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NON-NATIVE HERBAL MATERIA MEDICA IN GREEK TEXTS OF THE ROMAN PERIOD

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SUMMARY

The import of expensive fragrances and medicines from distant markets reached a peak during the Roman period. Greek texts allow to have an idea of the importance and uses of this non-native herbal materia medica in the Mediterranean world. Based on a search on ancient texts, the present article provides a first catalogue of these products, elucidates their origin according to the ancient physicians, and crosschecks ancient information with modern knowledge. This approach brings to light a world connected through a network of trade routes, on which traveled not only the products themselves, but an extensive knowledge on their preparation and applications in an actual mosaic of cultures.

Introduction

Even with the *Pax Romana* ensuring some level of safety, at least in a part of a very long journey, risk was very real for the traders traveling from the Mediterranean to East Africa or India and back. Risk not just for the cargo, but also for the sailors. Trade items should have been worth the risk and the investment. Maybe this was expected for precious metals and gemstones, but what was the real value of spices and aromatic materials? The demand for, and eagerness of wealthy Romans to obtain them should have been high enough to ensure the profits and continuity of such a trade. The Roman world must have

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had some fascination or enchantment for the African and Oriental fragrances, so as to consider them essentials. Pliny the Elder (23/24 CE-79 CE) complained (*Naturalis Historia*, henceforth *NH*, 6.26.5) that "The subject is one well worthy of our notice, seeing that in no year does India drain our empire of less than five hundred and fifty millions of sesterces, giving back her own wares in exchange, which are sold among us at fully one hundred times their prime cost." This financial burden of luxury imports could be lightheartedly attributed to the lustful Roman women or the extravaganzas of wealthy men, if there was not a long medical and cosmetic tradition rooted in the cultural exchanges in the Eastern Mediterranean, especially between Egypt and Greece.

Obsession with aromatics was definitely not a new Roman vice. Again according to Pliny (*NH*, 12.32.3), when still a boy, Alexander the Great loaded altars with frankincense in the greatest prodigality, upon which his tutor Leonides remarked, when he had conquered the countries that produced frankincense, that it would be time to worship the gods in such a lavish manner. After Alexander had conquered Arabia, he dispatched to Leonides a ship freighted with frankincense, and sent him a message, requesting that he would now worship the gods without stint or limit[1].

It was not just the gods who were demanding aromatic substances. Medical texts give a picture of a vibrant and elegant production of standardized compound medicines or perfumed oils and other cosmetics. Perfumers (*murepsoi*), the wizards of this *pandaisia* of smells, had already played an important role in the Mediterranean cultures for centuries before the dominance of the Roman Empire. At the background, physicians trained in Greek medicine and philosophy in Pergamos, Athens or Alexandria (a route followed by Galen himself in his medical and pharmaceutical education), appreciated the powerful warmth, pungency and aromas in treatment of disease. These potent medicines could dynamically warm, dry, cause sweat-

ing and expel wind or pathogenic moisture from the body. In the physicians' eyes the imported fragrant medicines were gifted with some rare properties. According to Galen (129-after 216 [?] CE[2]), the aromatic quality itself was directly connected with the tenuous property (*leptomeres*). This meant that the specific herbs that could be easily powdered and dissipated in thin parts, were able to penetrate deeper levels of the body. Potency or the combination of properties was even more important, like in the case of Arabic bdellium (Galen, *De simplicium medicamentorum temperamentis ac facultatibus*, henceforth *DSMTF*, 11.849.18 Kühn), a powerfully softening medicine, more drying than the rest of its category. Pliny (*NH*, 12.14) would grumble about the fascination for pepper: "its only desirable quality being a certain pungency; and yet it is for this that we import it all the way from India!" Galen (*DSMTF*, for example at 11.398.14 Kühn) would disagree, praising its powerful combination of warming and drying virtues.

Anyone willing to study the medicinal products imported in the Roman world should start his or her journey with Dioscorides' (1st century CE) *De materia medica* (henceforth *DMM*), and then proceed with Galen's *DSMTF*. In this essay, besides these two fundamental texts, the following other authors have been consulted (listed here in chronological order), from the *Corpus Hippocraticum* (henceforth *CorpHipp*[3]), the corpus of writings attributed to Aristotle (384-322 BCE) (henceforth *CorpArist*) and Theophrastus (ca 340-287/6 BCE), to others like Rufus of Ephesus (ca 70-100 CE), Archigenes (95-115 CE), Soranus of Ephesus (98-138 CE), Aretaeus of Cappadocia (150-190 CE?), and Athenaeus of Naucratis (ca 170-230 CE). Another important text for the study of non-native materia medica in Rome is the anonymous *Periplus Maris Erythraei* (henceforth *Periplus*) dated between 40-70 CE. The historical frame had to be extended to the Byzantine era, especially Oribasius (ca 350-400 CE), Aetius of Amida (ca 500-550 CE), Alexander of Tralles (ca 550-605 CE), and Paul

of Aegina (ca 630-670 CE?), since the information crystallized in a text can represent earlier common knowledge dating back to a couple of centuries. Some Latin sources were consulted as well, when they could provide some clarification, like Aulus Cornelius Celsus (ca 25 BCE – 50 CE), Pliny and *De re coquinaria*, a collection of culinary recipes of uncertain period ascribed to a certain Apicius.

Questions of method

Theophrastus put it simply (*Historia Plantarum*, henceforth *HP*, 9.7.3.8-10): "the most recherché and aromatic (herbs) all come from Asia and sunny places". The intriguing subject of the Roman trade routes towards East has been thoroughly investigated in several interesting publications[4], while aromas and spices caught the imagination of the readers in numerous books[5]. Merchants introducing these products into the Mediterranean were not necessarily aware of their actual area of cultivation or production. What they did know were the main places of export. Some of the authors - like the anonymous writer of the *Periplus* - were very much aware of the difference between areas of production and of export, as it is clear in the case of spikenard, for example. All the herbal products with medicinal properties imported from areas outside of the Mediterranean and the neighboring regions, were selected. This approach resulted in four main geographic areas of origin:

- Eastern Africa (mostly Ethiopia and Somalia);
- the Arabian Peninsula (mostly Yemen and Oman);
- Persia;
- India.

The main trade routes were by sea, but there were also routes by land. Pliny (*NH*, 6.19.1) describes roughly a land trading route from India to

the Mediterranean via the Caspian Sea and Pontus. There is no doubt that the land caravans had the disadvantage of a limited cargo ability, comparing with naval trading, besides being more difficult to defend. The resulting list of herbs in the table follows Dioscorides' order of presentation as a tribute to the most important treatise on materia medica of the ancient world. Some plants bearing a non-native name were excluded from the list. For example *ami* (*DMM*, 3.62), also called "Ethiopian or royal cumin" (*Aithiopikon kuminon* or *basilikon kuminon*), is described by Dioscorides as "a well-known seed", often identified[6] with *Trachyspermum ammi* (L.) Sprague (syn. *Ammi copticum* L, *Carum copticum* (L.) Benth. & Hook. f, and *Trachyspermum copticum* (L.) Link), a species originated in India. But *ami* could also be identified with two Mediterranean species, *Ammi visnaga* (L.) Lam. or *Ammi majus* L, the latter with a distribution extending to Ethiopia. No actual reference to *ami* trading contradicts the identification with the Indian species. There certainly are several other references in the Greek texts that have eluded identification or even simple discussion by researchers. This is the case, for example, of the "Indian alkyonion" (*alkuonion Indikon*, [Galen], *De remediis parabilibus*, henceforth *DeRePa*, 14.429.17 Kühn), of the "Indian cinnabar" (*kinnabari Indikon*), a tear collected from trees in Socotra or *Dioskoridou nêsos* (*Periplus*, 30.24), or of the "wood clove" (*xulokaruofullon*), not the same as *karuofullon* (possibly clove), in Aetius of Amida (*Iatricorum*, henceforth *Iatr*, i.132.18; xvi.146.14; xvi.147.1) and Cosmas Indicopleustes (530-570 CE) (*Topographia Christiana*, henceforth *TopChr*, 11.15.5). The list of herbs contains the main references that include a description and information on the production or origin of the plants, roughly in historical order. The proposed botanical identifications in the table are based on previous publications on the subject, while the taxa are following *The Plant List*[7]. Short discussions on the actual origin of a few species, as well as their uses were added, both in the Roman world and at their places of origin.

Table - Comparison of non-native herb references in Dioscorides, Galen and other authors, with botanical identifications, parts in use and places of origin.

DIOSCORIDES			GALEN			OTHERS				
Ref.	**Name**	**Origin**	**Ref.**	**Name**	**Origin**	**Ref.**	**Origin**	**Species**	**Part**	**Actual place of origin**
1.5	kuperos indikos	India	14.577.5	kuperos asiatikos	Asia			*Curcuma longa* L.	root	S. Asia
1.6	kardamômon	Arabia, India (Commagene, Armenia, Bosphorus)	12.12.12	kardamômon		Theophr. *HP*, 9.7.2.17	Persia, India	*Elettaria cardamomum* (L.) Maton	fruit	India, Sri Lanka, Malaysia & Indonesia
1.7	nardos indikê	India, Samfaritikê	12.84.11	nardou stakhus indikê	India			*Nardostachys jatamansi* (D.Don) DC.	flower	India, Nepal, Bhutan, Myanmar & SW China
1.7	nardos suriakê	India	12.84.11	nardou stakhus suriakê	India?			*Cymbopogon jwarancusa* (Jones) Schult.?	flower	Arabia, Iran, Iraq, Afghanistan, Pakistan, NW India, Nepal, S. China
1.12	malabathron	India	12.66.15 12.153.1	malabathron				*Cinnamomum tamala* (Buch.-Ham.) T.Nees & C.H.Eberm.	leaf	India, Nepal, Bangladesh & Myanmar
1.13	kassia	Arabia	12.13.5	kasia		Strabo *Geo*, 16.4.25.3	India	*Cinnamomum cassia* (Nees & T.Nees) J.Presl	bark	China or Indonesia
1.14	kinnamômon	Arabia?	12.26.8	kinnamômon		Strabo *Geo*, 15.1.22.13	India	*Cinnamomum verum* J.Presl	bark	Sri Lanka, S. India
1.15.1	amômon mêdikon	Persia	11.828.16	amômon				*Amomum subulatum* Roxb.	fruit	China, Bangladesh, Bhutan, N. India, Myanmar, Nepal & Sikkim
1.16	kostos	Arabia, India (Syria)	12.40.10	kostos				*Saussurea costus* (Falc.) Lipsch.	root	S. Asia

DIOSCORIDES			GALEN			OTHERS				
1.17	skhoinos murepsike	Nabataea, Libya, Arabia (Babylonia)	12.136.18	skhoinos leia, oxuskhoinos, oloskhoinos				*Cymbopogon schoenanthus* Spreng.	flower, leaf, root	S. Asia, N. Africa, Arabia, Iran, Sinai, Palestine, Lebanon
1.18	kalamos arômatikos	India	12.6.15	kalamos arômatikos				*Acorus calamus* L.	root	Turkey to Korea & Japan, India, SE Asia etc.
1.19	balsamon, opobalsamon, xulobalsamon	Judaea	11.846.12	balsamon	Assyria (*DA* 14.39.16)	Theophr. *HP*, 9.6.1.1-9.6.4.7	Syria	*Commiphora gileadensis* (L.) C.Chr.	resin, wood	Arabia, E. Africa
1.22	agalokhon	Arabia, India	no	no		*Cyranides* 5.14.2: xulalohon, xulaloê	India	*Aquilaria malaccensis* Lam, *Aquilaria crassna* Pierre ex Lecomte, *Aquilaria sinensis* (Lour.) Spreng.	bark, wood	SE Asia
1.23	naskaphthon	India	no	no		Paul *EpMed* 7.22.4.7: nakaphthon		UNIDENTIFIED	bark	
1.24	kagkamon	Arabia	12.8.6	kagkanon				*Commiphora kataf* (Forssk.) Engl.	resin	Arabia, E. Africa
1.64	smurna	Arabia	12.127.3	smurna				*Commiphora myrrha* (Nees) Engl, *Commiphora habessinica* (O.Berg) Engl.	resin	Arabia, E. Africa
1.67	bdellion	Arabia, India	11.849.18	bdellion	Scythia, Arabia			*Commiphora wightii* (Arn.) Bhandari, *Commiphora africana* (A.Rich.) Endl.	resin	N. Africa to C. Asia (especially N. India), sub-Saharan Sahel, E. & Southern Africa
1.68.1	libanos	Arabia, India	12.60.1	libanôtos				*Boswellia sacra* Flueck, *Boswellia serrata* Triana & Planch.	resin, bark, branch, fumes	Arabia, Somalia & India, Pakistan

DIOSCORIDES			GALEN			OTHERS				
1.82	makir	barbarian countries	12.66.5	maker	India			*Myristica malabarica* Lam, *Myristica fragrans* Houtt. ?	aril	India
1.98	ebenos	India, Ethiopia	12.867.14	ebenos				*Diospyros ebenum* J.Koenig ex Retz, *Diospyros melanoxylon* Roxb, *Dalbergia melanoxylon* Guill. & Perr. ?	wood	India, C. & S. Africa
1.100.4	lukion indikon	India	12.64.9	lukion indikon	India			*Berberis lycium* Royle, *Berberis aristata* DC, *Berberis asiatica* Roxb. ex. Dc, non Griff.	wood	India, Pakistan
2.82.5.4	sakharon	Arabia, India	12.71.3	sakhar	Arabia, India			*Saccharum officinarum* L.	secretion	N. India
2.159	peperi (melan)	India	12.97.7	peperi				*Piper nigrum* L.	fruit	W. India etc.
2.159.1.3	peperi makron	India	12.97.7	peperi makron				*Piper longum* L.	fruit	India, Sri Lanka, Burma, Malaysia
2.159.1.6	peperi leukon	India	12.97.7	peperi leukon				*Piper nigrum* L.	fruit (peeled)	W. India etc.
2.160	ziggiberi	Troglodytikê, Arabia	11.880.9	ziggiberi	barbarian countries	Ptol. *Geo*, 7.4.1.6	Sri Lanka	*Zingiber officinale* Rosc.	root	China, India
3.22	aloê	Arabia, India, Asia, Andros isl.	11.821.12	aloê	India, Coele Syria, Arabia, Great Syria, not Greece			*Aloe vera* (L.) Burm.f.	juice	Arabia, India

DIOSCORIDES			GALEN			OTHERS				
3.53.2	seseli aithiopikon	Ethiopia	12.120.5	seseli				UNIDENTIFIED	fruit, root	
3.80.2.7	silfion mêdikon	Persia	12.123.6	silfion				*Ferula assa-foetida* L. , *Ferula alliacea* Boiss, *Ferula narthex* Boiss, *Ferula foetida* (Bunge) Regel, *Ferula rubricaulis* Bois.	gum	Iran, Afghanistan, exUSSR, Pakistan, Persian Gulf
3.81	sagapênon	Persia	12.117.7	sagapênon				*Ferula persica* Willd, *Ferula szowitziana* DC.	gum	Iran, Afghanistan, Turkey
3.83	khalbanê	Syria	12.153.3	khalbanê				*Ferula gummosa* Boiss, *Ferula rubricaulis* Boiss.	gum	Iran
3.85	sarkokolla	Persia	12.118.7	sarkokolla	Persia			*Astragalus sarcocolla* Dymock	resin	Iraq, Iran, Afghanistan
5.92	indikon	India	-	-		melan indikon Paul *EpMed* 7.3.12.27 indikon melan *Periplus* (39.10)	India	*Indigofera tinctoria* L.	Leaf (fermented)	India?
-	-		-	-		tzandana Cosmas *TopChr* 11.15.5	S. China	*Santalum album* L.	wood	India, Indonesia, Malay Archipelago
-	-		-	-		aithiopikê riza CorpHipp/ *DNaMul* 101.1	Ethiopia?	Unidentified	leaf	

DIOSCORIDES			GALEN			OTHERS				
-	-		-	-		karuofullon Pliny *NH* 12.15.1 [Gal.] *Lexeis botanôn* 390.1;392.21 Paul *EpMed* 7.3.10.86	India	*Syzygium aromaticum* (L.) Merrill & Perry	flower (bud)	Indonesia
-	-		-	-		galagga Aetius *Iatr*, i.131.38; i.131.49; xi.13.116		*Alpinia galangal* (L.) Willd.	root	SE Asia
-	-		-	-		karua moskhatou Archigenes, *Frag*, 11.17-21 karua indika Aet. *Iatr*, i.132.4.	India	*Myristica fragrans* Houtt.	seed	Indonesia (S. Moluccan Islands: Ambon & Banda), then India

Case studies

A total of 39 herbs of non-native origin were recorded in the Greek texts surveyed for the present essay. Only a few examples can be analyzed here to stress significant differences in the knowledge of origin, the possible modern identifications, and the similarity in uses between the Greek texts and the areas of origin.

Turmeric

A plant is mentioned in Dioscorides as *kuperos indikos* or "Indian nut grass" (*DMM*, 1.5), which looks like ginger and tastes like saffron, but it is bitter. It was used externally as a depilatory. Galen does not mention *kuperos indikos*, but the Pseudo-Galen has a reference to a *kuperos asiatikos* or "Asian nut grass" (*DeRePa*, 14.577.5 Kühn) administered for dysuria and strangury. Another similar term *broullokuperos* mentioned by Aetius (*Iatr*, i.131.31 & 46) remains an unidentified species or a variety of nut grass.

Kuperos indikos and *asiatikos* were probably the same plant, which could be identified with turmeric, a rhizomatous herbaceous perennial plant (*Curcuma longa* L.) of the ginger family (Zingiberaceae), native to Southern Asia. Evidence indicates that turmeric was under cultivation in India from ancient times, but whether the turmeric that was used was *Curcuma longa* L. or some other similar species, is not known[8]. Although a Malayo-Polynesian origin of turmeric has been suggested[9] the taxonomy of the genus and the origin of the species are still the subject of controversy. In the Ayurveda, turmeric is considered pungent, bitter, aromatic, stimulant, tonic and carminative, and it is used in many ailments, both internally (as an anthelminthic, digestive, for jaundice or other liver problems etc.) and externally (on sprains, bruises, wounds, ulcers etc.)[10]. Turmeric powder mixed with oil is rubbed on the skin to improve its appearance[11]. A conjee made from the *Curcuma angustifolia* Roxb. (Sanskrit *tavakshiri*) is used in cases of dysentery, dysuria, and other conditions[12].

Green cardamom

The Greek word *kardamômon* is derived from *kardamon* or garden cress (*Lepidium sativum* L.) and *amômon*, which designed more than one species, probably of the Amomum genus. Cardamom was possibly an early import in the Mediterranean area. Already in the *CorpHipp* it is mentioned 4 times. In *De natura muliebri* (ca 450 BCE, henceforth *NatMul*, 32.113) cardamom is included in a list of uterine medicines, or as an ingredient in a recipe for asthmatic women (*NatMul*, 68.2; *De mulierum morbis*, ca 450 BCE, henceforth *MorbMul*, 34.18), whilst in another reference it is used for fumigation in amenorrhea complications (*MorbMul*, 133.148). Theophrastus (*HP*, 9.7.2.17) declares that some cardamom and spikenard are coming from Media and some from India. The same text includes cardamom in a list of aromatics (*HP*, 9.7.3.2). In *DMM* (1.6) there is an extended discussion on species or varieties and qualities of cardamom. The best quality comes from Commagene, Armenia and the Bosphorus, but it also grows in India and Arabia. It is a warming and abortifacient drug, useful for epilepsy, coughs, sciatica and paralysis, ruptures or sprains, colic, flatworms, kidney diseases, dysuria, scabies, scorpion stings and poisonous bites. The ancients added it in the process of binding perfumed oils with styptic substances. If Dioscorides' text is correct, there is no question that *kardamômon* from Commagene, Armenia and Bosphorus should be a different species. Galen in his main work on simple medicines (*DSMTF*, 12.12.12 Kühn) compares cardamom with garden cress (their names being closely related in ancient and modern Greek). Cardamom is less warm than garden cress, more pleasant to taste and smell, with some bitterness. It was administered against intestinal worms and scabies. In Galen's texts on compound medicines cardamom is abundantly used, like in the decoction of *Sôkration* (*De compositione medicamentorum secundum locos*, henceforth *DCML*,

12.836.14 Kühn), an asphalt plaster (*De compositione medicamentorum per genera*, henceforth *DCMG*, 13.556.14 Kühn), or the famous theriac of Andromachus the Elder (50-65 CE), called "serenity" (*Galênê*) (*De antidotis*, henceforth *DA*, 14.43.14 Kühn).

Cardamom is a general name for the seeds of several plants in the genera Elettaria and Amomum (Zingiberaceae family), both native to India, Bhutan, Indonesia, and Nepal. The green seed pods of *Elettaria cardamomum* (L.) Maton are dried and the seeds inside the pod are used, either entire or ground. Its native range includes India, Sri Lanka, Malaysia, and Indonesia. The Sanskrit word *ela* is mentioned in Ayurvedic texts, like *Sushruta samhita* (6th c. BCE to 6th c. CE) and *Charaka samhita* (4th c. BCE to 2nd c. CE), but it is not clear if it was *Elettaria cardamomum* (L.) Maton or *Amomum subulatum* Roxb[13] (*amômon* of the Greeks). In the Ayurvedic texts cardamom seeds are described as aromatic, acrid, sweet, cooling, stimulant, carminative, diuretic, cardiotonic and expectorant[14], used for various stomach complaints, like dyspepsia and nausea[15].

Spikenard

The *CorpHipp* has only two references to *nardos*: in *NatMul* (34.23) it is used for uterine fumigation, while in *MorbMul* (45.4) it is for postpartum expurgation. The Indian origin of nardos is mentioned by Theophrastus (*HP*, 9.7.2.18). Later on, several species of nardos were known. According to Dioscorides (*DMM*, 1.7), the Indian nardos (*nardos indikê*) was further distinguished into "Gangetic nardos" (*Gaggitis*, from the name of river Ganges[16]), of lower quality, and the mountain one (*oreinotera*), which has the same high quality as the Syrian. Dioscorides mentions another lower quality *nardos*, called *Samfaritikê* from its place of origin[17]. All species are warming, drying, and diuretic, and they stop diarrhea or uterus discharges. They could be used for nausea, heartburns, flatulence, liver or kidney diseases, and jaundice. Steam baths with spikenard were used

especially for uterus inflammation. A second species of *nardos* was called "Syrian" (*nardos suriakê*). Dioscorides informs us that its name does not come from Syria, but from the mountain where it was growing, which has one slope looking towards Syria and the other towards India[18]. Galen is using the words *nardostakhus* or *nardou stakhus* (*DSMTF*, 12.84.11 Kühn) for both the Indian and the Syrian *nardos*. He considered the Indian species more powerful and darker, warming in the 3rd degree[19] and drying in the 2nd, combining astringent, pungent, and slightly bitter tastes. In the *Periplus nardos* was an export commodity of all the main Indian ports[20]. There are 5 different varieties in the text, basically named after their supposed places of origin. As Casson (1989, p. 222) points out[21], the Gangetic *nardos* was mainly collected at and shipped out from a port at the mouth of the Ganges (63:21.3-5), but it was bought by the merchants of Roman Egypt at Mouziris or Nelkunda (56:18.25). The *Periplus* explains further how different varieties of spikenard, probably collected in the areas around Kabul, the Hindu Kush and Kashmir, were going through Ozênê, in Ujjain region, to the main port of Barugaza (*Periplus*, 48.8; 49.13).

The *Indian nardos* in *DMM* (1.7) is most probably spikenard, *Nardostachys jatamansi* (D.Don) DC, a flowering plant of the Caprifoliaceae family, endemic to the Himalayan Mountain range, occurring in northwest India, Nepal, Bhutan, Myanmar, and SW China, at 2,000-5,000 m above sea level. Today it is considered critically endangered in the *International Union for Conservation of Nature Red Plant List* (2015), mainly because of the indiscriminate collection (for its roots and rhizomes) from its wild habitat and the continuous population declining over the last decades[22]. In the Ayurveda the roots are considered sweet, bitter, astringent, cold, and antispasmodic, and they are used for the treatment of palpitations, nervous headaches, dysmenorrhea, digestive system ailments, and others[23].

The *Syrian nardos* is identified by some researchers with *Cymbopogon jwarancusa* (Jones) Schult. (syn. *Andropogon jwarancusa* Jones), a perennial lemongrass growing on mountain slopes and dry valleys, at altitudes 2,900-3,500 m above sea level. Its distribution extends from Oman, Socotra, Iran, Iraq, Afghanistan, NW India, Pakistan, and Nepal to China (West Xizang, Yunnan). In traditional medicine the roots are considered hot and dry, diuretic, carminative, stimulant and emmenagogue, used in gout, rheumatism, intermittent fever, coughs, and cholera[24].

Cassia and cinnamon

The date of the actual appearance of these spices in the Mediterranean is still an unresolved issue. The origin of the particular herbs found in the ancient authors is also problematic. In the Greek texts cassia appears either as *kasia* or *kassia*, sometimes even in the same text, and cinnamon is abundantly cited as *kinnamômon*[25]. The older reference to cassia could be the one in Sappho's (c. 630 – c. 570 BCE) *Fragmenta* (44.30): "aromatic oil (*murra*), cassia (*kasia*) and frankincense (*libanos*) were mixed"[26]. Theophrastus (*HP*, 9.5.1.1) seems to slightly deviate from his usual credibility in the chapters on cinnamon and cassia, although he readily discards some of the information as fictitious. He also blends the sources of frankincense and myrrh with those of cassia and cinnamon. His description of dividing cinnamon "shrub" in five parts (*HP*, 9.5.1.1) seems somewhat inaccurate, but it could have some basis if we consider that in present-day Traditional Chinese Medicine cassia is divided in three different medicines, according to the different tree parts[27]. The extravagant but likable myth of "cinnamon vulture" or *kinnamômon orneon* was first reported by Herodotus (445?-420? BCE) (*Historiae*, henceforth *Hist*, 3.111.2-3.112.1), followed by *CorpAris* (*Historia Animalium*, 616a.6 Bekker) and Pliny (*NH*, 10.50.2). These fragrant herbs are also connected with two rather spectacular archaeobotanical find-

ings. The first one, found in the archaeological site of Heraion on the Greek island of Samos (ca 7th c. BCE), is identified as a *Cinnamomum cassia* flower[28]. The second, more recently brought to light, is made of early Iron Age (about 1000 BCE) flasks from archaeological sites in Israel, in which cinnamaldehyde has been identified[29].

In *DMM* (1.13.1-2) Dioscorides mentions that there are many species of *kassia* growing in Arabia. It has a thick bark, and leaves like those of the pepper vine. He further describes eight different species or varieties. The best quality, which was called *ahu* by the locals and *dafnitis* by the Alexandrian merchants, is pale yellow, narrow, smooth, with long and thick tubes, a pungent and astringent taste, with some burning sensation. The next one is *gizir*, which was particularly useful in medicine, followed by *Mosylitis bush* (*batos Mosulitis*)[30], *asuf*ê, *kitt*ô and *darka*. There is also a pseudo-cassia, which is not pungent or aromatic, and another variety with wide tubes. Dioscorides wrote an unusually extended paragraph on *kinnamômon* (*DMM*, 1.14.1-3), where he describes five different varieties including *Mosulon* which is somewhat different, since it carries some similarity with the *Mosulitis* cassia. Distinguishing the best quality is based on the aroma, color, pungency, and caustic taste. There is also a pseudo-cinnamon, with weak scent and inferior properties, and another one called "ginger" (*ziggiberi*) or cinnamon wood (*xulokinamômon*), diffferent in appearance, and with unpleasant scent, which we should consider a separate species.

In the *CorpHipp* cinnamon appears in one pessary and six fumigation recipes[31]. In *DMM* (1.13-14) cassia and cinnamon are characterized as warming, diuretic, drying and slightly styptic, softening, and digestive. Cassia has the same effects as cinnamon when used in double quantity. Galen (*DSMTF*, 12.13.5 and 12.26.8 Kühn) considered both *kasia* and *kinnamômon* warming in the 3rd degree. But *kasia* is drying and tenuous, with a pungent and slightly astringent taste, so that it can separate and remove all useless matters from the body. Cinnamon on

the other hand is extremely tenuous, but less drying than similar herbs. Galen also mentions a weaker pseudo-cinnamon, called *kinnamômis* or *pseudokinnamômon*. He further explains the differences of qualities in another text (*De theriaca ad Pisonem*, 14.257.1-14.258.10 Kühn), and lists several compound medicines with cinnamon and cassia as ingredients, as for example Andromachus' famous *Galênê* theriac (*DA*, 14.43.7 Kühn). There seems to be some confusion in Galenic texts on the names of the different varieties of cassia[32]. Rufus of Ephesus (*De renum et vesicae morbis*, henceforth *DReVe*, 1.17.2; 13.8.3) included both cassia and cinnamon in the warm diuretics. The *Periplus* does not mention cinnamon, but cites the harbors around the African Horn[33] as cassia's points of export, forcing Casson[34] to speculate a cover up by Arab and Indian captains, so that their Greek rivals would not find the true sources of cassia (and cinnamon). Of course we have to consider also simpler reasons, like the repetition of a mistake or the omission of some parts of text in a manuscript, since Greek and Roman ships were going far into the East and could get these products in other ports, closer to their place of origin. Strabo (ca 30 BCE – 24 CE) (*Geographia*, 16.4.25.3 and 15.1.22.13) is probably the only Greek author who placed the sources of both cassia and cinnamon in India, followed two centuries later by Flavius Philostratus (*Vitae Apolloni*, 3.4.4).

Anyway, cassia and cinnamon collection is covered with a haze of myth, leaving space for radically different identifications[35]. Cassia is usually identified as the bark of Chinese cassia, *Cinnamomum cassia* (Nees & T.Nees) J.Presl. (family Lauraceae). Since this species is indigenous to the China and Vietnam region, we probably have to consider the possibility that ancient *kassia* could also come from the Indonesian cassia (*Cinnamomum burmanii* (Nees & T.Nees) Blume), native to the Sumatra-Java region of Indonesia. The Malayan and Indonesian name *kayu manis* (sweet wood) or an ancient version of this term could have contributed to the forming of the Greek word *kinnamômon*[36].

Cinnamon is coming from the bark of the species *Cinnamomum verum* J.Presl (syn. *Cinnamomum zeylanicum* Breyn.), native to Sri Lanka and south India[37]. It is described as carminative, antispasmodic, aromatic, stimulant, haemostatic, astringent, stomachic, and germicidal[38].
In the Ayurvedic texts, cinnamon and cassia are pungent and sweet, warming and drying, they improve blood circulation, and stimulate appetite and digestion[39].
It is interesting to note that in Unani Tibbia there still are recipes bearing Galen's name, for example the famous *jawarish jalinoos*[40], which contains cinnamon, cassia, spikenard, and cardamom among others[41].

Black cardamom

Theophrastus (*HP*, 9.7.2.17) already presented the problem of multiple origins for both *amômon* and *cardamômon*: "some people say it comes from Persia and others from India". There is only one reference to *amômon* in the whole *CorpHipp* (*NatMul*, 32.113) in a list of aromatic substances. In *DMM* (1.15) it is described as a small bush with climbing branches. It has a flower small like *leukoion*[42] and leaves like bryony[43]. The best quality is the Armenian, with golden color and yellowish wood, which is quite aromatic. The Median one is less powerful since it grows in flat and wet places; it is large and slightly yellow-green, with soft and fibrous wood and oregano-like scent. The Pontian one is yellowish, short and fragile, with racemes, full of pods and heavy odor. It has warming, styptic, drying, and hypnotic properties, also being an analgesic when it is applied as a poultice. It was an ingredient of antidotes and expensive perfumed oils. Galen (*DSMTF*, 11.828.16 Kühn) does not specify the origin or the different varieties of amomum. Actually his entry on *amômon* seems neglected, with just a couple of lines noting that it has similar properties to those of sweet flag, but it is more digestive, and less drying. Nevertheless, Galen included amo-

mum in many compound medicines. It is interesting that Oribasius (*Collectiones Medicae*, henceforth *CollMed*, 11.alpha.46.1) decides to omit Dioscorides' first two phrases that describe the plant, which are not very accurate. Actually the only possible connection with the *DMM* description are the small–presumably white–flowers, much like *leukoion*, although modern botanists and taxonomists will frown on that. Black or Indian cardamom is the English trade name for the fruit of two species in the Zingiberaceae family: *Amomum subulatum* Roxb, and *Amomum costatum* Benth. & Hook.f. The pods from the former are used primarily in the Indian and Pakistani cuisines, while the latter is used in Chinese (*cǎoguǒ*) and Vietnamese (*thảo quả*) culinary recipes. It is doubtful though whether the Chinese species could find its way to the Mediterranean world during the first centuries CE. *A. subulatum* is found in dense forests at 300 to 1,300 m above sea level, in Guangxi, Xizang, Yunnan (in China), as well as in Bangladesh, Bhutan, North India, Myanmar, Nepal, and Sikkim (*Flora of China* 2008, vol. 24, p. 355). In traditional medicine it is considered stomachic, carminative, stimulant and aphrodisiac, and it is used to allay irritation of the stomach caused by diseases like cholera, as well as in the treatment of snake bites[44].

Costus or kuth

Theophrastus' short treatise *On odours* mentions costus (*kostos*) as an ingredient of the famous marjoram aromatic oil (*amarakinon ek tou kostou*, *De odoribus*, 6.28.2). The *Periplus* cites three exporting harbors for costus, all in North-West India[45]. According to *DMM* (1.16) the name *kostos* could correspond to three different species: the Arabic one, white and light, with strong and pleasant scent; the Indian one, harsh and dark, as light as giant fennel (*Ferula communis* L.), of lower quality; and the Syrian one, heavy, with a colour like that of boxwood (*Buxus* spp.) and a heavy odour. It has warming, diuretic and emmenagogue properties, and was used in uterine ailments in the form of suppositories,

fumigations, and baths, in addition to the treatment of snake bites and as an aphrodisiac. Galen (*DSMTF*, 12.40.10 Kühn) considered costus to be mildly bitter, strongly pungent, and warm. It could be beneficial to sciatica, paralysis and diseases that need warmth or drawing pathogenic humour to the surface of the body. For the same reason, it is a diuretic and emmenagogue, being also effective in fracture healing and pleurisy. Its aphrodisiac power is attributed to an aeriform (*fusôdês*[46]) and moist constitution. Galen included costus in many compound medicines. Alexander of Tralles (*Therapeutica*, henceforth *Thera*, 2.497.7) furthermore suggested that costus increases sperm production.

Costus can be identified with the thistle species *Saussurea costus* (Falc.) Lipsch. (syn. *Aucklandia lappa* Decne, *Saussurea lappa* (Decne.) Sch. Bip.) (Asteraceae family). The name seems to derive from the Sanskrit *kustha* (*kut* in Hindi, *kostum* or *gostham* in Tamil). It grows mostly at altitudes of 2,500 to 3,000 m above sea level in South Asia, including the Himalayas, Kashmir, Jammu, and the Western Ghats. Costus aromatic root is used in traditional medicine and perfumery since ancient times, treating, among others, ulcers, convulsions, cancer, and arthritis[47]. Ayurvedic physicians describe costus root as bitter, acrid, stimulant, and expelling wind and phlegm. It is used for fevers, consumption, cough, dyspepsia, pleurisy, dropsy, asthma, skin diseases, and jaundice[48].

Aloeswood

The south Indian name for aloeswood or Indian eagle-wood (unrelated with aloe species) is *akilu* (Sanskrit *agaru*), possibly producing *ahaloth* and *ahalim* in the Old Testament (*Song of Solomon*, 4:14; *Numbers*, 24:6; *Psalms,* 45:6; *Proverbs*, 7:17). In Dioscorides (*DMM*, 1.22) *agalokhon* is a wood brought from India and Arabia. It looks like juniper (*Juniperus* spp.) and is aromatic, astringent, and a little bitter in taste. It is recommended as a mouthwash, or body deodorant, and as a substitute for frankincense. The root was used for flaccidity, and also deficiency and heat in the stomach. The wood was used for pleu-

risy, dysentery or colic. In Pseudo-Dioscorides' *Euporista*, *agalokhon* is used also in a poultice for spleen diseases, and as a decoction for steam bath to stop menorrhagia. Aloeswood seems to have been a rare commodity in the following centuries. A single reference in Oribasius (*CollMed*, 11.alpha.2.1) is almost identical to Dioscorides' text. In the hermetic compilation of the *Cyranides* (50-200 CE?) (5.14.2) there is a possible source for the English word "aloeswood": *xulalokhon* or *xulalo*ê (literally "wooden aloe"); an Indian fragrant wood, used as mouth deodorant, taken internally to cure loose stomach and dysentery, liver disease and pleurisy. Paul of Aegina (*Epitomae medicae*, henceforth *EpMed*, 7.3.1.7) keeps only India as the source of aloeswood in a strictly condensed form of Dioscorides' chapter.

Nine out of the seventeen species in the genus Aquilaria (family Thymelaeaceae), large evergreens native to Southeast Asia, are known to produce aloeswood[49]; but production comes mainly from *Aquilaria malaccensis* Lam, and secondarily from both *Aquilaria crassna* Pierre ex Lecomte, and *Aquilaria sinensis* (Lour.) Spreng. Formation of aloeswood occurs in the trunk and roots of trees that have been penetrated by a species of ambrosia beetle feeding on wood[50]. Because of the infection the tree produces resinous material as a defensive mechanism to seal beetle tunnels. The resin dramatically increases the mass and density of the affected wood, changing its color from a pale beige to yellow, orange, red, dark brown, or black. Only a small percentage of trees are infected naturally, so aloeswood must have been rare[51]. The exact procedure for its formation is still the object of scientific research.

In Ayurveda *agaru* is a stimulant, cholagogue and deobstruent, used in gout and rheumatism, to treat vomiting and snake-bites[52].

Naskafthon, an unidentified herb

Naskafthon or *narkafthon* still remains a mystery, since there are no suitable candidates for its identification. According to Dioscorides

(*DMM*, 1.23)–the unique reference in the Greek texts surveyed here–it was coming from India. Its bark was similar to that of mulberry. It was aromatic, and was used as incense or as a medicinal in fumigation for uterus blocking. Some lexica identify its two names with *lakafthon*[53], but this term does not seem to appear in Greek texts. Instead there is a *naskafon* in Oribasius (*CollMed*, 12.ni.5.1) with the same information as in *DMM*, and *nakafthon* in Paul of Aegina (*EpMed*, 7.22.4.7), which could be read *lakafthon* in some manuscripts, and is among the 36 ingredients of the famous aromatic *kufi* the great[54]. But Paul is not certain on the specific source of the drug: "it is the bark from pine or some other tree".

Bdellium

There is no mention of *bdellion* in the older texts of the corpus under consideration here. Archigenes' collected fragments include a few references to it (e.g. in a liver treatment, *Fragmenta in liene*, 13.14), and Rufus of Ephesus gives just one for kidney stone treatment (*DReVe*, 3.15.2). In *DMM* (1.67) bdellium (*bdellion*, *maldakon* or *blokhon*) was another tear produced from an Arabian tree, but there were also inferior qualities coming from India and Petra. Bdellium was considered warming, softening, and dissolving of hard masses, being a diuretic that treated goitre and hydrocele, opened the uterus, absorbed the embryo, eliminated any other moisture, and shuddered stones; it was supposed to be useful in cough and snake bites, ruptures of muscles and nerves, pleurisy, and circulation of spirit (*pneuma*[55]). The *Periplus* cites three exporting harbors for *bdella* (written here exactly as for the leech), all of them in North-West India[56]. Galen distinguished between Scythian and Arabic bdellium (*DSMTF*, 11.849.18 Kühn), the former being more softening and the latter more drying than the rest of the softening medicines. Its bitterness, pungency, and dryness increased with time. Especially the Arabic bdellium was used in cases of goitre and hydrocele, as

Dioscorides mentioned. Galen was using bdellium in a fair amount of compound medicines.

Bdellium is most possibly the resin extracted from *Commiphora wightii* (Arn.) Bhandari (syn. *Commiphora mukul* (Stocks) Hook, *Commiphora roxburghii* (Stocks) Engl.) and *Commiphora africana* (A.Rich.) Endl, both of the Burseraceae family. The former has a wide distribution from northern Africa to central Asia, but it is most commonly found in northern India, in arid or semi-arid ecosystems. The resin called *mukul* or *guggulu* is produced from the tapping of this small tree. Galen's correction of *DMM* was not misguided, since mukul areas of origin could be included in ancient Scythia.

Guggulu has been used in Ayurvedic medicine for centuries in the treatment of many disorders, like inflammations, gout, rheumatism (internally and externally), and obesity[57], in addition to cough, pneumonia, urinary disorders, stomach and skin diseases[58].

The second species is typical of the sub-Saharan Sahel, East and Southern Africa. Besides African myrrh obtained from tapping, other parts of the trees are used also to treat a wide range of ailments: the fruits for typhoid fever, the bark for tumours and stomach ache, and the stem for fever, malaria and snake bites. The resin itself is used for disinfecting and healing wounds, while burnt resin fumes are used as an insecticide and a treatment for migraine[59].

Makir

In *DMM* (1.82) *makir* is mentioned in a very short paragraph. It is a bark imported from barbarian countries, yellowish, thick, and quite astringent. It was used internally in phthisis, dysentery, and abdomen ailments. In the *Periplus* (8.12) it is mentioned as *makeir*, and it was bought in Malaô, a port on the African coast, opposite to Aden. Pliny (*NH*, 12.16) states that "macir is a vegetable substance, a red bark that grows upon a large root, and bears the name of the tree that produces it; what the nature of this tree is, I have not been able to ascertain.

A decoction of this bark, mixed with honey, is greatly employed in medicine, as a specific for dysentery". According to Galen, *maker* (*DSMTF*, 12.66.5 Kühn) is a bark imported from India, quite astringent in taste, with some aromatic pungency. Its fragrance is sweet, like most of the Indian perfumes. It has complex properties, mainly earthly and cold, but also somewhat warm and tenuous. This is why it is strongly drying and styptic, used in dysentery and other intestinal problems. The author classified it among 3rd-degree drying herbs.
Liddell-Scott's *Lexicon* identifies *makir* as *muttee-pal*, the fragrant resin of *Ailanthus triphysa* (Dennst.) Alston. (syn. *Ailanthus malabarica* DC.) (*halmaddi* in Hindi), but no ancient writer includes *makir* in the resins. In Liddell-Scott's *Supplement makir* is identified as *Myristica malabarica* Lam.[60], an endemic tree of India (Myristicaceae family); with greenish black, smooth and sometimes reddish bark. The aril is used as a febrifuge, cooling, and expectorant substance. The fat extracted from the seed is used to treat indolent ulcers and rheumatism, and to relieve pain. It is considered to have antinflammatory, analgesic, anti-ulcer, sedative, hypnotic, and antimicrobial properties. It is interesting that the tree exudates a profuse red sap from incisions, and that the aril is very similar in appearance to mace (aril from *Myristica fragrans* Houtt. fruits), but it is yellowish. In fact this aril is known as *Malabar nutmeg* or *Bombay mace*, and it is abundantly used as a substitute of true mace[61]. Actually both powdered seeds of Malabar nutmeg and mace are used traditionally to treat diarrhea. Mace is also useful in low fever, asthma, consumption, dyspepsia, liver and spleen obstructions[62]. Bostock & Riley[63] in their English translation of Pliny discussed this already: "What he means under this head is not known. …It seems by no means impossible that mace, the covering of the nutmeg, is the substance alluded to, an opinion that is supported by Gerard and Desfontaines". Actually the Greek word *makir* produced the Latin *macir*, from which came the Medieval Latin, Old French and Middle English *macis*, followed by the modern *mace*. Andrew

Dalby follows García de Orta (1563, p. 283) who concluded that "macir could not be true mace", because of different properties, originating in India and not further East and "no one mentioned a nutmeg that came with it"[64]. These arguments are not convincing, especially regarding the properties and uses of *makir*, which seem to coincide quite well. The late Lionel Casson[65] also rejects *Myristica malabarica* on the basis that the used part is the seed, which is not accurate. The dried aril of these plants could have been easily misidentified in ancient times as a bark. Casson further suggested *Wrightia antidysenterica* (L.) R.Br. (syn. *Holarrhena antidysenterica* Wall, *Holarrhena pubescens* (Buch.Ham.) Wall. ex G. Don.), as the most convincing identification. The plant has a reddish-brown root bark, which is its most effective part for dysentery. Unfortunately this does not "fit the requirements perfectly", as he says, because in Dioscorides and especially Galen this is a sweet fragrant product. *Wrightia antidysenterica* or *bitter oleander*, also preferred by Lily Beck[66], is a small deciduous tree found in Himalayan and sub-Himalayan tracts, ascending up to 1,200 m above sea level[67], and considered an important Ayurvedic plant. The root is used in amoebic dysentery, and the bark is an astringent, anthelmintic, amoebicidal, and diuretic agent, used in colic, dyspepsia, piles, and diseases of the skin and spleen. Seeds are used to reduce production of bile, promote conception, and tone up vaginal tissues after delivery. But for our story it has an important drawback: its characteristic bitterness seems to have dodged all the ancient authors. Finally, the proposed identification by Aufmesser[68], *Ailanthus altissima* (Mill.) Swingle (syn. *Ailanthus glandulosa* Desf.) seems even more problematic since this medium-sized tree (17-27 m) is native to northern and central China, Taiwan, and northern Korea.

Black & long pepper

Black pepper has been found in the nostrils of Ramesses II (c. 1303-1213 BCE) mummy[69], guiding researchers to suggest a trade route

from India to the Mediterranean, well before the first millennium BCE. Consequently the existence of such a trade could mean that other spices or aromatic substances could have been transported to Egypt from a very early stage. In the *Proverbia* (13.1) attributed to Aesop (ca 620-564 BCE), the following ancient Greek proverb reads: "The one who has pepper is using it even in lentils". According to Theophrastus (*HP*, 9.20.1) pepper is a fruit in two forms: one is round like ervil, with peel and flesh like laurel fruits, reddish in color; the other, long one, has seeds like those of poppy, and is more powerful. Both are warming and, like frankincense, can help in cases of hemlock poisoning (*Conium maculatum* L.). *Peperi* is mentioned several times in Hippocratic works, which are usually placed in the 5th–4th c. BCE[70]. Its diuretic property is mentioned in *CorpAris* (*Problemata*, 864b.12 Bekker), while the ptarmic use appears in Aretaeus of Cappadocia (*De curatione diuturnorum morborum*, 1.2.5.4). Dioscorides refers to *peperi* (*DMM*, 2.159) as a tree[71] growing in India, which is almost correct. Long pepper (*peperi makron*) from the other hand is considered by Dioscorides to be the initial stage of the fruit, while white pepper (*peperi leukon*) is identified as the immature form, and black pepper (*peperi melan*) the ripe one. Generally, pepper has warming, digestive, appetizing, diuretic and absorptive properties, and it was used for the treatment of many ailments, like *scotomata*[72], recurring shivers, snake bites, colic, cough, or other chest problems. Black pepper is more pungent and aromatic than white pepper. Dioscorides considered the long pepper to be more suitable for antidotes and theriacs, thanks to its supposed unripeness. White pepper was used mainly for ophthalmological medicines, antidotes, and theriacs. Another product mentioned by Dioscorides is pepper root, not to be confused with ginger (*ziggiberi*), with warming and moistening properties, used for contracting the spleen and expeleing phlegm. The *Periplus*, most appropriately, positions the main harbors for the export of pepper on the West

Indian coast (Barugaza, 49.15; Mouziris, 56.9). Galen followed this information (*DSMTF*, 12.97.7 Kühn), and tried to explain the warming and drying properties of the three different peppers. All of them were used as ingredients in a large number of compound medicines, already from Nicander's period (ca 150-110 BCE) (*Theriaca*, 876; *Alexiphamaka*, 201; 332; 607[73]).

The word *peperi* is derived from the Sanskrit *pippali*, which was actually used for the long pepper. In Sanskrit, pepper was also called *yavanapriya*, which literally translates as "beloved to the Greeks"[74].

The black pepper (*Piper nigrum* L. family Piperaceae) is found extensively in the evergreen forests of the Western Ghats and in the neighboring areas, from sea level up to 1,300 m. It is a perennial vigorous vine, with ivy-like roots, which get hold on the support tree[75]. Indian long pepper is the dried mature fruits (spike) of *Piper longum* L. a slender climber distributed mainly in India and less in other South Asian countries (e.g. Sri Lanka, Burma and Malaysia). Long pepper has a spicy and aromatic taste, while black pepper is more pungent[76].

Black pepper is one of the most important and widely used drugs in the Ayurveda, Unani, and Siddha traditional medical systems. It is used either as a single drug or in combination with long pepper and dry ginger, popularly known as "the three acrid" (*trikatu*), which cures the three unbalanced humours (wind, bile, phlegm[77]), and helps to maintain health. It is described as hot, pungent and acrid in taste, with rubefacient, carminative, and drying properties. It is used as an alterative, anthelminthic, and germicidal, digestive herb, used for cough, dyspnoea, cardiac diseases, colic, worms, diabetes, piles, epilepsy, as well as many other ailments[78]. Long pepper has very similar applications, used also as tussive, in snake bites or scorpion stings. It is noteworthy that long pepper roots are used as stimulant and tonic, in catarrh and hoarseness, palsy, gout, rheumatism, lumbago, sciatica, and other ailments[79].

Ginger

One of the first textual references to *ziggiberi* or ginger (*Zingiber officinale* Rosc, family Zingiberaceae) is found in Celsus (*De medicina*, 5.23.3), who listed it among the ingredients of the famous antidote of Mithridates. In *DMM* ginger comes just after pepper (2.160) and is considered a plant growing abudantly in the land of the Troglodytes and Arabia, where the green parts had numerous uses. It was held as warming, digestive, and slightly softening, beneficial for the stomach and *scotomata*, and as an antidote ingredient. Both Pliny (*NH*, 12.14) and Dioscorides mistakenly assumed that ginger was cultivated in Arabia. Ptolemy (127 – after 146 CE) (*Geographia*, 7.4.1.6) did much better, mentioning that ginger was among the products of Simoundou or Salikê at Taprobanê Island, the ancient Greek name for Sri Lanka. Galen (*DSMTF*, 11.880.9 Kühn), more cunningly, mentioned generally that this useful root was brought from barbarian lands. In terms of properties, *ziggiberi* root was deemed a powerful, but slowly warming substance, more tenuous than pepper. Because of its moisture, this warming effect could last longer. This appraisal was not enough for ginger to be included in a considerable number of compound medicines[80], but it was certainly included in some important recipes, like Andromachus the Elder's *Galên*ê theriac (*DA*, 14.40.11 Kühn), and the Mithridatean antidote (*DA*, 14.107.15 Kühn).

The history of ginger cultivation is not clearly understood. However, this crop is known to have been cultivated and used in India and China at least for 2,000 years. China is probably the region where cultivation started, but little is known about the center of origin, although the highest variability is located in China. The long period of domestication might have played a major role in the evolution of this sterile crop, which is propagated asexually only[81].

In Ayurveda, ginger root is considered pungent, hot and light, easy to digest, with a fatty texture. It is an appetizer, carminative and sto-

machic, anodyne, antirheumatic, antiphlegmatic, diuretic, aphrodisiac, cordial, anti-inflammatory, and it is used to clean the throat, provoke vomiting, and relieve constipation[82].
In Traditional Chinese Medicine fresh (*sheng jiang*) and dried (*gan jiang*) ginger rhizome are distinguished. The dried one warms the stomach and the spleen, expells cold, warms the lungs, and acts as an expectorant and tonic. The fresh root from the other hand expels mainly-cold from the external parts of the body an reduces toxicity of poisonous herbs[83].

Aloe

The oldest textual record of aloe known so far is found on a Mesopotamian clay tablet, dated to 2100 BCE. Another early record is located in Ebers Papyrus (16th c. BCE), in which at least twelve preparations containing aloe are prescribed for external and internal ailments[84]. Aloe is included in the Egyptian *Book of Remedies* (16th c. BCE), as a laxative and a dermatological drug. Contrary to these credentials of antiquity, *aloê* is not mentioned in the *CorpHipp* or in Theophrastus' works[85]. In *DMM* (3.22) aloe leaves and flowering stems are described with a reasonably good level of accuracy. According to Dioscorides, the plant has a heavy scent and a very bitter taste. It was abundant in India, from where its milky sap was exported. It grew also in Arabia and Asia, as well as in some littoral places and islands, like Andros in the Aegean (Greece[86]), but it was not suitable for extracting the sap, although it was still useful as a poultice for healing wounds. Aloe extract came in two types: a sandy residue and a clean one, with the color of liver. As for its properties, aloe was considered styptic, drying, and hypnotic. It contracted the body, released the abdomen and cleaned the stomach, and was used for the treatment of phthisis and jaundice. It was also added to other cathartics to make them less harmful to the stomach. Externally, dry aloe powder could be used to heal wounds, condylomas and fissures,

ulcers, mouth problems (like tonsillitis and gingivitis), and also to stop hemorrhoid bleeding and hair loss. The *Periplus* (28.9) contains only one reference of exporting aloe from the port of Kanê and the city of Sabbatha. Aloe was also used in a couple of compound medicines in Aretaeus of Cappadocia *De curatione acutorum morborum*[87] and *De curatione diuturnorum morborum*[88]. That could be due to its scarcity in the markets of Aretaeus' region (hypothetically Asia Minor) or because Aretaeus was not really fond of that expensive product. Galen (*DSMTF*, 11.821.12 Kühn), correcting Dioscorides, states that aloe did not grow in Greece, while the quality cultivated in Great Syria was watery and weaker in power, but it could be used to heal wounds. In warmer countries like Coele Syria and Arabia, aloe quality was much better. The variety growing in India was excellent and very much used in medicine, being dry without any pungency. Galen considered aloe mildly astringent and strongly bitter, dry in the 3rd degree and warm in the 1st or the 2nd, with cathartic and digestive properties. It was used to expel pathogens, treat vaginal ailments and the most difficult ulcers, inflammations and wounds, without causing pain. A great number of compound medicines in Galen's *DCML* and *DCMG* include aloe. Aetius of Amida (*Iatr*, i.21.1) recommends the use of aloe in ophthalmological problems, especially on children. Alexander of Tralles has also many references to aloe, several of them maintaining the term of "liverish aloe" (*aloê êpatitis*, *Thera*, 1.579.8, 2.51.13, 2.271.9, for example), the color mentioned by Dioscorides.

Aloes are perennial, leaf-succulent xerophytes with structural and physiological adaptations for survival in arid regions. They are widespread in sub-Saharan Africa, the Arabian Peninsula, and a number of islands the Indian Ocean, in many different kinds of natural habitats, from forest to exposed rocky surfaces, with the exception of moist lowland forests in mainland Africa. As a result of overexploitation and habitat destruction, many species are endangered

and in need of conservation[89]. The exact origin of *Aloe vera* (L.) Burm.f. is uncertain, since the species has been widely cultivated around the world, but the Arabian Peninsula is a good candidate, since it is also home to the closely related and possibly conspecific *Aloe officinalis* Forssk[90]. The word *aloê* comes from the Arabic *al-loeh* or the Hebrew *halal* and means a shining, bitter substance[91].
In Ayurveda aloe is considered pungent, bitter, astringent and cold[92], and it is used in inflammations, ulcers, intestinal worms, ophthalmias, and as a laxative tonic, among others[93].

Nutmeg

It has been suggested that nutmeg was not mentioned in Greek texts until 9th c. CE. *Makir* thus could not be identified with mace, because both substances should always have traveled together[94]. Excluding the naivete of such an opinion, it seems that there are some possible identifications for nutmeg, which is the internal seed of *Myristica fragrans* Houtt. The older textual reference is found in a work attributed to Archigenes of Apameia (95-115 CE;), with the title "On spleen inflammation" (*Peri flegmonês splênos*, 11.17-21)[95]. Among the seven ingredients of an exquisitely oriental and exotic compound antidote there are both *maker* and *karua moskhatou* (possibly "musk nuts"[96]). It is tempting to identify these two products with macis and nutmeg. Furthermore, in Aetius of Amida[97], there is a reference to *karua indika* or "Indian nuts" in the compound oil named *salka*, which was produced by Aetius himself in Alexandria and proved excellent as a head anointment (*Iatr*, i.132.4).
The nutmeg tree grows in the wild on rich volcanic soils in lowland tropical rain forests. It is only known from cultivation (e.g. in South India), but it most probably originated in the southern Moluccan Islands, especially Ambon and Banda. Trade of nutmeg and mace (the dried aril) spread from there throughout South East Asia[98].

In Ayurveda nutmeg is considered bitter, hot, with phlegm and wind disposal, aromatic, stimulant and carminative, aphrodisiac, which can act as hallucinogen in large doses[99].

Conclusions

This analysis should only be taken as an introduction to a more elaborate cross-cultural comparison which would hopefully elucidate the questions remained obscure in this essay. As the table indicates, a total of 39 herbs were located in the Greek texts under consideration here. There is general consensus on the identification of several herbs, like black and long pepper, ginger, and aloe. Surprisingly, however, the identity of some well-known spices, like cinnamon, cassia, cardamoms and spikenard, has been challenged by certain researchers, not always with good reason, since there is little doubt that there was an early trade route from India to the Mediterranean, as the finding of black pepper in the mummy of Ramesses II suggests. Only three of the 39 herbs remain unidentified (*naskaphthon*, *seseli aithiopikon*, and *aithiopikê riza*), and some identifications are widely disputed, like *makir*, or neglected, like *xulaloê* and *karua moskhatou*. Of the 39 herbs, 34 were included in the *DMM*, the other ones being probably not available in the Roman Empire in the 1st c. CE.

Dioscorides almost always presents some place of origin for every single plant in *DMM*. Actually he was quite accurate, with the exception of four herbs: cassia, cinnamon, Indian cardamom, and ginger. On the contrary, and possibly because of this full coverage by Dioscorides, Galen did not always include the place of origin of the plants studied in the present essay. He added this kind of information only in approximately one third of the herbs of our list (11 out of 34). For six of these plants he copied Dioscorides, and for two of them he gave broader areas of origin (e.g. Asia instead of India in *kuperos*). There are just two important exceptions: Galen specifies the origin of *makir* (India instead of "barbarian countries" in Dioscorides) and rejects the presence of aloe

in Greece. In the case of bdellium replacing Dioscorides' India with Scythia is not farfetched, since *mukul* could be found in North West India, Northern Pakistan, and Central Asia, that is, in areas included in what ancient Greeks perceived as *Skuthia*. Galen omitted three of all the plants in *DMM* (*naskaphthon*, *kagkamon* & *indikon*), maybe because he was not aware of them, although he did serious efforts to acquire spices of good quality from the closest sources, and did test them. Generally, the variations in the name of some plants in the manuscripts, like in the case of *naskafthon*, probably result from the fact that scribes were not familiar with the plants mentioned in the texts.

Comparing the modern knowledge on the core origin of these species, ancient writers appear to have been particularly exact. According to them, 21 herbs were coming from India, 13 from Arabia, 5 from Persia, and 3 from Ethiopia. From a contemporary perspective 28 herbs could have originated in Southern Asia (including India), 8 in Arabia, 6 in the area corresponding to ancient Persia (Iraq, Iran, Afghanistan), and another 6 in African countries. Only the late reference to galangal does not include any origin.

The comparison of properties and uses provided in the Greek texts seems to agree to a certain degree with information on Asian traditional uses. Differences in the cultural background whithin which the systems of traditional medicine were developed have to be taken into account. A typical example would be the different perceptions of the temperature effect of the herb (hot or cold). More careful reading and cross-reference of Greek texts can still provide new key information on herbs, as we indicated in the cases of *xulaloê*, *makir*, and *karua moskhatou*. Other interesting data can be found in Asian sources, which confirm the Greek authors, as in the case of *nardos* and the description of its trade routes from Kabul, the Hindu Kush and Kashmir to Ujjain, which coincides with ancient Indian sources. Finally, it is interesting to note that in Unani Tibbia there are still recipes bearing Galen's name, for example the famous *jawarish*

jalinoos, which contains cinnamon, cassia, spikenard and cardamom, among others. These aromatic spices were carried from the Indian ports to the Roman Empire to be contained in a recipe by Galen, and they then traveled all the way back to India, following the Arabic conquest. But, this time, they carried with them an important Mediterranean product, mastic or *mastagi* in Unani texts, a resin produced only in the Greek island of Chios, at least from the time of Dioscorides, providing a most suitable example of "Moving Plants, Transforming Medicine" processes between very diverse and distant worlds.

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15. Nadkarni KM, Indian Materia Medica (2 vols, 3rd ed.) Bombay: Popular Prakashan; 1976. vol. I, p. 475.
16. Pliny the Elder (NH, 12.26) mentions one kind that grew on the banks of the Ganges, which was useless; it bears the name of *ozænitis*, and emits a fetid odour. This last word is coming from the Greek word for a fetid nose polypus (ozaina).
17. Possibly identified with Safar, in the southern corner of the Arabian Peninsula, close to Mouza, the royal metropolis of the Omêrites and Sabaites tribes, according to the Periplus (23.1). This was probably an export place.
18. Nutton V, The drug trade in antiquity. Journal of the Royal Society of Medicine 1985;78:138-145, p. 143. does not help to clear the confusion on nard. Dioscorides is not referring necessarily to the "two sides of the Hindu Kush" here. The mountain must have been close to the Ganges plains.
19. Galen categorized medicinal substances in terms of temperature in four warm degrees (*taxeis*), four cold and a neutral. Similarly, he used nine more degrees in total for wetness and dryness of a medicinal substance.
20. NW India: Barbarikê (Periplus, 39.7), Barugaza (48.8; 49.13) has 3 varieties from Proklais (*Kattubourinê*, *Patropapigê*, *Kabalitê*), as well as a Scythian one; S. India: Mouziris, Nelkunda (56.13), a *Gaggêtikê* variety; NE India: *Gaggês* (see the useful list in: Casson L (Text With Introduction, Translation, and Commentary), The Periplus Maris Erythraei. Princeton University Press: Princeton; 1989. p. 16).

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22. In the CAMP workshop organized at Shimla in 2003 it was collectively agreed by experts that more than 80% of the wild population in the Himalayan region of India has declined over the last 10 years (IUCN Red List, 2015, online at: http://www.iucnredlist.org/details/50126627/0).
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24. Erroneously identified as *Andropogon iwarancusa* Roxb. Nadkarni KM, Indian Materia Medica (2 vols, 3rd ed.) Bombay: Popular Prakashan; 1976. vol. I, p. 107.
25. Found also as *kinnamômon*. Both forms are regularly found in the same text, like in DMM, 1.14.1-3. Cinnamon and cassia are discussed by several researchers (Amigues S, Un cinnamome fantomatique. Topoi 1996;6(2):657-664; a different view by Haw SG, Cinnamon, Cassia, and Ancient Trade. Journal of Ancient History and Archaeology; 2017;4(1):5-18).
26. The biblical word *qiddah* is usually translated as cassia, because of the resemblance with the name *kittô* in Dioscorides (DMM, 1.12). There are a few relevant references, like Ezekiel (27.19), Exodus (both cinnamon and cassia are mentioned at 30.24), and Psalm (45.8).
27. *Gui zhi* comes from the small branches, *guan gui* is the thin bark from 6-7 year old trees and *rou gui* is the thicker bark closer to the roots of older trees (Bensky D, Clavey S, Stroeger E, Gamble A, Chinese Herbal Medicine - Materia Medica (3rd ed.), Seattle: Eastland Press; 2004. p. 8-11 & 684-687).
28. An "unequivocal botanical attestation of a South Asian spice in the West" (Gilboa A, Namdar D, On the Beginnings of South Asian Spice Trade with the Mediterranean Region: A Review. Radiocarbon 2015;57:265-283, p. 272), although it is admitted that the identification is uncertain (Kučan D., Zur Ernährung und dem Gebrauch von Pflanzen im Heraion von Samos im 7. Jahrhundert v. Chr. Jahrbuch des Deutschen Archäologischen Instituts; 1995;110:1-64, p. 53). Haw (Haw SG, Cinnamon, Cassia, and Ancient Trade. Journal of Ancient History and Archaeology 2017;4(1):5-18.) refutes this finding.
29. It is alleged that this "raises the possibility of Levantine trade with South East Asia" at this very early time (Namdar D, Gliboa 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 2013;13:1-19, p. 1). 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 (Namdar D, Gliboa 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 2013;13:1-19; pp. 10, 12). But, as it was correctly noticed by Haw SG, Cinnamon, Cassia, and Ancient Trade. Journal of Ancient History and Archaeology; 2017;4(1):5-18; cinnamaldehyde could have originated from other plant species as well.

30. Probably brought from Mosullon, see Periplus, 10:4.10.
31. Together with cassia in DNaMul, 34.12 and DMulAf, 51.9 and 181.4; also in DNaMul, 34.23; DMulAf, 195.17 and 206.7. The pessary is described at De supefetatione, 33.4 (ca 450 BCE).
32. A *kassia* zigir and *motôdês* in DCML, 12.606.8, but *gizi*, *motô*, *arebô* and dafnitis in DA, 14.72.16.
33. *Malaô*, *Moundou* (9:4.3, presumably included among the "aforementioned"), Mosullon (10:4.10), *Arômatôn emporion* or Spice Port (12:4.27) and *Oponê* (13:5.4). *Mosullon* was supplying the largest quantity.
34. Casson L (Text With Introduction, Translation, and Commentary), The Periplus Maris Erythraei. Princeton University Press: Princeton; 1989.
35. Stephen G. Haw proposed that both cassia and cinnamon should be identified with *Cassia abbreviata* Oliv, an African species of different family (Fabaceae). Unfortunately this tree is not aromatic. (Van Alfen PG, Pant'agatha: Commodities in Levantine-Aegean Trade during the Persian Period, 6-4th c. B.C. PhD thesis, University of Texas at Austin, 2002. pp. 47-48; Haw SG, Cinnamon, Cassia, and Ancient Trade. Journal of Ancient History and Archaeology; 2017;4(1):5-18, p. 14).
36. Ravindran PN, Nirmal Babu K, Introduction. In: Ravindran PN, Nirmal Babu K, Shylaja M, Cinnamon and Cassia-The Genus Cinnamomum. London, New York, Washington: Boca Raton CRC; 2004. p. 1-2.
37. Ravindran PN, Shylaja M, Nirmal Babu K, Krishnamoorthy B, Botany and Crop Improvement of Cinnamon and Cassia. In: Ravindran PN, Nirmal Babu K, Shylaja M, Cinnamon and Cassia-The Genus Cinnamomum. London, New York, Washington D.C., Boca Raton: CRC; 2004b. p. 16.
38. Nadkarni KM, Indian Materia Medica (2 vols, 3rd ed.) Bombay: Popular Prakashan; 1976. vol. I, p. 328-330.
39. Vijayan KK, Ajithan Thampuran RV, Pharmacology and Toxicology of Cinnamon and Cassia. In: Ravindran PN, Nirmal Babu K, Shylaja M, Cinnamon

and Cassia-The Genus Cinnamomum. London, New York, Washington D.C., Boca Raton: CRC; 2004. p. 259, 264, 278).

40. Jalinoos or Jalinus is the Arabic form of Galen's name.
41. This semisolid traditional Unani formulation is used for the treatment of weakness of vital organs, liver, and stomach. It usually contains 17 herbs: *Pistacia lentiscus* (mastagi), *Nardostachys jatamansi* (sumbul-ut-teeb), *Elettaria cardamomum* (heel khurd), *Cinnamomum cassia* (saleekha), *Cinnamomum zeylanicum* (darchini), *Alpinia galanga* (khulanjan), *Syzygium aromaticum* (qaranfal), *Cyperus rotundus* (sad kufi), *Zingiber officinale* (zanjabeel), *Piper longum* (filfil daraz), *Piper nigrum* (filfil siyah), *Saussurea lappa* (qust shireen), *Commiphora gileadensis* (ood balsan), *Asarum europaeum* (asaroon), *Myrtus communis* (habb ul aas), *Swertia chirata* (chiraita shireen), *Crocus sativus* (zafran), and sugar (qand safaid) (Pharmacopoeia Commission for Indian Medicine & Homoeopathy 2016, p. 63).
42. Difficult to identify, maybe *Leukojum* spp. or *Galanthus* spp, both in Amaryllidaceae family.
43. Either *Dioscorea communis* (L.) Caddick & Wilkin (Dioscoreaceae family, syn. *Tamus communis L.*) or *Bryonia cretica L.* (Cucurbitaceae family).
44. Nadkarni KM, Indian Materia Medica (2 vols, 3rd ed.) Bombay: Popular Prakashan; 1976. vol. I, p. 93-94.
45. *Barbakikê* (Periplus, 39.7), *Ozênê* and Barugaza (48.10; 49.13).
46. According to galenic theory, these substances create "air" in the body, which can be manifested as intestinal gas, as well as rapid actions, like sex drive.
47. Madhuri K, Elango K, Ponnusankar S, *Saussurea* lappa (Kuth root): review of its traditional uses, phytochemistry and pharmacology. Oriental Pharmacy and Experimental Medicine 2012;12:1-9.
48. Nadkarni KM, Indian Materia Medica (2 vols, 3rd ed.) Bombay: Popular Prakashan; 1976. vol. I, p. 1110.
49. Ng LT, Chang YS, Kadir AA, A review on agar (gaharu) producing Aquilaria species. Journal of Tropical Forest Products 1997;2(2):272-285.
50. Mainly the species *Dinoplatypus chevrolati*. Ambrosia beetles (subfamilies Scolytinae and Platypodinae) live in nutritional symbiosis with ambrosia fungi and probably bacteria. The beetles excavate tunnels in the wood of trees, carrying the fungi spores and cultivate fungal gardens, their sole source of nutrition.
51. Ng LT, Chang YS, Kadir AA, A review on agar (gaharu) producing Aquilaria species. Journal of Tropical Forest Products 1997;2(2):272-285.
52. Nadkarni KM, Indian Materia Medica (2 vols, 3rd ed.) Bombay: Popular Prakashan; 1976. vol. I, p. 120-121.

53. For example in Henricus Stephanus' Thesaurus Graecae Linguae (1846, vol. 5, p. 1361) or Liddell & Scott (Liddell HG, Scott R, A Greek-English Lexicon. Revised and augmented throughout by Sir Henry Stuart Jones. With the assistance of Roderick McKenzie. Oxford: Clarendon Press; 1940. Liddell HG, Scott R, Lexikon tes Hellinikes Glosses. [in Greek], West Hartford: Pelekanos Books; 2015. vol. 4, p. 658, in the Greek edition).
54. Another version *naokafthon* in TLG or *naokauthon* in the Aldus Manutius edition (Venice 1528, f. 114) at Paul's EpMed (7.3.13.2) remains to be checked in the manuscripts.
55. Obstruction of pneuma circulation was a major cause of disease, especially, but not exclusively, for the Pneumatic School of Greek medicine (1st c. CE). Again there are interesting similarities with the Traditional Chinese Medicine.
56. A port with a lost name (Periplus, 37.10), *Barbarikê* (ib, 39.7), *Barugaza* (ib, 48.10; 49.13).
57. Sarup P, Bala S. & Kamboj S, Pharmacology and Phytochemistry of Oleo-Gum Resin of *Commiphora wightii* (Guggulu). Scientifica 2015:ID 138039;14.
58. Nadkarni KM, Indian Materia Medica (2 vols, 3rd ed.) Bombay: Popular Prakashan; 1976. vol. I, p. 169.
59. Paraskeva MP, A Phytochemical and Pharmacological Study of Ten Commiphora Species Indigenous to South Africa. Johannesburg, Dissertation submitted to the Faculty of Health Sciences, University of the Wiwatersrand Johannesburg in fulfilment of the requirements for the Degree of Master of Pharmacy; 2007. p. 51.
60. Kattujathi, literally "wild nutmeg", *ponnampu* etc. in Malayalam; *Rampatri* in Hindi.
61. Chelladurai PK, Ramalingam R, *Myristica malabarica*: A comprehensive review. Journal of Pharmacognosy and Phytochemistry 2017;6(2):255-258.
62. Nadkarni KM, Indian Materia Medica (2 vols, 3rd ed.) Bombay: Popular Prakashan; 1976. vol. I, p. 833-834.
63. Bostock J, and Riley HT, The Natural History. Pliny the Elder. London: Taylor and Francis; 1855.
64. Dalby A, Dangerous Tastes: The story of spices. London: British Museum Press; 2000. p. 54.
65. Casson L (Text With Introduction, Translation, and Commentary), The Periplus Maris Erythraei. Princeton University Press: Princeton; 1989. p. 126.
66. Beck LY (tr.), Pedanius Dioscorides of Anazarbus, De materia medica. Altertumswissenschaftliche Texte und Studien, vol. 38, Hildesheim-Zurich-New York: Olms-Weidmann; 2005. p. 63.

67. Baquar SR, Medicinal and Poisonous Plants of Pakistan. Karachi: Printas; 1989. p. 233; Nadkarni KM, Indian Materia Medica (2 vols, 3rd ed.) Bombay: Popular Prakashan; 1976. vol. I, p. 634-651.
68. Aufmesser M, Etymologische und wortgeschichtliche Erläuterungen zu De materia medica des Pedanius Dioscurides Anazarbeus. Olms: Hildesheim; 2002.
69. After the brain was completely removed, they filled his nasal cavity with pepper, seeds, and even small animal bones to retain the unique structure of Ramesses II's nose. This was a rare procedure and could explain why Ramesses' mummy was one of the few with such a distinctive profile (Fitzgerald S, Ramses II: Egyptian Pharaoh, Warrior, and Builder. Minneapolis: Compass Point Books; 2009. p. 88).
70. See Jouanna J, Hippocrates. De Bevoise MB (Tr. by), Baltimore: Johns Hopkins University Press; 1999. pp. 373-416. (Appendix 3: The Treatises of the Hippocratic Collection) and Touwaide & Appetiti, 2015, p. 14-15. Examples include: De diaeta acutorum (ca 430-370 BCE, 11.48), De morbis popularibus (ca 450-380 BCE, 4.1.40.5; 5.1.67.2; 6.6.13.2; 7.1.64.2), De morbis (ca 450-380 BCE, 3.12.9; 3.16.87; 3.16.97), DNaMul (32.172) and DMulAf (34.36; 37.18; 81.14; 84.21; 84.40; 201.24; 205.13; 205.31).
71. That is not far from truth since *Piper nigrum* L. is a flowering vine (family Piperaceae). Black pepper is produced from the still-green, unripe drupes processed with hot water. White pepper is produced by retting: the fully ripe red pepper berries are soaked in water to soften the flesh, which is removed by rubbing. A different species of the same genus, long pepper (*Piper longum* L.) has in fact many minuscule fruits, with the size of the poppy seed, embedded in the surface of a flower spike. Dioscorides' parallelization of long pepper's seeds with millet (*Panicum miliaceum* L.) is not far-fetched.
72. A scotoma (Greek: *skotoma*, from skotos, darkness, plural: *skotomata*) is an area of partial alteration in the field of vision consisting of a partially diminished or entirely degenerated visual acuity that is surrounded by a field of normal vision.
73. See the commented editions by Jacques JM (ed.), Nicandre, Les Thériaques. Fragments iologiques antérieurs à Nicandre. Paris: Belles Lettres; 2002. Jacques JM (ed.), Les Alexipharmaques. Paris: Belles Lettres; 2007.
74. Ummer C, Indian spices-from the leaves of history. Spices Fair Commemorative Volume, pp. 27-40, 1989. Ravindran PN, Balachandran I, Chempakam B, End uses of black pepper. In: Ravindran PN, Black Pepper-Piper nigrum. Amsterdam: Harwood Academic; 2000. p. 5).
75. Ravindran PN, Nirmal Babu K, Sasikumar B, Krishnamurthy KS, Botany and Crop Improvement of Black Pepper. In: Ravindran PN, Black Pepper-Piper nigrum. Amsterdam: Harwood Academic; 2000. p. 30.

76. Ravindran PN, Black Pepper-Piper nigrum. Amsterdam: Harwood Academic; 2000 p. 502.
77. Tridosha or the "three aggregates" are usually translated as "three humours", since it is a theory very similar with the ancient Greek four humours. Their English translation follows the same rule: *vata* is air, *pitta* is bile and *kapha* is phlegm. Astonishingly enough, Tibetan Medicine chose to keep the tridosha doctrine, together with the Greek five elements (earth, water, fire, air and ether) and not the Chinese ones (earth, metal, water, wood and fire). All these medical systems consider humoural imbalance to be one of the main pathogenic factors.
78. Ravindran PN, Introduction. In: Ravindran PN, Black Pepper-Piper nigrum. Amsterdam: Harwood Academic; 2000. p. 472-474.
79. Nadkarni KM, Indian Materia Medica (2 vols, 3rd ed.) Bombay: Popular Prakashan; 1976. vol. I, p. 967-969.
80. For example: DCML, 12.403.13, for alopecia; ib., 12.584.13, expelling phlegm.
81. Ravindran PN, Nirmal Babu K, Shiva KN, Botany and Crop Improvement of Ginger. In: Ravindran PN, Nirmal Babu K, Ginger-The Genus Zingiber. London, New York, Washington: Boca Raton CRC; 2005. p. 17.
82. Remadevi R, Surendran E, Ravindran PN, Properties and Medicinal Uses of Ginger. In: Ravindran PN, Nirmal Babu K, Ginger-The Genus Zingiber. London, New York, Washington: Boca Raton CRC; 2005. p. 490.
83. Bensky D, Clavey S, Stroeger E, Gamble A, Chinese Herbal Medicine - Materia Medica (3rd ed.), Seattle: Eastland Press; 2004. p. 30-34 & p. 681-684.
84. Atherton P, Aloe vera revised. British Journal of Phytotherapy 1997;4:176-183.
85. According to Scarborough (Scarborough J, Aëtios of Amida. In: Keyser PT & Irby-Massie GL, The Encyclopedia of Ancient Natural Scientists. The Greek tradition and its many heirs. New York: Routledge; 2008.) aloe didn't enter Roman pharmacy before the reign of Augustus.
86. It seems that much later some Greek islands were producing some kind of aloe, e.g. the report by Christophoro Buodelmonti on Kalymnos and Leros Island in 1408 (Buodelmonti C, Liber Insularum Archipelagi, e codicibus parisiniis regiis nunc primum totum editit, praefatione at annotatione instruxit Gabr. Rud. Ludovicus de Sinner. Leipzig & Berlin: Reimer; 1824. p. 105; Buodelmonti C, Description des Iles de l'archipel par Christophe Buondelmonti, version Grecque par un anonyme. Ernest Leroux: Paris; 1897. p. 67). In this text the term is *xulaloê* (lignum Aloë in the Latin text), but certainly this could not be aloeswood.
87. Seven references, for example: 2.2.5.10; 2.3.13.4 etc.
88. Two references: 1.5.6.4; 1.5.11.1.

89. Currently 22 species of Aloe (mostly Madagascan) are listed in CITES Appendix I and the rest are in Appendix II, with the sole exception of *Aloe vera*, which is free of restrictions.
90. Newton LE, Aloes in habitat. In: Reynolds T (ed.), Aloes. The Genus Aloe. Medicinal and Aromatic Plants-Industrial Profiles. v.35. London, New York, Washington: Boca Raton CRC; 2004. p. 21.
91. Mascolo N, Izzo AA, Borrelli F, Capasso R, Di Carlo G, Sautebin L, Capasso F, Healing powers of aloes. In: Reynolds T (ed.), Aloes. The Genus Aloe. Medicinal and Aromatic Plants-Industrial Profiles. v.35. London, New York, Washington D.C.: Boca Raton CRC; 2004. p. 223.
92. There are some notable differences in attributing temperature properties in medicinal substances, between Greek and Indian medical systems, like for example in aloe (warm in the Greek texts, but cold in the Indian ones).
93. Nadkarni KM, Indian Materia Medica (2 vols, 3rd ed.) Bombay: Popular Prakashan; 1976. vol. I, p. 73-77.
94. (García de Orta's opinion, 1563, p. 283; quoted by Dalby A, Dangerous Tastes: The story of spices. London: British Museum Press; 2000. p. 54.
95. This was probably part of the extensive "Therapeutics for chronic diseases" (*Hroniôn nosôn therapeutika*) (Mavroudis ED, Archigenes Philippou Apameus. The life and works of a Greek physician in imperial Rome. [In Greek], Athens: Academy of Athens; 2000. p. 105.).
96. The word moskhaton is used by Aetius to denote the heavily aromatic incense (see Iatr, xvi.126, 142, 144, for example).
97. Scarborough J, Aëtios of Amida. In: Keyser PT & Irby-Massie GL, The Encyclopedia of Ancient Natural Scientists. The Greek tradition and its many heirs. New York: Routledge; 2008. p. 38-39.
98. Flach M, Tjeenk Willink M, *Myristica fragrans* Houtt. PROSEA (Plant Resources of South-East Asia), Wageningen: Netherlands; 2016. http://uses.plantnet-project.org/en/Myristica_fragrans_(PROSEA)
99. Nadkarni KM, Indian Materia Medica (2 vols, 3rd ed.) Bombay: Popular Prakashan; 1976. vol. I, p. 830-834.

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