2001, 103.
[54] KUČAN 1995, 53.
[55] VAN DER VEEN 2011, 62–63.
[56] For example, it has been used for *Zanthoxylum fagara* (L.) Sarg. from the southeastern USA, *Fagara cujabensis* Engl. from Bolivia, and for *Zanthoxylum chalybeum* Engl. (synonym *Fagara chalybea* Engl.) from Africa. QUATTROCCHI 2012, 1714, comments that "*Fagara* is the Arabic name used by Avicenna for an unknown plant".
[57] VAN DER VEEN 2011, 55.
[58] VAN DER VEEN 2011, 57.
[59] VAN DER VEEN 2011, 55–57.
[60] WU/RAVEN/HONG 2008, 71.
[61] HARTLEY 2001, 224–228.
[62] GOITEIN/FRIEDMAN 2008, 447. The note on this page also states that *fāghira* has been translated "Lotus of India"!
[63] AUSTIN/FELGER 2008, 567–573.
[64] COBLIN 2007, 156, 172; PULLEYBLANK 1991, 128, 151.
[65] PULLEYBLANK 1991, 128, 151.
[66] GUO 2004, 43.

region. Since contacts between southern India and Arabia are attested by the *Periplus Maris Erythraei*: a more plausible route for cinnamon-cassia would be from South Asia to the Red Sea.[67] In fact, the settlement of Madagascar by Austronesians is now generally believed not to have occurred before the middle of the first millennium CE. Although there is some evidence of human activity on Madagascar about 2,300 years ago,[68] there is no indication whatsoever that the humans of this period were Austronesians. A considerable body of evidence, linguistic, archaeobotanical and genetic, suggests strongly that Austronesians arrived in Madagascar very much more recently, too late for them to have played any role in trade during the classical period.

The date at which Austronesians colonized Madagascar has been much debated in the past, but the general consensus now is that it occurred at some time during the first millennium CE, and most likely after the middle of that millennium.[69] A recent genetic study has concluded that the initial settlement of Madagascar involved only about thirty women, 93% of whom were of Indonesian origin (the others being African), and that "Madagascar was settled approximately 1200 years ago".[70] This dating is supported by linguistic evidence. Some thirty-five loanwords from Sanskrit have been identified in the Malagasy language. Most of them show evidence of having been borrowed via Malay or Javanese, presumably before the ancestors of the Malagasy people left Southeast Asia.[71] The earliest evidence for the use of Sanskrit in Southeast Asia is the series of inscribed stones known as *yūpas* found in eastern Borneo, which date from about 400 CE.[72] It is therefore unlikely that Sanskrit loanwords can have entered Malay or Old Javanese, and then passed on to the language ancestral to Malagasy, much before about 500 CE. It is highly probable that the migration of the Austronesian ancestors of the modern Malagasy people occurred only after that time. This fits well with the arrival of Austronesians in Madagascar at some time about 1200 years ago, or perhaps a century or so earlier.

Recent investigations of plant remains from archaeological sites in eastern Africa, the Comoros Islands and Madagascar have shown that Asian crop plants (principally rice, mung bean and cotton) predominate at sites on Madagascar and the Comoros, but are rare or absent at sites on the mainland. Radiocarbon dates for these crop remains range from about 650 to 1200 CE. It is suggested that Austronesians may have arrived in Madagascar indirectly, after first settling on the African coast or the Comoros Islands.[73] Whatever the case may have been, this evidence indicates that the settlement of Austronesians in Madagascar, direct or indirect, is unlikely to have occurred before about 650 CE. Any East or Southeast Asian products which made their way to the Mediterranean region before this date are likely to have travelled in stages, passed from one merchant to another, via Sri Lanka and southern India.

The question still remains, however, of what the ancient terms "cinnamomum", "kinnamômon (κιννάμωμον)", and "cassia", "kasia (κασία)", really meant. Various classical authors state specifically that these products came from Arabia or Ethiopia.[74] (It should be noted that some early authors may have used "Arabia" in a broad sense, to include regions on the southern side of the Gulf of Aden, so that, in this case, both "Arabia" and "Ethiopia" may have referred to the same area.)[75] If this is so, then they cannot have been cinnamon-cassia, as no species of *Cinnamomum* grows anywhere in Arabia or Africa. The genus is confined to Asia and tropical America.[76] The claim that cinnamon was known and used by the ancient Egyptians can readily be dismissed, as the translation of Egyptian *tyspsy* or *ti-spš* as "cinnamon" is controversial and very little better than hypothetical.[77]

The opinion has been expressed that: "botanists have yet to find conclusive evidence for *Laural* (*sic*) family species in Africa or Arabia. This fact leaves those arguing for non-Far Eastern origins with the unenviable position of first trying to find an Arabian or African species to label 'cinnamon' and 'cassia', and then explain the shift in meaning to the Far Eastern species later on".[78] It is indeed true that no species of the family Lauraceae occurs naturally in Africa. Otherwise, however, this opinion has no value whatsoever. It is certainly possible to find trees and shrubs from Africa and Arabia that might have been *kinnamômon* and *kasia*, and there was, in reality, no continuity in terminology. Casson has claimed that "there is no discernible break in the trade in cassia and cinnamon after the end of the ancient world: both remained commercially available all through the Dark and Middle Ages".[79] Nonetheless, there was considerable argument at an early date about whether ancient "cinnamon" and "cassia" were the same as modern cinnamon-cassia. During the seventeenth century, John Ray discussed the various opinions that had been expressed about this up to his time. His own view was that they were the same, but this was no more than an opinion. The question was clearly a subject of controversy.[80] A serious difficulty was that, before Ray's time, what is now called cinnamon was usually known by a different name, *canella*. This was the normal term for cinnamon in mediaeval Latin,[81] the language of learning throughout most of Europe during the Middle Ages. Indeed, in several European languages, a cognate term is still the normal word for cinnamon.[82] There was, then, a clear change in terminology from classical Latin to mediaeval Latin. This at least raises the possibility that *cinnamomum* and *canella*

[67] CASSON 1984, 190–192.

[68] PEARCE/PEARCE 2010, 73, 77. It may be noted that the supposed "cloves" from Terqa, referred to by PEARCE/PEARCE, 73, have never been positively identified by any expert; see BOIVIN/FULLER 2009, 143. It certainly must be doubted that they are, in fact, cloves.

[69] BEAUJARD 2011, 169–172; RASOLOSON/RUBINO 2005, 456; ADELAAR 2012, 145; ADELAAR 1995, 327–330.

[70] COX/NELSON/TUMONGGOR/RICAUT/SUDOYO 2012, 2766–2767.

[71] ADELAAR 2009, 721, 724–725.

[72] BRONKHORST 2011, 267.

[73] CROWTHER et al. 2016, 6635–6640.

[74] CASSON 1984, 233; SCHOFF 1920, 266–268.

[75] COOLEY 1849, 169–171; RETSÖ 2003, 249.

[76] RAVINDRAN/SHYLAJA/NIRMAL BABU/KRISHNAMOORTHY 2004, 14.

[77] SCHOFF 1920, 263; GILBOA/NAMDAR 2015, 273–274.

[78] VAN ALFEN 2002, 50.

[79] CASSON 1984, 236.

[80] RAY 1688, 1559–1560.

[81] NIERMEYER 1976, 126. There are no entries for either *cinnamomum* or *cassia* in this dictionary.

[82] Latin *canella* means "little reed", a reference to the appearance of cinnamon quills. In other languages the name occurs as: French *cannelle*, Spanish *canela*, Italian *cannella*, Dutch *kaneel*, etc. See RAVINDRAN/NIRMAL BABU 2004,. 2–3. In German, cinnamon is *Zimt*. Note that *canella* refers solely to the appearance of the product, not to its smell or uses. It might well have been applied to different products which looked similar.

were two different things.

That different plant products are easily confused is well shown by what Pietro della Valle says about "una droga nuova, incognita (a new, unknown, drug)" from India, which he saw in Constantinople in 1615. A friend who was a doctor ("un medico amico") called it "cannella nuova (new cinnamon)" because it was somewhat similar to cinnamon ("cannella").[83] Clearly, a "new cinnamon", if it became common and familiar, might well have come to be known simply as "cinnamon". In such wise one plant product might easily replace another. Della Valle also noted that the "Dar Sini" of the Arabs and "Dar Cini" of the Turks and Persians was nothing other than "cannella" from China. True cinnamon, he had heard, had become very scarce in Venice, where it could be found only in "pochissima quantità (very small quantity)".[84] Again, if true cinnamon had become hard to obtain, a substitute might well have replaced it.

Casson has argued that ancient "cinnamon" and "cassia" must have been the same as modern cinnamon-cassia, principally because there are only "very few [trees] whose bark serves as an aromatic."[85] The source he cites for this assertion is a work on "spices and condiments",[86] although he himself noted that "cinnamon" and "cassia" were never used in cooking in the Graeco-Roman world.[87] (In contrast, the Chinese used cassia in cooking from an early date.)[88] Casson left completely out of consideration a large number of woody plants which have bark that is used medicinally, as the ancient "cinnamon" and "cassia" were. He wondered "what other trees could have been the source?"[89] The fact that he could even ask such a question is a clear indication that he entirely failed to appreciate the richness and diversity of the plant world. His question can very easily be answered. One suggestion that has already been made is that the cinnamon of the ancients might have been *Cinnamosma fragrans* Baill., a tree of the family Canellaceae which occurs in Madagascar.[90] This seems possible, but there is another tree of the same family which would have been more accessible, as it is quite widely distributed in eastern Africa, including parts of Ethiopia. *Warburgia ugandensis* Sprague is a tree of small to medium size with fragrant wood, and bark that is often used medicinally. Its fruits and leaves are sometimes used to flavour curries.[91] It would clearly match all the general characteristics of ancient "cinnamon". It is entirely conceivable that bark of this tree might have been carried to ports on the southern side of the Gulf of Aden, the "far-side ports" of the *Periplus Maris Erythraei*.[92]

However, there are problems with identifying either of these two trees with ancient "cinnamon" and "cassia". When Dioscorides' account of the medicinal properties of "cinnamon" and "cassia" is looked at in detail, it soon appears that the medicinal uses of *Cinnamosma* and *Warburgia* do not match them very exactly. In particular, Dioscorides states that cinnamon is abortifacient. Cassia is "fit for eye medicines that are made for clearing the sight". Both cinnamon and cassia remove freckles if mixed with honey and applied to the skin, and both are good against poisons, particularly snakebite. "If there is no cinnamon at hand", then twice as much cassia "will do the same things".[93] Neither *Cinnamosma* nor *Warburgia* are reported to be abortifacient, nor to remove freckles or be useful as eye medicines, although *Warburgia* (but not *Cinnamosma*) is used to treat snakebite.[94] The uses described by Dioscorides do not match the reported medicinal properties of cinnamon-cassia either. Cinnamon bark and oil are mainly used as a carminative and a stomachic, and for the treatment of dyspepsia. Chinese cassia is reported to be used as an astringent, germicide, and antispasmodic, and to treat bronchitis. Other uses include treatment of inflammation of the eye, but otherwise there is little in common with what Dioscorides says of "cinnamon" and "cassia".[95] Indeed, if cinnamon-cassia was abortifacient, it would presumably be unsafe for pregnant women to consume foods flavoured with cinnamon. There is in fact some concern regarding the safety of consumption of cinnamon-cassia (especially of Chinese cassia), but it relates not to any possible abortifacient effect, but to the coumarin content of the spice, which may be carcinogenic and hepatotoxic.[96]

It seems, then, that none of the plants considered above has very similar medicinal uses to those of ancient "cinnamon" and "cassia". There is, however, a woody plant which occurs in eastern Africa, including Somalia and Ethiopia, which is reported to have properties closely matching those described by Dioscorides for "cinnamon" and "cassia". *Cassia abbreviata* Oliv. is a medium-sized shrub or small tree occurring widely in Africa, particularly in the east, from Somalia southward to South Africa. It is drought-tolerant and often occurs in Acacia-Commiphora bushland. Its medicinal uses are many: a decoction prepared from the roots is used to treat gastrointestinal disorders, malaria, gonorrhea, pneumonia and menstrual problems, and as a purgative. The stem bark is used as a cure for dysentery, diarrhoea, toothache, blackwater fever, and abdominal pains, and is an abortifacient. Branches are burnt and the smoke inhaled to relieve headache. Bark and roots are used to treat snakebite. A preparation of the roots made with water is used as an eyewash to cure inflammation.[97] As Dioscorides said of "cinnamon", "it is effective for many things". In fact, the medicinal properties of *Cassia abbreviata* are a good match for those Dioscorides describes for "cinnamon" and "cassia".[98] It seems very likely that *Cassia abbreviata* was the source of ancient "cinnamon" and "cassia", the two being

[83] DELLA VALLE 1650, 214.
[84] DELLA VALLE 1650, 762–763.
[85] CASSON 1984, 236.
[86] REDGROVE 1933.
[87] CASSON 1984, 231.
[88] NEEDHAM 2000, 91.
[89] CASSON 1984, 236.
[90] RAVINDRAN/NIRMAL BABU 2004, 5; the authors state that this species occurs "in the eastern coastal African forests as well as in Madagascar", but it is reported to be a Madagascan endemic (QUÉRO/MOLINIÉ/BRANCOURT/MINASOA/MESNARD 2016, 1056).
[91] MAROYI 2014, 378–383; ORWA *et alii* 2009a, 1, 3.
[92] CASSON 1989, 18, 123.
[93] DIOSCORIDES 2000, 1-12, 1-13, 17–19; DIOSCORIDES 2005, I,13, I,14, 13–16.
[94] BEHRA *et alii* 2009, 486–487; MAROYI 2014, 4–5.
[95] VIJAYAN/AJITHAN THAMPURAN 2004, 259–260; FENG/LIU/LIN/ZHOU 2015, 589–593.
[96] ABRAHAM/WÖHRLIN/LINDTNER/HEINEMEYER/LAMPEN 2010, 228–229.
[97] MONGALO/MAFOKO 2013, 2902–2903; ORWA *et alii* 2009, 1–3; IWU 2014, 173.
[98] DIOSCORIDES 2000, 1-12, 1-13, 17–19; DIOSCORIDES 2005, I,13, I,14, 13–16.

different qualities of material from the same species. It may be noted that Galen claimed that he had himself seen sprigs of "cinnamon" on a "cassia" tree.[99] The *Periplus Maris Erythraei* makes no mention at all of "cinnamon", only of "cassia",[100] suggesting that the difference between them may have been largely artificial. As already noted above, the chemistry of plants can be variable. This may be significant when plants are used medicinally, so that the same species from different localities might have somewhat different effects and therefore be given different names. It is also possible that some material may have come from species closely related to *Cassia abbreviata* (perhaps including plants of the genera *Senna* Mill. and *Chamaecrista* Moench, both formerly included in the genus *Cassia*).[101]

Apart from the similarity of medicinal properties, *Cassia abbreviate* also matches the descriptions of ancient authors in being often a shrub rather than a tree. Theophrastus describes "cinnamon" and "cassia" as shrubs "not of large size ... . Others say that cinnamon is shrubby or rather like an under-shrub".[102] Pliny states that: "the actual shrub of the cinnamon is only about three feet high at the most, the smallest being only a span high ... . Casia also is a shrub, and it grows close to the plains of cinnamon, but on the mountains ... . This shrub grows to a height of 4½ feet"[103] It is worth noting that Pliny seems to have had a reasonably clear idea of where various plant products came from. For example, he gives a good description of the banyan, the "Indian fig-tree", which, he says, "spreads its branches to an enormous width and the bottom ones bend down to the earth so heavily that in a year's time they take root, and produce for themselves a fresh offspring planted in a circle round the parent tree".[104] He also correctly says that the pistachio grew in Bactria, describing it accurately as a tree "that resembles the terebinth in every other respect but the fruit of which is like an almond, though smaller".[105] The terebinth, *Pistacia terebinthus* L., belongs to the same genus as the pistachio, *Pistacia vera* L.[106] He was also fully aware that pepper came from India: "To think that its only pleasing quality is pungency and that we go all the way to India to get this!"[107] More examples could be given. Why Pliny should have had good information about where plant products came from in more or less every case except that of cinnamon and cassia seems quite inexplicable.[108]

At least it is clear that there are plants which grow in the area from which ancient authors believed that cinnamon and cassia came which could have been the sources of these products. There is therefore no necessity to postulate that it was an error to ascribe cinnamon and cassia to northeast Africa, and no reason to believe that the Arabs deliberately deceived their customers about the true origin of these products, as has been claimed.[109] It is only necessary to understand that it is common for the same name to be applied to entirely different plants, and that there are indeed plants which grow in the "Cinnamon Country" of the ancient writers which could have supplied their "cinnamon" and "cassia", and all problems are resolved. Nor is it justifiable to claim that Pliny described cinnamon and cassia being carried by the "Cinnamon Route" to Rhapta.[110] What Pliny actually described was voyaging by raft from the coast around the Horn of Africa to the other side of the Gulf of Aden. He clearly states that the port of destination was Ocilia, on the Arabian side of the Bab el-Mandeb at the entrance to the Red Sea.[111] He does not mention Rhapta. The ascription by Strabo and others of some cinnamon and cassia to India[112] does not necessarily mean that this referred to "true" cinnamon, or to cinnamon-cassia. It is equally possible that the source of Indian cinnamon and cassia was *Cassia fistula* L., the golden shower tree or Indian laburnum. It has long been used medicinally in India and has similar properties to those of *Cassia abbreviata*.[113]

The probability that ancient "cinnamon" and "cassia" were not products from *Cinnamomum* trees may also explain why the Greeks and Romans made no connection between them and malabathron.[114] In later times, malabathron was believed to be leaves of the tree *Cinnamomum tamala* and other *Cinnamomum* species.[115] Again, however, it is questionable if this was so in early times, for Dioscorides clearly states that malabathron was an aquatic floating herb, like duckweed. From his description, and from the medicinal uses which he gives, it seems very likely that his malabathron was *Pistia stratiotes* L., the water lettuce. "It helps inflammation of the eyes ... and it is put among cloths for it keeps them from moths", and is diuretic and good for the stomach. He also says that it has the same properties as nardus, "but does everything more forcibly".[116] Modern reports state that *Pistia* is diuretic and stomachic, and an insecticide. Juice from the leaves is dropped into the eyes. It is also reported to be toxic in large quantities, so might indeed act "more forcibly".[117] There was a clear break in the export of malabathron from India during the Middle Ages, and it was not until the sixteenth century that the Portuguese writer Garcia da Orta identified an Indian product which he thought was malabathron.[118] It seems very likely that his identification was erroneous.

[99] COOLEY 1849, 175; CASSON 1989, 123, suggests that: "The distinction was not, as today, botanical, but purely qualitative: cinnamon was the finer".
[100] COOLEY 1849, 173, 175–176.
[101] LEWIS 1984, 665.
[102] THEOPHRASTUS 1916, 9.5.1–2; 242–243.
[103] PLINY 1960, XII.xlii, xliii, 64–65, 68–69.
[104] PLINY 1960, XII.xi, 16–17.
[105] PLINY 1960, XII.xiii, 18–19.
[106] For a recent discussion of relationships within the small genus Pistacia, see SAGHIR/PORTER 2012, 12–32.
[107] PLINY 1960, XII.xiv, 20–21.
[108] Casson says that Pliny "thought that ginger and cardamom came from Arabia" (CASSON 1989, 123). However, Pliny apparently says that ginger was *cultivated* – "grown on farms" - in "Arabia and the Cave-dwellers' Country" (PLINY 1960, XII.xiv; 20–21). This is by no means impossible. Whether his "cardamomum" was cardamom might be questioned, for it is described as having "four varieties: one very green and oily, with sharp corners and awkward to crumble" which does not sound like cardamom (PLINY 1960,XII. xxix, 36–37).
[109] CASSON 1984, 235; RAVINDRAN/NIRMAL BABU 2004,. 5–6; SCHOFF 1912, 6.
[110] PEARCE/PEARCE 2010, 75.
[111] PLINY 1960, XII.xlii, 64–65. For the location of Ocilia (Okélis), see BEESTON 2005, fig. 2, 54; CASSON 1989, 157–158.
[112] CASSON 1984, 233–234.
[113] QUATTROCCHI 2012, 840; YADAV/JAIN 1999, 293–294.
[114] CASSON 1984, 238.
[115] YULE/BURNELL 1903, 543.
[116] DIOSCORIDES 2000, 1-11, 17; DIOSCORIDES 2005, I, 12, 12–13.
[117] QUATTROCCHI 2012, 2963; BHAGYALEENA/GOPALAN 2012, 34.
[118] LAUFER 1918, 10.

In fact, there is no indication that products of trees of the genus *Cinnamomum* figured at all in trade at an early date, at least in the area around the South China Sea.[119] If Southeast Asia was exporting any kind of cinnamon-cassia, then the Chinese knew nothing about it. The Chinese term for cassia (*Cinnamomum cassia*) and related trees and their products is *gui*.[120] Lists of aromatics involved in trade between China and Southeast Asia never include *gui*. There is only a single occurrence of the character *gui* in Zhao Rukuo's *Zhu fan zhi*, in the combination *qingguimu*, recorded as a product of Hainan Island.[121] Hirth and Rockhill translate this character for character, as "green cassia-wood",[122] but this is certainly wrong. A Song period pharmacopoeia quotes a Tang period work as saying that *qinggui* is another name for *chen xiang*; that is, agarwood.[123] Writing half a century before Zhao Rukuo, Fan Chengda omitted *gui* from a list of aromatics (*xiang*), instead discussing *gui* under the heading of "herbaceous plants and trees (*caomu*)". He noted that it was used as medicine and that people liked to chew the leaves, but said nothing of *gui* being used as an aromatic.[124] Likewise, the two extant Song period monographs on aromatics (*Xiang pu*) do not include *gui* in their lists, except as *qinggui*, agarwood.[125] It would seem that, for the Chinese, *gui* was a culinary spice and a medicine, but not an aromatic. They did not use it as incense.

Other important Chinese works which include information about China's maritime trade, such as Zhou Qufei's *Lingwai dai da* and Zhu Yu's *Pingzhou ke tan*, likewise contain no mention of *gui* as an item of trade.[126] Like Fan Chengda's writings, these both date from the twelfth century. The *Zhu fan zhi* was completed in 1225. All these works are therefore relatively late. However, there is no indication that cinnamon-cassia was traded at any earlier period, either. Studies of early Southeast Asian and Chinese trade contain no mention of cinnamon-cassia. For example, Wolters' study of the trade of Srivijaya, which takes into consideration Chinese sources dating from before the Tang period (618–907), has no entries in the index for cinnamon, cassia or *gui* (although asafoetida, benzoin, camphor, cardamons (*sic*), cloves, lakawood, nutmegs, pepper, and numerous other plant products do appear therein).[127] Wang Gungwu's account of the Nanhai trade from its earliest traceable beginnings to the tenth century includes nothing about cinnamon-cassia. There is only a mention of "cinnamon-insects (*guidu*) ", said to be a delicacy eaten with honey.[128] It might be argued that, since *Cinnamomum cassia* occurs naturally in southern China, the Chinese had no need to import cinnamon-cassia from Southeast Asia. Against this, it must be considered that Southeast Asian cinnamon-cassia was not identical with the Chinese product, as it came from different species of the genus *Cinnamomum*. Indeed, today, the bark of the Southeast Asian *Cinnamomum burmannii* is distinguished from that of *Cinnamomum cassia*, and is called by a different name, *yinxiangpi*, rather than *rougui*.[129] The only reasonable conclusion is that products of trees of the genus *Cinnamomum* (with the possible exception of camphor)[130] did not figure in Chinese and Southeast Asian trade at an early period.

This conclusion is to some extent supported by the documents from the Cairo Geniza. They include a number of references to "cinnamon". In most cases, there is nothing to indicate what exactly this "cinnamon" was, or where it came from, but one document, dating from about 1130, apparently states that it was from Sri Lanka:

On my own account I sent with him sixty bags of Sēlī (Ceylon) cinnamon, each bag weighing 100 pounds, which makes a total of twenty bahārs. Kindly take delivery of one-half of this, too, and sell it for your servant for any price God, the exalted, may apportion.[131]

Of course, this raises almost as many questions as it may answer. Did this "cinnamon" actually originate in Sri Lanka, presumably from *Cinnamomum verum*? Or was it merely bought in Sri Lanka, after it had been shipped there from somewhere else (presumably Southeast Asia or China)? Why was it specified to be "Sēlī cinnamon"? Does this mean that there were other kinds, from other places? There are no clear answers to these questions, but, as cinnamon trees are certainly native to Sri Lanka, it seems likely that this product was indeed bark of *Cinnamomum verum*. At least at this period, then, cinnamon traded in Arabia, and to Egypt and the Mediterranean region, probably came from Sri Lanka, not from Southeast Asia or China.

On the question of different kinds of "cinnamon", it is the case that there are at least three Arabic terms which have been translated either as "cinnamon" or "(Chinese) cassia". These are *qirfa*, *salīkha*, and *dār ṣīnī*. It has been suggested that these three terms were "interchanged or used for the other species", but that *dār ṣīnī* was the common name for both Sri Lankan and Chinese cinnamon-cassia, while *qirfa* was Sri Lankan cinnamon and *salīkha* was Chinese cassia.[132] This is not convincing. *Dār ṣīnī*, as Della Valle stated, was "cannella" from China (see above). *Qirfa* was specifically associated with Sri Lanka in the letter from the Cairo Geniza already quoted. Whether the translation of *salīkha* as "cinnamon" or "Chinese cassia" is correct might be doubted. It is almost certainly the case that identifying ancient *cinnamomum* or

[119] LAUFER 1919, 541–543.

[120] It must be noted, however, that *gui* is ambiguous, and is also used to refer to *Osmanthus fragrans* Lour. This is the case in the Ming-period *Chang wu zhi*, for example (WEN 1984, *juan* 2, 66–67).

[121] ZHAO 2000, *juan xia*, 216.

[122] HIRTH/ROCKHILL 1911, 176.

[123] TANG 1957, *juan* 12, 307. On agarwood and its many names,, see JUNG 2013, 103–125, especially 104 note 3.

[124] FAN 2002, 93–97, 123; FAN 2010, 34–46, 117–120, 237–239, 249–250. The translation "Cinnamon Sea" of the Chinese *guihai* in the title of this work (FAN 2010) is rather fanciful. There are various explanations of *Guihai*, but all agree that it was a general term for the most southerly part of China. During the Song period, it was probably an abbreviation of *Guizhou Nanhai* (modern Guilin and Guangzhou), the chief cities of the province of Guangnan (Guangxi and Guangdong). Fan Chengda held office in Guilin.

[125] HONG 1987; CHEN 1987.

[126] ZHOU 1999; ZHU 2007.

[127] WOLTERS 1967; in the system of romanization used by Wolters, *gui* is written *kuei*.

[128] WANG 1958, 13; BAN 1962, vol. 11, *juan* 95, 3852.

[129] GUOJIA ZHONGYIYAO GUANLIJU « ZHONGHUA BENCAO » BIANWEIHUI 1999, vol. 3, 27, 34.

[130] As already stated above, camphor can be obtained from numerous different plants.

[131] GOITEIN 1973, 181, 185; GOITEIN/FRIEDMAN 2008, 371, 375–376. The original Arabic for "Ceylon cinnamon" is *qirfa sīlī*. There is some uncertainty that *sīlī* refers to Sri Lanka.

[132] LEV/AMAR 2008, 143–144.

kinnamômon (or Hebrew QNMWN) with *qirfa*[133] is an error, exactly as identifying them with cinnamon-cassia is. It seems possible that *salīkha* really refers to the genus *Cassia* rather than to "(Chinese) cassia" (*Cinnamomum cassia*). The equivalent of this term in Late Latin, Old Occitan and Old Catalan is reported to have been *Cassia lignea*, "woody cassia".[134] This would describe twigs and branches of *Cassia* better than bark of *Cinnamomum*. In any event, there is little reason to feel confident that the generally accepted translations are correct.

In conclusion, it may confidently be stated that ancient "cinnamon" and "cassia" are very unlikely to have been the same as modern cinnamon and cassia, in the sense of products obtained from trees of the genus *Cinnamomum*. The arguments in favour of such an identification are very weak and can readily be refuted. Claims that remains of cinnamon-cassia have been found at archaeological sites in the Mediterranean region are highly dubious. It is very probable that early writers such as Theophrastus, Pliny and Dioscorides were generally correct in what they said about "cinnamon" and "cassia". These products came from a shrub which grew in the Horn of Africa. *Cassia abbreviata* is most probably the true source of ancient "cinnamon" and "cassia". There was no "Cinnamon Route", and there was .no early long-distance trade in Chinese cassia, and probably not in any similar product from Southeast Asia. It is unlikely that Southeast Asians were directly involved in trade in the western Indian Ocean at any very early date.

Those who believed that ancient "cinnamon" and "cassia" were identical with modern cinnamon-cassia failed to look at the available evidence sufficiently closely. They assumed that ancient writers were wrong about where "cinnamon" and "cassia" originated, and also wrong to describe the plants from which they came as shrubs. They ignored the fact that the uses of "cinnamon" and "cassia", as described by authors such as Dioscorides, do not match those of cinnamon-cassia. It is of course always possible that there are errors in historical source material, but to assume that there are multiple errors, without very careful consideration, is simply poor historical methodology. Which is more likely, that writers such as Theophrastus, Pliny, Dioscorides and others were all seriously wrong about "cinnamon" and "cassia", or that ancient "cinnamon" and "cassia" were not the same as modern cinnamon-cassia? The answer to this question is very simple: it is highly improbable that ancient "cinnamon" and "cassia" were the same as cinnamon-cassia. They were almost certainly not products of trees of the genus *Cinnamomum*, but rather were derived from shrubs of the genus *Cassia*. Historians who lack botanical knowledge should be wary of making claims relating to plants and plant products. Very great care always needs to be taken to verify identifications of plants referred to in early works.

[133] BOS/HUSSEIN/MENSCHING/SAVELSBERG 2011, 453.
[134] BOS/HUSSEIN/MENSCHING/SAVELSBERG 2011, 466.

REFERENCES

ABRAHAM/WÖHRLIN/LINDTNER/HEINEMEYER/LAMPEN 2010
Abraham, K./Wöhrlin, F./Lindtner, O./Heinemeyer, G./Lampen, A., Toxicology and risk assessment of coumarin: focus on human data, *Molecular Nutrition and Food Research* 54, 228–239.

ADELAAR 1995
Adelaar, A., Asian Roots of the Malagasy: a linguistic perspective, *Bijdragen tot de Taal-, Land- en Volkenkunde* 151, 325–356.

ADELAAR 2009
Adelaar, A., Loanwords in Malagasy. In: Haspelmath, M./Tadmor, U. (eds.), *Loanwords in the World's Languages: a comparative handbook* (Berlin: De Gruyter Mouton), 717–746.

ADELAAR, 2012
Adelaar, A., Malagasy Phonological History and Bantu Influence, *Oceanic Linguistics* 51, 123–159.

ADSHEAD 2000
Adshead, S.A.M., *China in World History* (3rd Edition) (Basingstoke, Palgrave).

AUSTIN/FELGER 2008
Austin, D.F./Felger, R.S., Sichuan Peppers and the Etymology of *Fagara* (Rutaceae), *Economic Botany* 62, 567–573.

BAN GU 1962
Ban Gu 班固, *Han shu* 漢書 (Beijing: Zhonghua shuju).

BEAUJARD 2011
Beaujard, P., The First Migrants to Madagascar and their Introduction of Plants: linguistic and ethnological evidence, *Azania: Archaeological Research in Africa* 46, 169–189.

BEESTON 2005
Beeston, A.F.L., The Arabian Aromatics Trade in Antiquity, *Proceedings of the Seminar for Arabian Studies*, 53–64.

BEHRA *et alii* 2009
Behra, O./Danthu, P./Sarter, S./Radaniela, R./Fourcade, C./Randrianarivelo, R./Ranaivosoa, B./Arnal-Schnebelen, B., Saro (*Cinnamosma fragrans* Baillon) Essential Oil: application in health and medicine. In: Juliani, H.R./Simon, J.E./Ho C.-T.(eds.), *African Natural Plant Products: new discoveries and challenges in chemistry and quality*. ACS Symposium Series, 1021 (Oxford: Oxford University Press), 485–494.

BHAGYALEENA/GOPALAN 2012
Bhagyaleena, P./Gopalan, R. Aquatic medicinal plants in ponds of Palakkad, Kerala, India, *IOSR Journal of Pharmacy and Biological Sciences* 2, 29–35.

BHUIYAN/CHOWDHURY/BEGUM 2009
Bhuiyan, M.N.I./Chowdhury, J.U./Begum, J., Chemical Components in Volatile Oil from *Blumea balsamifera* (L.) DC, *Bangladesh Journal of Botany* 39, 107–109.

BOIVIN/FULLER 2009
Boivin, N./Fuller, D.Q., Shell Middens, Ships and Seeds: Exploring Coastal Subsistence, Maritime Trade and the Dispersal of Domesticates in and around the Ancient Arabian Peninsula, *Journal of World Prehistory* 22, 113–180.

BOS/HUSSEIN/MENSCHING/SAVELSBERG 2011
Bos, G./Hussein, M./Mensching, G./Savelsberg, F. *Medical Synonym Lists from Medieval Provence: Shem Tove ben Isaac of Tortosa, Sefer ha-Shimmush, Book 29*, Part 1, *Edition and Commentary of List 1 (Hebrew – Arabic - Romance/Latin* (Leiden: Brill).

BRONKHORST 2011
Bronkhorst, J., The spread of Sanskrit in Southeast Asia. In: Manguin, P.Y./Mani, A./Wade, G. (eds.), *Early Interactions between South and Southeast Asia: reflections on cross-cultural exchange* (Singapore: ISEAS), 263–275.

BULLIET 2010
Bulliet, R.W., *Cotton, Climate and Camels in Early Islamic Iran: a moment in world history* (New York: Columbia University Press).

CASSON 1984
Casson, L., *Ancient Trade and Society* (Detroit: Wayne State

University Press).
CASSON 1989
Casson, L., *Periplus Maris Erythraei: text with introduction, translation, and commentary* (Princeton: Princeton University Press).
CHALCHAT *et alii* 1993
Chalchat, J.-C./Garry, R.-P./Michet, A./Benjilali, B./Chabart, J.L. Essential Oils of Rosemary (*Rosmarinus officinalis* L.). The Chemical Composition of Oils of Various Origins (Morocco, Spain, France),.*Journal of Essential Oil Research* 5, 613–618.
CHEN 1987
Chen Jing 陳敬. *Xiang pu* 香譜, 4 *juan*. In: *Wenyuange Siku quanshu*, *Zi bu*, vol. 844, (Taibei: Shangwu yinshuguan), 239–347.
COBLIN 2007
Coblin, W. S., *A Handbook of 'Phags-pa Chinese* (Honolulu: University of Hawai'i Press).
COOLEY 1849
Cooley, W. D. On the *Regio Cinnamomifera* of the ancients, *Journal of the Royal Geographical Society of London* 19, 166–191.
COUNSELL 2008
Counsell, D.J., Intoxicants in Ancient Egypt? Opium, nymphea, coca, and tobacco. In: David, A.R. (ed.), *Egyptian Mummies and Modern Science* (Cambridge: Cambridge University Press), 195–215.
COX/NELSON/TUMONGGOR/RICAUT/SUDOYO 2012
Cox, M. P./Nelson, M.G./Tumonggor, M.K./Ricaut, F.-X./Sudoyo, H. A small cohort of island Southeast Asian women founded Madagascar, *Proceedings of the Royal Society B* 279, issue 1739, 2761–2768.
CROWTHER 2016
Crowther, A., *et alii*., Ancient Crops Provide First Archaeological Signature of the Westward Austronesian Expansion, *Proceedings of the National Academy of Sciences* 113, 6635–6640.
DELLA VALLE 1650
Della Valle, P., *Viaggi di Pietro della Valle il pellegrino, con minuto ragguaglio di tutti le cose notabili osservati in essi …* (Roma: Mascardi).
DIOSCORIDES 2000
Dioscorides, *De Materia Medica: being an herbal with many other medicinal materials, written in Greek in the first century of the Common Era*, edited by T.A. Osbaldeston and R.P.A. Wood (Johannesburg: Ibidis).
DIOSCORIDES 2005
Dioscorides, Pedanius, of Anazarbus, *De Materia Medica*, translated by L.Y. Beck (Hildesheim: Olms-Weidmann).
DONKIN 1999
Donkin, R.A., *Dragon's Brain Perfume: an Historical Geography of Camphor* (Leiden: Brill).
DÜZYAMAN 1997
Düzyaman, E. Okra: Botany and Horticulture. In: Janick, J. (ed.), *Horticultural Reviews*, Vol. 21 (New York: Wiley), 41–72.
FAN 2002
Fan Chengda, *Guihai yuheng zhi*. In: *Fan Chengda biji liu zhong* (Beijing: Zhonghua shuju), 71–177.
FAN 2010
Fan Chengda, *Treatises of the Supervisor and Guardian of the Cinnamon Sea: the natural world and material culture of 12th century South China*, translated by James M. Hargett (Seattle: University of Washington Press).
FENG/LIU/LIN/ZHOU 2015
Feng, Tingting/Liu, Xiongli/Lin, Bing/Zhou, Ying, *Cinnamomum cassia* Presl. (Rougui, cassia bark tree). In: Liu, Yanze/Wang, Zhimin/Zhang, Junzeng (eds.), *Dietary Chinese herbs: chemistry, pharmacology and clinical evidence* (Wien: Springer), 587–595.
GILBOA/NAMDAR 2015
Gilboa, A./Namdar, D., On the Beginnings of South Asian Spice Trade with the Mediterranean Region: A Review, *Radiocarbon* 57, 265–283.
GLEDHILL 2008
Gledhill, D., *The Names of Plants* (4th Edition), (Cambridge: Cambridge University Press).
GOITEIN 1973
Goitein, S.D., *Letters of Medieval Jewish Traders* (Princeton: Princeton University Press).
GOITEIN/FRIEDMAN 2008
Goitein, S.D./Friedman, M.A., *India Traders of the Middle Ages: Documents from the Cairo Geniza ('India Book')* (Leiden: Brill).
GUO 2004
Guo, Li, *Commerce, Culture, and Community in a Red Sea Port in the Thirteenth Century: the Arabic Documents from Quseir* (Leiden: Brill).
GUOJIA ZHONGYIYAO GUANLIJU « ZHONGHUA BENCAO » BIANWEIHUI 1999
Guojia Zhongyiyao guanliju « Zhonghua bencao » bianweihui, (ed.), *Zhonghua bencao*, 10 vols. (Shanghai: Kexue jishu chubanshe).
HARTLEY 2001
Hartley, T.G., On the Taxonomy and Biogeography of *Evodia* and *Melicope* (Rutaceae), *Allertonia* 8, 1–328.
HEO/VAN DER WERFF/TOBE 1998
Heo, K./Van der Werff, H./Tobe, H., Embryology and Relationships of Lauraceae (Laurales), *Botanical Journal of the Linnaean Society* 126, 295–322.
HÉTHELYI/DÁNOS/TÉTÉNYI 1989
Héthelyi, É./Dános, B./Tétényi, P. Phytochemical Studies on the Essential Oils of Species Belonging to the *Achillea* Genus by Gas Chromatography/Mass Spectrometry, *Biomedical and Environmental Mass Spectrometry* 18, 629–636.
HIRTH/ROCKHILL 1911
Hirth, F./Rockhill, W.W., *Chau Ju-kua: his work on the Chinese and Arab trade in the twelfth and thirteenth centuries, entitled Chu-Fan-Chï* (St. Petersburg: Imperial Academy of Sciences).
HONG 1987
Hong Zou, *Xiang pu*, 2 *juan*. In: *Wenyuange Siku quanshu*, *Zi bu*, vol. 844 (Taibei, Shangwu yinshuguan), 217–237.
HÜSNÜ CAN BAŞER/BETÜL DEMIRCI/TABANCA/ÖZEK/GÖREN 2001
Hüsnü Can Başer/Betül Demirci, K./Nurhayat Tabanca/Temel Özek/Nezhun Gören Composition of the essential oils of *Tanacetum armenum* (DC.) Schultz Bip., *T. balsamita* L., *T. chiliophyllum* (Fisch. & Mey.) Schultz Bip. var. *chiliophyllum* and *T. haradjani* (Rech. fil.) Grierson and the enantiomeric distribution of camphor and carvone, *Flavour and Fragrance Journal* 16, 195–200.
INTERNATIONAL ASSOCIATION FOR PLANT TAXONOMY 2012
International Association for Plant Taxonomy, *International Code of Nomenclature for Algae, Fungi, and Plants* (*Melbourne Code*), http://www.iapt-taxon.org/nomen/main.php. Accessed 23 July 2016.
IWU 2014
Iwu, M.M., *Handbook of African Medicinal Plants* (2nd. Edition), (Boca Raton: CRC).
JUNG 2013
Jung, D. The Cultural Biography of Agarwood – perfumery in eastern Asia and the Asian neighbourhood, *Journal of the Royal Asiatic Society* 23, 103–125.

KEIGHTLEY 1978
Keightley, D.N., *Sources of Shang History: The Oracle Bone Inscriptions of Bronze Age China* (Berkeley: University of California Press).
KHAN/ABOURASHED 2010
Khan, I.A./ Abourashed, E.A., *Leung's Encyclopedia of Common Natural Ingredients Used in Food, Drugs and Cosmetics* (3rd. Edition), (Hoboken: Wiley).
KIPLE 2007
Kiple, K.F. *A Movable Feast: Ten Millennia of Food Globalization* (Cambridge: Cambridge University Press).
KRESS/DEFILIPPS/FARR/KYI 2003
Kress, W.J./DeFilipps, R.A/Farr, E./Kyi, D.Y.Y. *A Checklist of the Trees, Shrubs, Herbs, and Climbers of Myanmar* (Washington, DC: Dept. of Systematic Biology – Botany, National Museum of Natural History).
KRISHNAMOORTHI/REMA 2004
Krishnamoorthi, B./Rema, J., End Uses of Cinnamon and Cassia. In: Ravindran, P.N./ Nirmal Babu, K./Shylaja, M. (eds.), *Cinnamon and Cassia: the genus Cinnamomum* (Boca Raton: CRC), 311–326.
KUČAN 1995
Kučan, D. Zur Ernährung und dem Gebrauch von Pflanzen im Heraion von Samos im 7. Jahrhundert v. Chr., *Jahrbuch des Deutschen Archäologischen Instituts* 110, 1–64.
LAUFER 1918
Laufer, B. Malabathron, *Journal Asiatique*, 11e série, 12, 5–49.
LAUFER 1919
Laufer, B., *Sino-Iranica: Chinese contributions to the history of civilization in ancient Iran* (Chicago: Field Museum of Natural History).
LEV/AMAR 2008
Lev, E./Amar, Z. *Practical Materia Medica of the Medieval Eastern Mediterranean According to the Cairo Genizah* (Leiden: Brill).
LEWIS 1984
Lewis, G.P., Review of Howard S. Irwin and Rupert C. Barneby, *The American Cassiinae: a synoptical revision of Leguminosae tribe Cassieae subtribe Cassiinae in the New World* in Memoirs of the New York Botanical Garden Volume 35 (in two parts) … , *Kew Bulletin* 39, 664–666.
LI 1982
Li Shizhen, *Bencao gangmu*, 2 vols. (Beijing: Renmin weisheng chubanshe).
LIU 1982
Liu Wentai et al., *Bencao pinhui jingyao* (Beijing: Renmin weisheng chubanshe).
LOWMAN/KELLY 1945
Lowman, M.S./Kelly, J.W. Camphor from Camphor Basil (*Ocimum kilimandscharicum* Guerke), *Journal of the American Pharmaceutical Association* 34, 153–162.
MARCO POLO 1938
Marco Polo, *The Description of the World*, edited and translated by A.C. Moule and Paul Pelliot, 2 vols. (London: Routledge).
MAROYI 2014
Maroyi, A., The genus *Warburgia*; a review of its traditional uses and pharmacology, *Pharmaceutical Biology* 52, 378–391.
MILLER 1969
Miller, J.I., *The Spice Trade of the Roman Empire, 29 B.C.–A.D. 641* (Oxford: Clarendon Press).
MONGALO/MAFOKO 2013
Mongalo, N.I./Mafoko, B.J., *Cassia abbreviata* Oliv. a review of its ethnomedicinal uses, toxicology, phytochemistry, possible propagation techniques and pharmacology, *African Journal of Pharmacy and Pharmacology* 7, 2901–2906.
MORSE 1974
Morse, L.E., Computer-assisted Storage and Retrieval of the Data of Taxonomy and Systematics, *Taxon* 23, 29–43.
NAMDAR *et alii* 2013
Namdar, D./Gilboa, A./Neumann, R./Finkelstein, I./ Weiner, S. Cinnamaldehyde in Early Iron Age Phoenician Flasks Raises the Possibility of Levantine Trade with South East Asia, *Mediterranean Archaeology and Archaeometry* 13, 1–19.
NAPOLI/CURCURUTO/RUBERTO 2010
Napoli, E.M./Curcuruto, G./Ruberto, G., Screening of the Essential Oil Composition of Wild Sicilian Rosemary, *Biochemical Systematics and Ecology* 38, 659–670.
NEEDHAM 2000
Needham, J., *Science and Civilisation in China*, vol. 6, *Biology and biological technology*, part 5, *Fermentations and food science*, by H.T. Huang (Cambridge: Cambridge University Press).
NIERMEYER 1976
Niermeyer, J.F., *Mediae Latinitatis Lexicon Minus* (Leiden: Brill).
NIRMAL BABU/RAVINDRAN/SHYLAJA 2004
Nirmal Babu, K./Ravindran, P. N./Shylaja, M., Camphor Tree. In: Ravindran, P.N./Nirmal Babu, K./Shylaja, M. (eds.), *Cinnamon and Cassia: the genus Cinnamomum* (Boca Raton: CRC), 211–238.
OISHI 1884
Oishi, H., On Japanese Camphor - its Preparation, Experiments and Analyses of Camphor Oil, *Journal of the Society of Chemical Industry* 3, 353–354.
ORWA *et alii* 2009
Orwa, C./Mutua, A./Kindt, R./Jamnadass, R./ Anthony, S., *Agroforestree database: a tree reference and selection guide*, version 4.0, *Cassia abbreviate*, http://www.worldagroforestry.org/treedb/AFTPDFS/Cassia_abbreviata.PDF. Accessed 18 September 2016.
ORWA *et alii* 2009a
Orwa, C./Mutua, A./Kindt, R./Jamnadass, R./Anthony, S., *Agroforestree database: a tree reference and selection guide*, version 4.0, *Warburgia ugandensis*, http://www.worldagroforestry.org/treedb/AFTPDFS/Warburgia_ugandensis.PDF. Accessed 18 September 2016.
PARKER 2002
Parker, G., *Ex Oriente Luxuria*: Indian Commodities and Roman Experience, *Journal of the Economic and Social History of the Orient* 45, 40–95.
PEARCE/PEARCE 2010
Pearce, C.E.M./Pearce, F.M., *Oceanic Migration: Paths, Sequence, Timing and Range of Prehistoric Migration in the Pacific and Indian Oceans* (Dordrecht: Springer).
PINO/ ESTARRÓN/FUENTES 1998
Pino, J.A./Estarrón, M./Fuentes, V., Essential Oil of Rosemary (*Rosmarinus officinalis* L.) from Cuba, *Journal of Essential Oil Research* 10, 111–112.
PLINY 1960
Pliny, *Natural History*, vol. 4, translated by H. Rackham (London: Heinemann).
PULLEYBLANK 1991
Pulleyblank, E.G., *Lexicon of Reconstructed Pronunciation in Early Middle Chinese, Late Middle Chinese, and Early Mandarin* (Vancouver: University of British Columbia Press).
QUATTROCCHI 2012
Quattrocchi, U., *CRC World Dictionary of Medicinal and Poisonous Plants: Common Names, Scientific Names, Eponyms,*

Synonyms, and Etymology (Boca Raton: CRC).

QUÉRO/MOLINIÉ/BRANCOURT/MINASOA/MESNARD 2016
Quéro, A./Molinié, R./Brancourt, D./Minasoa, J.R./Mesnard, F., Sesquiterpene composition of *Cinnamosma fragrans*: a Malagasy endemic plant used in traditional medicine, *Comptes Rendus Chimie* 19, 1056–1061.

RASOLOSON/RUBINO 2005
Rasoloson, J./Rubino, C., Malagasy. In: Adelaar, A./Himmelmann, N.P. (eds.), *The Austronesian Languages of Asia and Madagascar* (London: Routledge), 456–488.

RAVINDRAN/NIRMAL BABU 2004
Ravindran, P.N./Nirmal Babu, K., Introduction. In: Ravindran, P.N./Nirmal Babu, K./Shylaja, M. (eds.), *Cinnamon and Cassia: the genus Cinnamomum* (Boca Raton: CRC), 1–13.

RAVINDRAN/SHYLAJA/NIRMAL BABU/KRISHNAMOORTHY 2004
Ravindran, P.N./Shylaja, M./Nirmal Babu, K./Krishnamoorthy, B., Botany and Crop Improvement of Cinnamon and Cassia. In: Ravindran, P.N./Nirmal Babu, K./Shylaja, M. (eds.), *Cinnamon and Cassia: the genus Cinnamomum* (Boca Raton: CRC), 14–79.

RAY 1688
Ray, J., *Historiae Plantarum*, vol. 2 (London: Faithorne).

REDGROVE 1933
Redgrove, H.S., *Spices and condiments* (London: Pitman).

RETSÖ 2003
Retsö, J., *The Arabs in Antiquity: Their History from the Assyrians to the Umayyads* (London: RoutledgeCurzon).

ROYAL BOTANIC GARDENS, KEW/MISSOURI BOTANICAL GARDEN 2013
Royal Botanic Gardens, Kew and Missouri Botanical Garden, *The Plant List: a working list of all plant species*, http://www.theplantlist.org. Accessed 03 January 2017.

SAGHIR/PORTER 2012
Saghir, M.G. Al-/Porter, D.M., Taxonomic Revision of the Genus *Pistacia* L. (Anacardiaceae), *American Journal of Plant Sciences* 3, 12–32.

SATO/TAKAGI/AOKI/NOYORI 1998
Sato, K./Takagi, J./Aoki, M./Noyori, R., Hydrogen Peroxide Oxidation of Benzylic Alcohols to Benzaldehydes and Benzoic Acids under Halide-free Conditions, *Tetrahedron Letters* 39, 7549–7552.

SCHOFF 1912
Schoff, W.H., *The Periplus of the Erythraean Sea: Travel and Trade in the Indian Ocean by a Merchant of the First Century* (New York: Longmans, Green & Co.).

SCHOFF 1920
Schoff, W.H., Cinnamon, Cassia and Somaliland, *Journal of the American Oriental Society* 40, 260–270.

SCHOFF 1922
Schoff, W.H., Camphor, *Journal of the American Oriental Society* 42, 355–370.

SCOTLAND 2002
Scotland, R., Editorial, *Oxford Plant Systematics* 9, 2–3;

SENANAYAKE/WIJESEKERA 2004
Senanayake, U.M./Wijesekera, R.O.B., Chemistry of Cinnamon and Cassia. In: Ravindran, P.N./Nirmal Babu, K./Shylaja, M. (eds.), *Cinnamon and Cassia: the genus Cinnamomum* (Boca Raton: CRC), 80–120.

SHANG 2008
Shang Zhijun, *Shennong bencao jing jiaozhu* (Beijing: Xueyuan chubanshe).

SHERIFF 1981
Sheriff. A.M.H., The East African Coast and its Role in Maritime Trade. In: Mokhtar, G. (ed.), *General History of Africa*, vol. 2, *Ancient Civilizations of Africa* (Paris: UNESCO), 551–567.

SIEMONSMA 1982
Siemonsma, J.S., West African Okra – Morphological and Cytogenetical Indications for the Existence of a Natural Amphidiploid of *Abelmoschus esculentus* (L.) Moench and *A. manihot* (L.) Medikus, *Euphytica* 31, 241–252.

TANG 1957
Tang Shenwei, *Chongxiu Zhenghe jingshi zhenglei beiyong bencao* [facsimile of 1249 edition] (Beijing: Renmin weisheng chubanshe).

THEOPHRASTUS 1916
Theophrastus, *Enquiry into plants*, vol. 2, translated by A. Hort (London: Heinemann).

VAN ALFEN 2002
Van Alfen, P.G., *Pant'agatha*: Commodities in Levantine-Aegean Trade during the Persian Period, 6–4th c. B.C. PhD thesis, University of Texas at Austin.

VAN DER VEEN 2011
Van der Veen, M., *Consumption, Trade and Innovation: Exploring the Botanical Remains from the Roman and Islamic Ports at Quseir al-Qadim, Egypt*, Journal of African Archaeology Monograph Series 6, (Frankfurt am Main: Africa Magna Verlag).

VAN DER WERFF/RICHTER 1996
Van der Werff, H./Richter, H.G., Toward an Improved Classification of Lauraceae, *Annals of the Missouri Botanical Garden* 83, 409–418.

VIJAYAN/AJITHAN THAMPURAN 2004
Vijayan, K.K./Ajithan Thampuran, R.V., Pharmacology and toxicology of cinnamon and cassia. In: Ravindran, P.N./Nirmal Babu, K./Shylaja, M. (eds.), *Cinnamon and Cassia: the genus Cinnamomum* (Boca Raton: CRC), 259–284.

WANG 1958
Wang Gungwu, The Nanhai Trade: a study of the early history of Chinese trade in the South China Sea, *Journal of the Malayan Branch of the Royal Asiatic Society* 31, 1–135.

WEN 1984
Wen Zhenheng., *Chang wu zhi jiaozhu* (Nanjing: Jiangsu kexue jishu chubanshe).

WHEATLEY 1959
Wheatley, P., Geographical Notes on Some Commodities involved in Sung Maritime Trade, *Journal of the Malayan Branch of the Royal Asiatic Society* 32, 4–140.

WIGHT 1840
Wight, R., On the *Laurus cassia* of Linnaeus, and the plants producing the cassia bark of commerce, *Annals of Natural History; or, Magazine of Zoology, Botany, and Geology* 4, 179–185.

WOLTERS 1967
Wolters, O.W., *Early Indonesian Commerce: a study of the origins of Srivijaya* (Ithaca: Cornell University Press).

WOOD 2002
Wood, J., Three Days Plant Collecting in Eastern Bolivia, *Oxford Plant Systematics* 9, 10–12.

WU/RAVEN/HONG 2001
Wu Zhengyi/Raven, P.H./Hong Deyuan (eds.), *Flora of China*, vol. 7 (St Louis and Beijing: Missouri Botanical Garden Press/Science Press).

WU/RAVEN/HONG 2008
Wu Zhengyi/Raven, P.H./Hong Deyuan (eds.), *Flora of China*, vol. 11 (St Louis and Beijing: Missouri Botanical Garden Press/Science Press).

YADAV/JAIN 1999
Yadav, R./Jain, G.C., Antifertility effect of aqueous extract of seeds of *Cassia fistula* in female rats, *Advances in Contraception* 15, 293–301.

YULE/BURNELL 1903
Yule, H./Burnell, A.C., *Hobson-Jobson: a glossary of colloquial Anglo-Indian words and phrases, and of kindred terms, etymological, historical, geographical and discursive*, new edition, ed. William Crooke (London: Murray).

ZHAO 2000
Zhao Rukuo, *Zhu fan zhi jiaoshi*, annotated by Yang Bowen (Beijing: Zhonghua shuju).

ZHOU 1999
Zhou Qufei, *Lingwai dai da jiaozhu*, annotated by Yang Wuquan (Beijing: Zhonghua shuju).

ZHU 2007
Zhu Yu, *Pingzhou ke tan*, edited by Li Weiguo (Beijing: Zhonghua shuju).