

ANCIENT FORESTRY

An historical study

PART I

Facts and information on trees

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Preface

Down the ages history has been an intensively cultivated area of knowledge. The general history of mankind as well as the special histories dealing with different facets of civilization have become the objects of thorough research and elucidation. There are certain branches of human knowledge, however, the history of which is still very imperfectly known. One such area comprises the development of knowledge pertaining to the forest and trees, and the progress made in utilizing them, before conscious efforts at forest preservation appeared on the scene. Such efforts can be considered to have made their appearance to some extent already during the Middle Ages as a consequence of the feudal lords' attention to their game lands, and from these times on, the history of matters associated with the forest is fairly accurately known, at least as far as the most important of the present day countries engaged in silvicultural activities is concerned. The importance of the forest to the peoples of ancient times, however, has up to now received very little attention.

EDWIN LINKOMIES, the late rector and chancellor of Helsinki University, was very understanding and encouraging regarding my endeavor and gave valuable pointers on the literature involved. Professor ARMAS SALONEN has very kindly lightened the task of digging up sources which are significant from the standpoint of my theme. In matters pertaining to language I have been forced to turn to Professor IIRO KAJANTO and Assistant Professor PÄIVÖ OKSALA, receiving valuable help. My interest in the undertaking of such a study was especially aroused by two men: my forest economy teacher, Professor EINO SAARI, and the former head of the forest economy department of the Forest Research Institute, Professor VILHO PÖNTYNEN. While preparing this study I have often thought of my former Latin and Greek teacher ESKO JOKI, who is no longer with us. It is to him that I attribute my own interest in the classical languages. To all of these I am deeply grateful.

I have written my study in Finnish as well as rendered the necessary translations from the original texts into Finnish. The part of the study now being published has been translated into English by Mr. ROBERT GOEBEL. I wish to express my warm thanks to him for having performed what is to my knowledge a very difficult task and for his pleasant co-operation in smoothing out the rough spots which are always involved in translations of this sort. In citing direct translations from the original languages into English, in some instances the translations which

have appeared in the »Loeb Classical Library» have been used; the names of the translators in question will be found in the bibliography at the end of this work.

My original intention was to publish my study, which had swollen to sizeable proportions, in one part under the title, »The Significance of Forests to the Peoples of Ancient Times.» It has become evident, however, that the costs involved make this impossible. Accordingly, it has been decided to publish my study in separate installments under the general title »Ancient Forestry». Part I, now appearing, is primarily concerned with biological information in ancient times. The subtitle of the following installment is »The Procurement and Trade of Forest Products.» I hope to see its publication by 1968.

Before looking into the matter, I considered it virtually impossible to receive financial assistance for a study of this nature under the conditions prevailing in Finland. Thus, the greater has been my joy and the more have I been spurred onward to have received the subsidies which the Finnish Research Council for the Natural Sciences, the Finnish Research Council for Agriculture and Forestry and the Finnish Cultural Foundation have granted for this purpose. The aforesaid likewise applies regarding the smaller special lecturer's stipend which Helsinki University granted for the same purpose. I wish to express my sincerest thanks for the support gained from these sources.

Finally, I extend my thanks to the Society of Forestry in Finland for approving my work to be published in the series Acta Forestlia Fennica.

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I. Introduction

A. Background

The beginning of the author's interest in forest history may be seen in a translation error which he made as a schoolboy. In the sixth book of CAESAR'S »Gallic War» it is told how the king of the Eburonites, Catuvolcus, took his life by imbibing the poison of the yew tree (*taxo se exanimavit*, literally, killed himself with the yew). I offered up for the teacher's consideration the interpretation that Catuvolcus had hanged himself on a yew tree, but it did not pass muster. This misunderstanding stuck in my mind, and, when in time I had attained my bachelor's in forestry, got me to thinking that it might be worthwhile to undertake a study of what was known in antiquity about those things which nowadays are a part of the specialized knowledge of the forester. Such a study would also supply information on the importance of the forest and its products for the lives of ancient peoples.

I knew that such matters receive quite little discussion in the works of ancient writers which are included in school and university courses; whatsmore, my knowledge of other ancient literature was not worth mentioning. At first I thought that the theme was rather barren and for a considerable time I was hesitant about whether it would be worthwhile at all to involve myself in the large-scale task of hunting up textual references in one way or another connected with forests. Fortunately, however, I ran across the works of two ancient writers when my work was just getting under way: THEOPHRASTUS, a Greek, and PLINY THE ELDER, a Roman. I noticed very quickly that I had found so much material within the scope of my theme that there was no fear that my endeavor would turn out to have been in vain. As I gradually continued to widen my acquaintance with the sources of information of ancient times, I realized before long that I was faced with the problem of excess material. In the end my problem became the selection of the most important points from an extremely extensive subject matter.

When the work of going through the ancient literature was at about the half-way point, I received word from professor Eino Saari that there was extant a German work published in the last century dealing with forest history, which might be of aid to me. At this stage I had not yet come to study what had possibly been written in modern times about forestry matters in antiquity because I considered familiarity with the sources in the original to be necessary in any

event. I was, however, quite surprised to find, on the basis of this tip, a two volume work published in 1886 and entitled »Waldgeschichte des Alterthums». According to the wrapper its author was AUGUST SEIDENSTICKER, »Königl. Preuss. Forstmeister a.D. in Frankfurt a.O. Ritter des Rothen Adler-Ordens».

When I flipped through the densely printed, already slightly time-worn pages of this worthy-appearing work for the first time, I thought that all my labour up to this point had been in vain, for surely all possible information about forestry matters in antiquity would have to be included in a work whose two volumes comprised over 850 pages! Closer attention to the date of publication, however, indicated that Seidenstricker could hardly have known very much at all about the history of Egypt and the Fertile Crescent because our more detailed information about the early history of these lands is substantially based on the results of excavations that were not carried out until these very times or later on. And so it was. My German colleague did not really know much more about the history of Egypt and the Fertile Crescent than did the writers of antiquity, whose information, often based on word of mouth, has in many instances proved unreliable.

When I began to compare the information that I had compiled with that presented by Seidensticker, it was readily apparent that there was indeed plenty to be done. In interpretation of the facts, I noticed that I was more often than not at variance with my predecessor. I am frankly pleased at this, because it endowed my work with purpose and made it interesting. Quite naturally, Seidenstricker had handled the above-mentioned problem of excessive material differently than I deemed appropriate. I shall return to this matter in more detail in connection with the discussion of the literature, which is taken up later on.

B. The most important ancient written sources of information from the viewpoint of their connection with forests

In almost all the written sources of information of antiquity some mention is made, at least in passing, of matters which in one way or another touch on forests and forestry. There are, however, rather few works and texts in which such matters are dealt with directly or even appreciably spoken of. In the following section we shall briefly examine in historical chronology the most important written sources of information from the standpoint of the scope of the study. Mention of the date and place of publication of the texts or translations used will not be made in this connection, but such information is to be found in the bibliography, which includes all sources used, at the end of the study.

So far as it is known, the oldest written source which tells about trees to a significant degree — it mentions about 13 tree species and also tells about the procurement and use of wood — is probably the hymn of GUDEA, prince of the Sumerian city of Lagash commemorating the building of a temple. This has been

preserved for later generations in written form on two clay cylinders, of which especially the so-called A cylinder contains information relevant to our field of interest. Lately the increase in information based on the results of excavations appears to have continually brought Gudea closer to the present, but at the present his placing in time seems to have already achieved a sure foundation. Yet in 1945 SALONEN (Kaksoisvirranmaa, p. 70) tells us that he (Gudea) lived somewhere about the year 2300 B.C. In 1953 FALKENSTEIN and VON SODEN (Sumerische und akkadische Hymnen und Gebete, p. 9) date him at about the year 2100. Finally, in the new Finnish language edition of GRIMBERG'S »The History of Nations» (1956), the Near East section of which has been examined by Salonen, it is now considered possible to date GUDEA, with certainty, around the year 2000 B. C.

The Iliad and Odyssey, whose author is traditionally held to be HOMER, should be mentioned next as important sources. The epic poems contain, to be sure, most frequently only mentioned in passing, abundant information about tree species, the uses of wood, logging equipment, and the felling of trees as well as the preparation and transportation of timber. The events and descriptions contained in the epic poems can in many instances be traced back to the Mycenaean Age (1600—1200 B.C.), although they also contain a great deal of newer material (LINKOMIES 1948, pp. 294—335). HOMER apparently lived in the eighth century B.C. and was widely known as a singer of poems. To his name were later attributed all the heroic poems which thereafter between the years 650—600 were joined together and reshaped as the Iliad and Odyssey. The creator of the epic poems, surely a great poetic figure, has remained unknown. To aspire to become a writer was unheard of at this time and the man who compiled the epic poems most likely had no conception of what a magnum opus he had completed. It was evidently enough for him that the songs which he had compiled would live on after him in written form, and it hardly occurred to him that his name had earned the honour to be preserved down the ages (LINKOMIES 1948, pp. 348—367).

The world's first peasant poet, HESIOD, a native of Boethia near Helicon, whom LINKOMIES (1948, p. 61) places in the same period with the creator of the Iliad and Odyssey, the latter half of the seventh century B.C., is probably also the first to have expressed his opinion as to what time of year trees should be felled. His poem, »The Works and Days», represents something entirely different from the heroic poems we have just mentioned. In these verses there is not a trace of such deeds of daring or feasting; rather, they exude the barren reality of life and workaday diligence and even complaining discontent itself. On the other hand, however, the supporting strength of this poem is its insistence on justness and its respect for law and rightfulness.

The fitting of the *Bible* into historical chronology along with the other written sources is not an easy task, but since the oldest sources, which in a combined form are considered to have come into being as the Books of Moses, date back

to the ninth century B.C., and since they relate things that belong to the very earliest period of history, it may be possible to mention the *Bible* here despite its abundant material of later origin. Here and there in the *Old Testament* we come across facts which fall within the scope of this study. For example, as far as is known, the oldest note on the floating of wood by sea is to be found in the *Old Testament*.

Next in line, HERODOTUS (ca. 484—425 B.C.), who was born in Halicarnassus and lived for some time in Athens and who is honoured as the »father of history«, may be deserving of mention. In his compendious history, this widely travelled writer portrays all the lands and peoples that were then known. As we might expect, Herodotus has in many instances been forced to rely on word of mouth, and, consequently, his work is seen to contain many misconceptions, especially in the light of information provided by the findings of excavations. Nevertheless, to speak of HERODOTUS' naïveté, as if it were something ridiculous — an error of which GRIMBERG (*The History of Nations*, vol. 2, p. 139) is guilty — is to strain one's hindsight. From the point of view of the present, all ancient writers were laughably naïve, but this is not the right way of looking at the matter. HERODOTUS has abundant information on trees and the use of wood. He may be the first one to have spoken about trees of masculine and feminine gender, although the phenomenon itself — the dioecious nature of date palms was in question — was known in ancient Babylonia.

It may seem surprising that the most well known figure of ancient Greece, ARISTOTLE, who was the first true devotee of science and who was considered to be the most learned man of his time, can be passed by here with a mere mention. Natural science was by no means something strange to this philosopher and logician — indeed, he can be considered the founder of, along with other things, zoology — but he did not have time to extend his investigations to plant life. It is quite possible that he expressed the wish that information about plants be collected and analyzed to his student and successor, whom we shall be discussing next.

THEOPHRASTUS, whom Aristotle designated as his successor as director of the peripatetic school, has, as far as general history is concerned, remained completely in the shadow of his precursor. From the standpoint of information dealing with trees and forests, however, he is, along with the Roman, Pliny, by far the most important of the ancient investigators. He was born on the Isle of Lesbos at Eresos in 370 B.C. While still very young, he removed to Athens and became a pupil of Plato. From Plato he, along with another student of the master, Aristotle, who was fifteen years his senior, learned the importance of classifying phenomena. In »The History of Plants« THEOPHRASTUS repeatedly attempts to answer such questions as: What is real nature of this phenomenon?, What are the typical differences among these plant species?, etc. The modern division of plants into trees, bushes, shrubs, and herbaceous plants is attributable to THEOPHRAS-

TUS. When Plato died, THEOPHRASTUS became the pupil of Aristotle; however, he really was almost on the level of a friend. Aristotle was deeply attached to his friend, who, upon his death, took care of his son. Aristotle bequeathed all his original manuscripts to THEOPHRASTUS. It is likely that we owe him a debt of gratitude for publishing certain of the last investigations of Aristotle.

The life of THEOPHRASTUS occurred at a propitious moment in time. Among other things, the expeditions of Alexander the Great turned out to be of great benefit to him. Alexander, who was also a student of Aristotle, took scientifically trained individuals along with him on his expeditions, and THEOPHRASTUS received their observations on plants of foreign lands for his purposes. Thus, his botanical information applies to a noticeably more extensive area than only Greece and the Near East. On the other hand, his information on his immediate surroundings is not first hand, that is, not collected by himself. It seems probable that the students of THEOPHRASTUS, of which there were, according to Diogenes Laertius, the Greek biographer, two thousand, carried out the collection of information, presumably mainly by interviewing farmers, forest workers and carpenters. This is evidenced by the fact that THEOPHRASTUS very often relates what the inhabitants of some district had to say about a given matter. To our knowledge he had no written sources pertaining to botanical matters at his disposal. In »The History of Plants«, THEOPHRASTUS directs his main attention at trees. Just as he is called the »father of botany«, he could also be called, in a slightly more limited sense, »the father of dendrology«. In this connection there is no reason to go further into THEOPHRASTUS' information. Its many-sidedness will surely become most evident from what is said later on. Our peripatetic friend was a very prolific writer, though not many of his works have survived for later generations. He is known to have written about such things as religion, politics, ethics, education, rhetoric, mathematics, astronomy, logic, and meteorology, as well as other things. His life followed a somewhat peaceful course, but once, however, he was ostracized from Athens for a year for an unknown reason. He died about the year 285 B. C. having reached a venerable age and, in deference to his wish, probably received his last place of repose in some tranquil corner of the garden of the peripatetic school.

Since THEOPHRASTUS has lived on in the consciousness of successive generations primarily only as the representative of one special field, it is understandable that he is not granted much space in general history works. Nevertheless, it is unforgivable that NORDENSKIÖLD (1927) in his »History of Biology« passes him by with a couple of brief mentions.

From Theophrastus we can already shift to the cultural sphere of Rome, where the first individual we meet is MARCUS PORCIUS CATO (234—149 B. C.), soldier, statesman, and jurist, who, in addition to his other activities, was also interested in agriculture. This he considered to be in the last analysis the most important means of livelihood. This fanatical opponent of Greek culture, new

fashions, women's rights, and frivolity of any sort, this indefatigable enemy of the Carthaginians, has lived on with his »ceterum censeo» in the milieu of successive generations primarily as a symbol of obstinacy approaching the unbearable. Regarded from the narrow sector of interest of the professional forester, however, of most interest to us is his work dealing with agriculture, »De re rustica», in which we encounter the first known classification of the fertility of the ground.

After Cato, we should mention MARCUS TERENTIUS VARRO (116—27 B.C.), who competes with Pliny (who is to be presented later on) for the title of Rome's most learned man. Since both of these investigators, however, belong to different centuries, it is probably possible to decide the contest by calling both of them the most learned man of their respective centuries. VARRO has been left behind his competitor in the eyes of the later world due to the fact that fewer of his works have been preserved. However, he is estimated to have written 74 separate, extensive works comprising 620 books in all. According to QUINTILIANUS, VARRO himself on his 78th birthday told of having written seventy times seven books, and afterward, he lived on into a second decade. »De re rustica», the only one of his works that has been preserved in its entirety and the very one that is of interest to us in this connection, he wrote at the age of eighty. This work, which is uncommonly logical in its organization for a written work of the time, really does show great learning. We shall have an opportunity later on to become acquainted with it in certain points.

GAIUS IULIUS CAESAR (100—44 B.C.) is also worthy of mention because he, as was explained at the beginning of the introduction, is in a way guilty of the conception of this study. As one of the best known individuals of history, he probably does not require biographical presentation here. In his »Gallic War» he gives in some measure information on tree species and also the use of wood. Of appreciable technological interest is his detailed description of the bridge that was built over the Rhine.

We had the opportunity to affirm previously that certain of the oldest of our sources are in the form of poetry. Accordingly, as the next, and whatsmore especially important source, we meet the Roman poet PUBLIUS VERGILIUS MARO, one of the greatest names in literature. He was born in 70 B. C. in the vicinity of Mantua in northern Italy. His father was a humble farmer, who, nevertheless, saw that his son received a good general education. VIRGIL's first well-known work is his pastoral poem »The Eclogues», a sort of idealizing and mild »back to nature» manifesto. In the way they react, his shepherds ultimately are suspiciously reminiscent of the society set. Noticeably more important, however, both in a general sense as well as from the viewpoint of forestry, is his next work, »The Georgics», a didactic poem which tells about the life of a country man. Besides great poetic gifts, this poem also shows particularly firmly grounded factual information on everything connected with

a farmer's life, here included being information about trees and the logging of timber. VIRGIL wanted consciously to write a work which would be the counterpart of Hesiod's poem »The Works and Days». VIRGIL attained a much higher level than Hesiod artistically, although opinions may differ as to who had the better *Lebensanschauung*. To wit, VIRGIL saw the life of a countryman through a thoroughly idealizing haze, »The Georgics» are truly a hymn in praise of the rustic life, verdant nature, and the sighing forest. VIRGIL knows how to derive enjoyment from the idyllic, something of which Hesiod was not capable. At the most, Hesiod might for a fleeting instant feel some sort of contentment while sitting beside a babbling brook on a beautiful summer day, but in that same instant he is already thinking once more about filling the grain bins and fetching the vicious dog to guard over them. VIRGIL on the other hand, always strives to forget humdrum cares when ever it is at all possible. One is inclined to say that it is regrettable that VIRGIL is best known as the author of the heroic epic »The Aeneid». In writing this poem VIRGIL fulfilled the great hope of emperor Augustus that the Romans should receive a heroic epic of their own, which would invite comparison with the songs of Homer. One cannot avoid the impression that there is in this poem, at least in places, the barely perceptible stamp of something made to order. VIRGIL is decidedly most genuine in »The Georgics», the casual acquaintance of which we shall make later on, unfortunately only in a frame of mind which is merely matter-of-fact. VIRGIL died in 19 B.C. and was buried near Naples at the present day town of Pausilippo.

The well known world traveller and geographer STRABO, who knows no other than this one name, was born in 63 B.C. in Amasia in Cappadocia. He wrote an extensive and well-known geography of the world, which carries the name »Geography». This work, written in Greek, contains many facts of the sort upon which one can make judgements, at least to some extent, as to the profusion of forests and the distribution of various kinds of trees in ancient times. In the intervals between his travels STRABO lived for the most part in Rome, but he moved away when about 56 years old, presumably back to Amasia, the city of his birth, where he lived out the end of his life, dying in 21 A.D. at a ripe old age.

Later on we shall have cause to refer several times to TITUS LIVIUS PATAVINUS (59 B.C. — 17 A.D.), who, as his extra name indicates, was a native of Patavium, or, the present-day Padua. He wrote the history of the Roman empire from the founding of the city of Rome to the year 9 B.C. His work, known by the name »Ab urbe condita», once comprised 124 books, but only 35 of these have passed on to us. From these 35 books, the »Loeb Classical Library» series has published a fourteen volume work complete with translations; thus, considered from the present point of view, LIVY's history is an extraordinarily compendious work. Of historical works written by one man, only Grimberg's »The History of Nations» compares with it in terms of extent.

The Roman construction expert, VITRUVIUS POLLIO, who was a contemporary of Augustus and Tiberius but for whom more precise biographical information is lacking, is deserving of mention primarily because his work »De architectura» provides information on the adaptation of different kinds of wood for building purposes.

Keeping to historical chronology, we next come upon the individual who, together with Theophrastus, has provided the most material for this study. GAIUS PLINIUS SECUNDUS, or, PLINY THE ELDER, was born in the year 23 A.D. in Comum (present day Como). Having studied in Rome for some time, he took up soldiery at the age of twenty five and led a cavalry division under Lucius Pomponius Secundus in Gaul. Seven years later he returned to Rome and began to study law. He spent the period of emperor Nero's rule for the most part in seclusion, but when it had ended he returned again to public life and served for some time as procurator in Spain. When Vespasian had become emperor, he returned again to Rome and attached himself to the emperor's — his former comrade in arms — closest circle of friends. PLINY was an energetic and versatile man who had a strong desire to investigate and write. He has written on quite a few fields, but only his »Natural History» has been preserved for later generations. And fortunately so, for this work containing 37 books is truly an astoundingly extensive book of facts, comprehending, in effect, the entire body of natural scientific knowledge of the time. In his preface PLINY claims to have covered some 2 000 previous works while preparing his opus, subsequently making use of one hundred writers selected from among these. He tells of having taken 20,000 facts worthy of mention from these one hundred authors and compiling them into the thirty six books of his work, adding his own views to the result, for, in the words of DOMITIUS PISO, encyclopedic works are what is needed and not individual books (thesaurus oportet esse, non libros). Book XVI of the »Natural History» is entirely dedicated to forest trees, and elsewhere, too, such matters as fall within the scope of our theme are discussed. Thus, it is natural that we find ourselves dealing with PLINY very frequently later on. — Being so uncommonly energetic, PLINY also served as a naval officer, and in this capacity he happened to be at Misenum on the shore of the bay of Naples in 79 A.D. at the very time when Vesuvius erupted, burying Herculaneum and Pompeii under ash and lava. Eager to obtain a more exact account of this stupendous natural spectacular, PLINY sailed across the Gulf of Naples and landed near Stabiae, a short distance to the southeast. While trying to make his way nearer to Vesuvius, he perished in the poisonous gasses and ash generated by the eruption. Thus, this giant in spirit met his fate at the age of 56 years as a sacrifice to knowledge. The description of this event has been given by his sister's son, PLINY THE YOUNGER, who, from his vantagepoint on the shore, witnessed his uncle's last moments.

Of Pliny's contemporaries, LUCIUS IUNIUS MODERATUS COLUMELLA, whose

dates of birth and death are not precisely known, should be mentioned. He was a native of southern Spain from the region of present-day Cadiz. Later he owned several landed estates in Italy. He is also known to have spent a bit of time in Asia Minor. Of all the ancient works on agriculture, COLUMELLA's work »De re rustica», is probably on the highest level in regard of pertinence to the subject. However, I cannot agree with the opinion of ASH, who translated the beginning part of COLUMELLA's work into English (Loeb Classical Library, Columella I, Introduction, p. XIII), that COLUMELLA is the most systematic of the ancient writers on agriculture. In this respect I would place Varro before COLUMELLA. From the pen of Columella is also a tract known by the title »De arboribus», which seems very promising from our standpoint. In this tract, however, it is mainly grape-vines and olive trees which are discussed, but forest trees not at all. Besides, the same matters are more fully presented in »De re rustica». In any event we shall in places make ourselves acquainted with COLUMELLA's information.

We can conclude our survey of the most important ancient written sources touching on elements of our theme with PALLADIUS RUTILIUS TAURUS AEMILIANUS, usually known as Palladius. He has previously been dated at about the middle of the 4th century A.D., but the Swedish scholar SVENNUNG (1935), who has written an extensive study on PALLADIUS, considers it more probable that he lived in the first half of the 5th century. Palladius wrote a monthly agricultural calendar — also called »De re rustica» — explaining which types of farm work should be done during each month.

Perhaps this is a fitting place to say something about the attitude one should take toward the information presented by the learned men of antiquity. I have heard from the mouths even of some devotees of knowledge opinions to the effect that it is absolutely worthless to examine the superstitious and purile conceptions of the ancient savants. To all appearances the state of affairs is such that during the golden age of technology, that is, when knowledge is applied and expressly made the servant of practical considerations, an age which we are apparently living through now, the study of the early history of some special field seems very surprising. Thus, the opinion mentioned should probably primarily to be thought of as the first instinctive reaction to a matter which evokes surprise. Nor do historical studies usually at all concern themselves with the search for such information as might be directly beneficial to us. The point of departure of all historical investigation is, as LINKOMIES has said, the need of cultured man to obtain organized information about the past. A human being who has awakened to a consciousness of his cultural environment — such an awakening is clearly perceptible for the first time in ancient Greece — desires to link his life to the chain of past generations. The historiographer does not think pragmatically, but in point of fact, an historical investigation does prove useful to him self and his readers for it is the sort of thing which

expands the vistas of thought. It teaches us, or at least should teach us, to judge the attainments of each epoch and each individual man of science against the background of that very epoch, within the limits of the actual conditions and possibilities of the time. It warns us against using the yardstick of today in examining matters which lie thousands of years in the distance, and it advises us not to speak of the superstitiousness of the concepts of the learned men of antiquity, for the level of natural science at that time did not provide conditions favorable to a before-the-fact division of phenomena and explanations into the possible and impossible. It also warns us against overevaluating the attainments of our own age, for it is likely that in the eyes of future generations, they will sooner or later appear just as superstitious as the concepts of the learned men of antiquity seem according to our yardstick. These facts have been most eloquently emphasized by KETONEN (1948) in his work »Suuri maailmanjärjestys».

Thus, the purpose of this study is certainly not to criticize and expose the primitiveness of ancient information pertaining to forests either. Our goal is only to explain what was known in antiquity about matters relating to the professional field of the forester, whether development was observable in this information, and what the true significance of the forest was to ancient peoples. It goes without saying that the examination of ancient times in this sense is only one link of a longer chain.

C. Recent literature on forest history in antiquity

If we wish to stick to historical chronology in this section also, SEIDENSTICKER'S (1886) »Waldgeschichte des Alterthums», of which we have spoken in the beginning of the introduction, should be mentioned first. As far as the present writer knows, this is the only work proper in the field up to now which attempts to shed light on the history of all matters connected with forestry. If SEIDENSTICKER had not had at his disposal translations into his mother tongue of almost all ancient literature, his work could almost be characterized by the word »colossal», but it has in fact been relatively easy for SEIDENSTICKER to become acquainted with the source material. And perhaps it is for this very reason that on closer examination, the marks of haste and superficiality can be perceived in his work. Without doubt, misconceptions and inaccuracies in the German translations which he used have been in part responsible for this. On the other hand, it is indeed verifiable that he has even misunderstood such points as he has cited in the original.

SEIDENSTICKER'S method of dividing his material using the rather far-developed forestry science classifications of his day cannot be considered to have succeeded. In a work dealing with the forestry history of ancient times, it seems odd to find such headings as Weltliche Körperschafts-Wälder, and then

as subheadings, 1. Keine Marken- oder Genossenschafts-Wälder, 2. Keine Stadtwaldungen, and 3. Keine Landgemeinde-Wälder. One may also ask whether from the viewpoint of forestry it is to the point to deal with the so-called sacred groves — which certainly had a great importance as »reserve forests» — taking each divinity separately, and winding up with twenty three subheadings. The following headings, too, would seem to belong more properly to a history of religion: A. Götter-Cultus, a. Einzel-Widmungen, b. Für eine Mehrzahl von Gottheiten, and c. Für alle Gottheiten. Furthermore, is it necessary to discuss the problem of pasturage separately with respect to nine different animals?

Nevertheless, it must be remembered that we cannot any longer criticize SEIDENSTICKER altogether on the basis of the standards of our own time, even though such a procedure might seem natural in view of the remoteness of the object of our study. Be that as it may, I have for my own part solved the problem of the abundance in source material largely differently than SEIDENSTICKER.

»Waldgeschichte des Altertums» is a very detailed analysis of almost, but not entirely, everything that the learned men of ancient times have said about matters pertaining to forestry. Synthesis, however, is well-nigh entirely lacking. SEIDENSTICKER skips by the question of what each ancient writer has picked up from his predecessors and what is his (the ancient's) own contribution. He merely cites facts one after the other, mentioning as a footnote who the originator of each piece of information was. Thus, it remains unexplained whether a development in information and conceptions concerning forestry was already noticeable in ancient times. Since SEIDENSTICKER has divided his work into two parts under the headings *Vor Cäsar* and *Nach Cäsar* — it is difficult to grasp how Caesar could be some kind of line of demarcation in matters pertaining to forestry — one would have thought that he would attempt to explain how the latter period differed from the former, but one may search in vain for such clarification. The discerning reader can himself, of course, try to shape some kind of coherent picture from this, but due to the almost unlimited wealth of details, this is extraordinarily troublesome.

SEIDENSTICKER'S work has apparently passed into oblivion in Germany, too, for in the periodical »Holz-Zentralblatt» (number 29/1958) SANDERMANN (Also sprach Theophrastus. Ein Blick in vergessene Bücher der Holzkunde und Holztechnologie des Altertums) tells of having come across Seidensticker's »History of Forestry in Antiquity» and describes it to the readers.

Some of the earliest information about the raising and use of trees in ancient Babylonia is given by the German DEIMEL (1925) in his study »Die altsumerische Baumwirtschaft.»

»Die Wasserfahrzeuge in Babylonien» (1939), a doctoral thesis by the Finnish scholar SALONEN, as well as his extensive work »Kaksoisvirranmaa» contain an abundance of information falling within the scope of our theme.

The history of the use of wood has received varied elucidation in an extensive work by the Dutchman BEEKMAN (1949), »Hout in alle tijden».

The history of the transportation of wood by water has been dealt with by the Austrian HAFNER in a paper of his entitled »Zur Geschichte des Wassertransportes von Holz, besonders in Österreich und Deutschland, von den Anfängen bis zur Jetztzeit» which appeared in the periodical »Zentralblatt für das gesamte Forstwesen» (number 1/1955).

As the most recent work, which contains abundant information touching on our field of interest, we should mention the compendious English encyclopedic work »A History of Technology» (SINGER et al.). The sections of this work dealing with antiquity and the Middle Ages appeared in 1956.

D. Some remarks on the form of the presentation

In the main, the worth and significance of a historical study based on available literature depends entirely on whether the sources in the original language have been interpreted correctly. For this reason the untranslated textual excerpts used in the preparation of this study have been card indexed and presented as an appendix at the end of this paper. Direct quotations have also been in part incorporated into the text proper, but most often reference is made to the text in the original by using a superscribed numerical index. These indexes begin again with the number one for each main section indicated by a Roman numeral. By means of the Roman numeral at the head of each section and the index number of the footnote, the reference can be found in the original at the end of this paper.

The titles of written works appear in quotation marks, or when necessary, parentheses. Words in other languages occurring in the English language text have been printed in italics. Direct quotations extending to several words or sentences, however, have been printed in conventional type, but they have been put into quotation marks or parentheses as the case may be.

In spite of the fact that a brief biographical sketch has been provided above for the most important of the ancient writers, the period when the individual in question lived is nevertheless mentioned again when needed. For tree species known in ancient times, the modern scientific name is also mentioned the first time that the name in question occurs and this is repeated again later on as required.

II. Information on the structure of trees

A. Exterior structure

The learned men of ancient times divided trees exteriorly into parts in the same fashion as we do nowadays: into roots (Gr. ῥίζα, Lat. *radix, stirps*), the trunk (Gr. κοῦλος, στέλεχος, Lat. *truncus, stipes, caulis, caudex*), boughs or thick limbs parting directly from the trunk (Gr. ἀκρομῶν, Lat. *ramus*), branches of different degree (Gr. κλών, ῥάβδος, κλάδος Lat. *ramulus, ramusculus, palma*), and leaves (Gr. φύλλον, Lat. *folium*). As far as is known, THEOPHRASTUS¹ is the first one to have presented a classification of the parts of a tree. The trunk and branch are mentioned already in the ancient Sumerian domestic texts of the temple of the goddess Bau. These date from the first half on the third millenium B.C. (DEIMEL 1931, p. 91).

THEOPHRASTUS already knew very much about the characteristics of the roots of different tree species. With respect to the tree species which he dealt with, he generally mentions whether the roots are deep-going or superficial, thin or thick, scarce or profuse, etc. The oak tree is especially mentioned as a deep-rooted species^{2,3}. PLINY also mentions that the roots of the oak penetrate deep into the earth. He tells that VIRGIL asserted that the roots of the winter oak (*Quercus sessiliflora*) grow just as deep down into the earth as the above ground parts grow in height.⁴ PLINY also knows of an instance being confirmed in which the root system of an old oak (*Q. robur*) which had been yanked loose by a storm encompassed a Roman acre (*iugerum*) or approx. 1/4 hectar (roughly 3 000 sq.yards) of earth.⁵ According to THEOPHRASTUS, the fir (*Abies cephalonica*) and the pine (*Pinus sp.*) have a tap root which is directed straight into the earth and from which smaller roots branch out.⁶

In dealing with the trunk of trees, THEOPHRASTUS mentions the knots or whorls of branches (ὄζος), which are located at regular intervals for certain tree species and at irregular intervals for other species. The distance between the branch whorls is generally greater at the stem part of the trunk than at the crown.⁷ — Trees which grow crowded together assume a tall and slender form whereas those which grow far apart from one another grow short and thick. There are also such trees and woody plants, the grape-vine, for example, as remain short, even when growing close together, if their branches are allowed to grow freely. If their branches are lopped, however, they grow tall.⁸

PLINY mentions that the larch (*Larix europea*) and fir (*Abies pectinata* or *A. cephalonica*) form the longest and straightest trunks.⁹ He also tells of a 120 ft. (about 36 m) larch log, set up by the emperor Tiberius for the people to marvel at, which was at least two feet thick throughout its entire length. When on the basis of this log one tried to estimate the length of the crown part which had been cut off, at a conclusion that was utterly unbelievable was arrived.¹⁰ Four times the breadth of a man's extended arms is mentioned as the girth of the largest known fir.¹¹ A Cyprian tree the length of which was 130 ft. and the girth three times the breadth of a man's extended arms is mentioned as the greatest »cedar».¹²

THEOPHRASTUS gives varied information on the external appearance and quality of the bark of various tree species. Certain tree species, like the medlar (*Mespilus germanica*) and hawthorn (*Crataegus Heldreichii*) for example, are smooth-barked¹³, whereas others, like the black alder (*Alnus glutinosa*), and cork oak (*Quercus suber*), and Aleppo pine (*Pinus halepensis*), have a rough or cracked bark^{14,15}. The roughness of the bark increases as the tree grows older.¹⁶ The cork oak, ordinary oak, and black poplar (*Populus nigra*) have a meaty, sappy bark, whereas certain other trees, for example, the grape-vine, are fibrous in this respect.¹⁷ The bark of the fir, the linden, and certain other trees is formed of several layers.¹⁸ — PLINY gives a great deal of information reminiscent of these things about three hundred years later.¹⁹ The similar arrangement of material and words leads us straightaway to a suspicion of plagiarism since PLINY does not mention a source in this connection. On the other hand, it must nevertheless be remembered that in the first book of his compendious work he presents a detailed list of all the previous writers of which he has made use, and the name of THEOPHRASTUS is also to be found in this list.

THEOPHRASTUS knows a considerable amount about the thickness and abundance of the branches of various tree species and whether they are situated regularly or irregularly in the tree species in question. The positioning of the branches of the fir is especially regular.²⁰ PLINY also comments on the same phenomenon.²¹ According to the last mentioned source, a tree which he calls the Greek beantree (*fabia Graeca*) has the longest, thickest and most profuse branches of all. He says that at Rome this tree was known as the lotus on account of the excellence of its fruit. Today it is known by the name *Celtis australis*.²²

In both Greek and Latin a word that in the standard language means »top» (Gr. *κορυφή*, Lat. *cacumen*, *vertex*) occurs with the meaning branch system or crown. The poet VIRGIL also uses the word *corona*, which means wreath or crown, and in several modern languages a word corresponding to this is used to indicate the crown of a tree.

In discussing leaves THEOPHRASTUS observes that their change in size and shape is endless.²³ The numerous sound facts which THEOPHRASTUS gives

about the form of the leaves of various tree species, the length of the leaf base, the patterns formed by the veins, the differences between the upper and under surfaces of the leaves, and so forth probably do not require further explanation because they represent matters which are in a way self evident. Let us mention, however, certain observations and conclusions which go slightly deeper. Leaves are generally similar in the same tree, but nevertheless, there are certain trees and woody plants which form an exception to this. For example, the leaves of the white poplar (*Populus alba*) and the ivy plant (*Hedera helix*) are rounded when young, but angular when old (which may mean either polygonal or only tapering or ovate at the tip). Immediately after this explanation, THEOPHRASTUS informs us that the leaves of the young ivy plant are angular, becoming more rounded as the plant ages.²⁴ HORT, who has translated THEOPHRASTUS' »The History of Plants» into English (Loeb Classical Library) observes in a footnote that »this seems to contradict what has just been said», as the matter indeed seems at first glance. Upon closer examination, however, it appears that THEOPHRASTUS knows more about the matter than philologist HORT. In following the growth of the ordinary ivy plant, which in Finland, too, is found as a house plant, anyone can prove for himself that the young, just appeared leaves are fairly round until they gradually become angular, or, in botanical terminology, digitate. This is what is meant by THEOPHRASTUS' first assertion. On the other hand, ivy belongs to the so called heterophyllous plants, by which is not meant the phenomenon just mentioned, but that the leaves of the young flowering plant or the new flowering shoot are different (up to the time when they fall) from the leaves of older plants or plant members. The leaves of a flowering ivy shoot are elliptically ovate and, therefore, angular in the sense that they are tapering at the tip. The digitate leaves of the old parts of the plant are clearly rounder than these, and this is most likely what THEOPHRASTUS means in the later part of his explanation since he expressly speaks of a young ivy plant and not a young leaf. SEIDENSTICKER (1886 I, p. 27), who refers to the same place in the text, probably wondered about this seeming conflict without finding an explanation because he has left the ivy plant entirely unmentioned in the foregoing case, speaking only of the poplar. PLINY, who in this instance has borrowed his information from THEOPHRASTUS, gets off easy by affirming briefly that in general leaves remain similar for each plant species except the poplar and ivy (as well as the castor oil plant, which THEOPHRASTUS, too, mentions in the same connection)²⁵.

THEOPHRASTUS is probably the first one who has been able to connect the longevity of evergreen leaves with their narrow shape, glossy surface, and the odorous, oily substances contained by them²⁶, all of which are factors preventing transpiration.

THEOPHRASTUS' mention of the inversion of the leaves of the olive (*Olea Europea*), linden (*Tilia platyphyllos*), elm (*Ulmus glabra*) and white poplar

after the summer solstice should be further mentioned as a unique circumstance. From this it was known that the summer solstice had occurred.²⁷ PLINY repeats this assertion as it is, with the addition, however, of the willow (*Salix* sp.)²⁸. SEIDENSTICKER (1886 II, p. 41) says that later on in his work, PLINY maintained that all trees, both the forest trees of remote regions and the trees of city parks, invert their leaves after the summer solstice. SEIDENSTICKER has either translated incorrectly or made use of an imperfect translation because PLINY in fact maintains just the opposite. In the place to which SEIDENSTICKER refers in this instance²⁹, PLINY is expounding on the appropriate procedure of Mother Nature in that she commands expressly the olive tree, which the farmer cultivates, the linden, which he seeks for a thousand different purposes, the poplar and elm, the cultivation of which is closely connected with the culture of wine, and the willow, which the farmer uses in binding work, to invert their leaves after the summer solstice. To be sure, knowing when this time has arrived is important from the standpoint of the farmer's ordering of his tasks. Mother Nature has not bidden the trees of distant forests to invert their leaves, because the farmer would then have to set off along unknown ways to search for signs, nor has she given her command to the city park trees, although these are sometimes found on country estates.

It might be asked what natural phenomenon the foregoing represents. Modern natural science does not know of any phenomenon of this sort, which would be exactly associated with the time of the summer solstice or even dependent on it in any way. On the other hand, both THEOPHRASTUS and PLINY tell that by this very sign people know when the day begins to grow shorter; in other words, people in general, the learned excepted, did not know when the summer solstice was, and thus, the matter does not have to rest on an exact definition of the time. Whatsoever, the former of the investigators mentioned did not to our knowledge perform his own personal observations, and as far as the exactness of the specified time is concerned, the later may have become the victim of faith in established authority. As far as the phenomenon itself is concerned, this may be a case of leaf withering, or perhaps even sudden wilting, which occurs in Mediterranean lands at the beginning of the regularly recurring hot and dry summer season. Above all, trees growing in open places suffer from this. Just such trees, growing in Mediterranean lands and included within the farmer's immediate sphere of activity, are the trees which PLINY mentions.

SEIDENSTICKER (1886 I, p. 87) seems to suppose that this is a question of the leaves turning edgewise, for he maintains that in Germany, too, every shepherd, forest worker, or hunter knows that the branches of leafy trees no longer provide shelter from the rain after Midsummer Day. It is indeed known that certain plants can protect themselves from excessive light by turning their leaves edgewise to the direction of the sun, but modern botanical and dendrological literature does not know of a phenomenon of this sort for the trees mentioned by THEOPHRASTUS and PLINY.

The linking of the phenomenon in question — whatever may be its cause — to the summer solstice may originally have been caused by the characteristic tendency of the learned men of ancient times to generalize without empirical information. When the sun turned about, so did the leaves of the trees, too. The Roman GELLIUS, who lived in the second century A.D., carried his systematizing so far as to assert that the olive tree inverted its leaves also on the shortest day of the year.³⁰ One may only wonder that a German forester of the later half of the last century also appears to connect the turning of the leaves with that of the sun (*Sonnenwende*), even though he takes a more disparaging attitude toward the superstitious conceptions of ancient times (considered from a present-day standpoint) than would perhaps be appropriate in view of the conditions of the science of those times.

It is natural that the plant morphological terminology of the learned men of ancient times differs somewhat from that of modern times. Accordingly, THEOPHRASTUS says that the leaf of the fir is divided into parts and resembles a saw³¹, as does the leaf of a fern; thus, he considers to be a leaf stalk what, according to the modern conception, is a branch.

The flowers and fruits of plants and also of trees have naturally attracted the attention of mankind since the earliest times. All flowers (i.e., according to present day conceptions) were not considered to be flowers. The Greeks, for example, did not consider the willow and the poplar to bloom at all. — THEOPHRASTUS often speaks about the colour of flowers, but more rarely about their form. A couple of mentions of the latter characteristic, however, can be found. The flowers of the grape-vine, mulberry tree (*Morus nigra*) and ivy are fluffy, whereas those of the almond tree (*Prunus Amygdalus*), apple (*Pyrus malus*), pear (*Pyrus communis*), and plum (*Prunus domestica*) trees are leafy.³² In certain plants, like the grape-vine and olive tree, the flower surrounds the fruit, whereas in others, like the pomegranate (*Punica granatum*), apple tree and pear tree, myrtle (*Myrtus communis*) and rose (*Rosa centifolia*), the flower is attached to the middle of the (coming) fruit.³³ In modern terminology we should probably say in the first case that the perianth is hypogynous and in the latter case that the perianth is epigynous or perigynous. That part of the flower which later on develops into the fruit was called the fruit already in the blooming stage. This is quite understandable since at the time there was no conception of the process of fertilization.

PLINY mentions a circumstance which THEOPHRASTUS does not speak about, namely, that young growing trees do not bear fruit.³⁴ According to the same investigator, in certain trees, like the strawberry bush (*Arbutus unedo*) and oak, the fruit is located for the most part in the crown part of the tree, whereas in others, like the walnut (*Juglans regia*) and fig tree (*Ficus carica*) it is primarily located in the lower branches.³⁵

B. Interior structure

Timber cutters and carpenters have since quite early times been compelled to focus their attention on the structure of wood, and thereafter, the learned have communicated their information to successive generations. In this respect THEOPHRASTUS may be the first noteworthy compiler of information. He mentions circles³⁶ and concentric layers,³⁷ i.e. the annual rings, although he apparently did not know how to reckon the age of a tree any better than the other learned men of ancient times, and thus, did not know about the generation of annual rings. In fact, no mention of this is to be found in the literature of antiquity. THEOPHRASTUS in a way refers to the medullary rays when he speaks about natural direction of splitting in dealing with the splitting of wood.³⁸ SEIDENSTICKER (1886 I, p. 34) has interpreted this statement in such a way that »Es (das Holz) ist von Markstrahlen von der Rinde nach der Stammachse durchzogen», which is, however, to be considered more a piece of information stemming from the latter than from THEOPHRASTUS. Furthermore, THEOPHRASTUS usually distinguishes the heartwood, for which he uses the term *καρδία*³⁹ (heart) or *μήτρα*⁴⁰ (womb) from the light-coloured surface wood.⁴¹ SEIDENSTICKER (1886 I, pp. 35 and 36) maintains that THEOPHRASTUS confuses the concepts heartwood and pith, using the above-mentioned words to mean now heartwood now pith. It would not be any wonder if the world's first botanist had really done so, but even in that event, would SEIDENSTICKER not have underestimated THEOPHRASTUS? Nothing seems to point to the fact that THEOPHRASTUS used each of these words in any place to mean necessarily the pith. Instead, he uses the word *ἐντεριώνη*, which apparently escaped the notice of SEIDENSTICKER, in such cases where the pith seems to be in question. As it would seem, this word is originally a term coined by HIPPOCRATES for medical purposes. The word in question is not encountered anywhere else in the Greek literature which has come down to us than in the works of HIPPOCRATES and THEOPHRASTUS. The primitive word is *ἐντερον* (Sanskrit. *antaras*, Lat. *interus*), which originally meant inner part or core, but took on the specialized meaning of intestine or innards in the plural. The term of HIPPOCRATES and THEOPHRASTUS is perhaps a derivative of a comparative form and thus would mean something which is within the core — the most interior part —, which is a very fitting term for the pith.

According to THEOPHRASTUS, pith is encountered in the hazel bush⁴², the elder⁴³, (*Sambucus nigra*), and dogwood⁴⁴ (*Cornus sanguinea*) as well as in other trees. In all these cases he frequently mentions that the trees gradually become hollow on this account. In addition, he says that the fig tree has a firm heart but no pith.⁴⁵ Indeed, the pith of the fig tree is in fact extremely inconspicuous. The Englishman HORT, who has translated »The Natural History of Plants» into English, has translated this passage as if the fig tree had a firm heart in place

of the heartwood proper. Regarded in a matter-of-fact way, this sort of sentence does not make sense. In other places also HORT has translated *enterione* as heart wood. Only once does he observe in a footnote that the pith is meant by this.

According to THEOPHRASTUS, the elements of wood are the juice, the sinews, the veins, and the flesh,⁴⁶ thus, just as in animals.

PLINY, who, contrary to the fashion of the »ivory tower» savant, THEOPHRASTUS, is known to have made personal observations, gives information on the interior structure of trees that is detailed to such an extent — borrow though he does from his predecessor here, too — that it may be worthwhile to cite chapters LXXII and LXXIII of Book XVI of his »Natural History» entirely.

»LXXII. There is also a juice in the body of trees, which must be looked upon as their blood. It is not the same in all trees — in figs it is a milky substance, which has the property of curdling milk so as to produce cheese, in cherries it is gummy, in elms slimy, sticky and fat, in apples, vines and pears watery. The stickier this sap is, the longer the trees live. And in general the bodies of trees, as of other living things, have in them skin, blood, flesh, sinews, veins, bones and marrow. The bark serves for a skin; it is a remarkable fact as regards the bark on a mulberry that when doctors require its juice they strike it with a stone two hours after sunrise in spring and the juice trickles out, but if a deeper wound is made the bark seems to be dry. Next to the bark most trees have layers of fatty substance, called from its white colour alburnum; this is soft and the worst part of the wood, rotting easily even in a hard oak and liable to wood-worm, for which reason it will always be removed. Under this fat is the flesh of the tree and under the flesh the bones, that is the best part of the timber. Those trees which have a drier wood, for instance the olive, are more liable to bear fruit only every other year than trees whose wood is of a fleshy nature, like the cherry. And not all trees have a large amount of fat or flesh, any more than the most active among animals; there is no fat or flesh at all in the box, the cornel and the olive, nor any marrow, and only a very small quantity even of blood, just as the service tree has no bones and the elder no flesh — though both have a great deal of marrow — nor have reeds for the greater part.

LXXIII. The flesh of some trees contains fibres and veins. It is easy to distinguish between them, the veins being broader and whiter than the fibre. Veins are found in wood that is easy to split, and consequently if you put your ear to one end of a beam of wood however great its length you can hear even taps made with a graver on the other end, the sound penetrating by passages running straight through the wood, and by this test you can detect whether the timber is twisted and interrupted by knots. In the case of trees in which there are tuberosities resembling the glands in the flesh of an animal, these contain no vessels or fibres, but a kind of hard knot of flesh rolled up in a ball; in the citrus and the maple this is the most valuable part. The other kinds of wood employed for making tables are cut into circles by splitting the trees along the

line of the fibre, as otherwise the vein cut across the round of the tree would be brittle. In beech trees the grainings (literally, combs) in the fibre run crosswise, and consequently even vessels made of beechwood were highly valued in old days: Manius Curius declared on oath that he had touched nothing of the booty taken in a battle except a flask made of beech-wood, to use in offering sacrifices.

A log of timber floats more or less horizontally, each part of it sinking deeper the nearer it was to the root. Some timbers have fibre without veins, consisting of thin filaments merely; these are the easiest to split. Others have no fibre, and break more quickly than they split, for instance olives and vines. But on the other hand in the fig-tree the body consists entirely of flesh, while the holm-oak, cornel, hard oak, cytissus, mulberry, ebony, lotus and the trees that we have stated to be without marrow, consist entirely of bone. The timber of all of these is of a blackish colour except the cornel, hunting spears made of which are bright yellow when notched with incisions for the purpose of decoration. The cedar, the larch and the juniper are red. The female larch contains wood called in Greek *aegis*, of the colour of honey; this wood when made into panels for pictures has been found to last for ever without being split by any cracks; it is the part of the trunk nearest to the pith; in the fir-tree the Greeks call this *lusson*. The hardest part of the cedar also is the part nearest the pith — as the bones are in the body — provided the slime has been scraped off. It is reported that the inner part of the elder also is remarkably firm, and some people prefer hunting spears made of it to all others, as it consists entirely of skin and bones.»

As for the words that PLINY uses to correspond to the structure of animals, to begin with, he probably intends layer of fatty substance (*adepts*, *alburnum*) to mean the bast layer and outermost soft annual growth, but hardly the whole living sapwood or *alburnum* (Ger. Splint) as SEIDENSTICKER (1886 II, p. 39) supposes. The latter is indeed most generally thought to be the case, for, to wit, the English language word *alburnum* (occurring in this form in the *Metsäsana-kirja*, but *alburn* according to a general dictionary) is used to mean sapwood.

The following facts point in this direction. In the first place, PLINY says that *alburnum* is liable, even in the oak, to the wood-worm. Starting from the assumption that insect species have not had time in a couple of millenia to change to any speakable extent, it can be affirmed that the sort of insect larva encountered in the oak, which usually bore into the tree, do not restrict their inroads expressly to the sapwood. On the other hand, the most common injurious insect found in the oak, *Scolytus intricatus*, in spite of its Finnish language name, the oak sapwood borer, gouges out its figures immediately underneath the bark in the surface of the tree. Secondly, PLINY says that *alburnum* is always removed, and it is probably not likely that the sapwood would always be entirely removed. Furthermore, if *alburnum* is the sapwood, then the flesh which PLINY mentions is already the heartwood. What then are the bones, which are underneath the flesh, the best part of the wood, and dark in colour?

Such being the case, flesh would thus mean the sapwood and bones the heartwood in such an instance when a distinct difference in color exists. If there was no difference in color, a flimsy-structured and juicy wood was considered to be entirely flesh and a compact and hard wood, contrarily, all bone. The sinews in the flesh apparently meant the dense wood, primarily the summer wood portion of the annual growth, and the veins, on the other hand, the spring wood portion («the veins are broader and whiter than the fibre») containing more extensive water cells and ducts. The transverse combs in the sinews of the beech seem to have meant the medullary rays.

Perhaps the section touching on the handling of tree species employed for making tables requires an explanation. Let it be given here, although the matter per se belongs in another context. It is apparently a matter of the manner in which *alburnum* — or the whole of the sapwood in the event that the coloured heartwood was expressly desired — was removed from pieces of wood earmarked for the purpose mentioned, these pieces having been split in the direction of the medullary rays. This was done following the annual ring, and not in such a way that the exterior surface would be hewn straight, in which case «the vein would have cut across the round of the tree»; in other words, the annual rings would have become severed in the cross cutting of the wood. Possibly it was feared that the pieces of wood would crack as they dried from the surface side if such a procedure were used.

It should furthermore be mentioned that the special terms for the heartwood which have been mentioned as having been employed by the Greeks are to be found in THEOPHRASTUS' «The History of Plants».

Slightly later on in his work⁴⁸, PLINY says that the veins of the larch, fir, and pine run through the length of the tree in four or in two divisions, or else in a single line, and he adds that in the first mentioned case, the wood is adaptable for interior carpentry work. After this PLINY most likely says that the wood in the last mentioned case is softer than in the other cases, but there is a gap of a couple of words at this place in the original text, so it cannot be known with certainty what is softer than the others. In question here, however, is apparently the fact that the dry period in Mediterranean lands, as well as other temporary fluctuations in the weather, can produce some sorts of intermediary rings which are more faintly appearing than the boundary of the annual growth proper. The more of these that there are, or in other words, the more compact that the wood is, the better it is for the carpenter's purposes. Trees in which the «veins run in a single line» were apparently native to regions where the change of seasons was distinct and the summer devoid of especially dry periods, for example, the slopes of mountainous regions.

III. Information on the vital functions of trees

A. Propagation

In ancient times it was common to speak of feminine and masculine trees, but most frequently, these designations did not have anything to do with gender. In addition, in speaking about the same tree species, they were liable to distinguish yet a kind of neuter gender, a tree which bore no fruit. This was apparently either due to the fact that not all trees bore fruit every year, or that they did not bear any fruit at all on barren sites, or that a staminate tree of a dioecious tree species was in question in the specific instance. THEOPHRASTUS, for example, makes this kind of triple division for the pine¹. According to the present-day conception, the two trees mentioned first were of different pine species, the one mentioned as feminine probably *Pinus laricio*, and the masculine one *Pinus halepensis*. The barren tree was probably a *P. halepensis* growing on a poor site, in which instance it may occur as a dioecious tree. THEOPHRASTUS observes that the Arcadians considered the last mentioned tree, and likewise the cultivated pine (*P. pinea*), a different species. According to the same investigator, some were of the opinion that masculine trees only bloomed, but did not bear fruit, whereas others asserted that only masculine trees bore fruit². The last textual reference reflects the variableness of concepts also in the way that in some cases trees were thought to arise from flowers, whereas in others, from the fruit.

The nature of the fertilization event was understandably entirely unknown to the learned men of ancient times. Since prehistoric times, however, the dioecious nature of the date palm, which had been cultivated as a fruit tree, had been gained on the basis of long experience. Furthermore, it was learned how to intentionally bring about fertilization, for instance, by binding the inflorescence of the staminate tree to the inflorescence of the pistillate tree. This procedure was already known to the Babylonians and they even depicted it in their art (SALONEN 1945, pp. 231—232, fig. 1 of this study). According to the fourth century B. C. historian HERODOTUS, the Greeks were the first to begin calling trees that did not bear fruit male. HERODOTUS relates that the Babylonians cultivated date palms after the fashion of fig trees, binding the fruit of those trees which the Greeks called male to date-bearing trees³, i. e. to pistillate trees. THEOPHRASTUS presents a slightly different procedure: »This takes place in the following manner: when the male palm blossoms, the case containing the flower is detached as it is and



Fig. 1. The fertilization of the date palm as performed by the fertility spirits (Maailmanhistoria I, Salonen 1945)

the tuft (= stamens), flower, and pollen are shaken above the female tree's fruit; and when this has happened, it retains its fruit and does not drop it.»⁴ It is in the same connection that THEOPHRASTUS expressly observes that the fruit-bearing tree is referred to as female. Figurative designations were thus in question, and in this case they were correct with respect to the matter dealt with. On the basis of the date palm it was assumed that other trees were also dioecious, and for their part, it was common to speak of male and female individuals. In reality this was most frequently a question of external appearance. Of two closely related tree species, the one which was more beautiful and »feminine» in appearance was called the female. With respect to the cypress, the skittle-shaped *fastigiata* form was said to be female, and the form which extends its branches out to the side is called male. The designation »*fastigiata*-shape», which is used in present-day dendrology, is apparently traceable to PLINY's exposition on the matter. PLINY namely speaks of a skittle which appears as an upward tapering pyramid, which is also called female (*meta in fastigium convoluta, quae et femina appellatur*); he, thus, uses the word *fastigium* (peaked roof, peak, apex).

In the passage just referred to, SALONEN (1945, p. 231) considers HERODOTUS to account the unisexuality of date palms — in question, however, may be their dioecious nature — an observation made by the Greeks, although the Babylonians in fact knew of it much earlier. On the basis of what has been explained above, HERODOTUS' assertion may be interpretable as perhaps only bearing on the question who were the first to have begun to refer to non date-bearing date palms as male, not on the observation of the phenomenon itself.

Thus, as we have mentioned above, on the basis of the date palm all trees were regarded as being dioecious. Hence, in this case as in so many other matters, an individual phenomenon was generalized. A monoecious tree, to say nothing of a

bisexual flower, was not even within the realm of imagination. When a monoecious tree was in question, the staminate flower was considered to be some kind of extra outgrowth. In this instance let us again quote THEOPHRASTUS: »Certain trees, for instance the tree already mentioned above, have a special kind of outgrowth, which is called by the name *καχρῶς* (a word used in poetry, meaning toasted barley). Such an outgrowth is found in the fir, the pine, and the oak, as well as the linden, the hazel, the chestnut, and the Aleppo pine. This kind of growth arises in the oak at the very outset of growth before the opening of the leaves. This is a certain kind of leafy formation (literally, pregnancy), which is encountered during the time between the first symptoms of swelling in the leaf buds and the unfolding of the leaves.»⁵ THEOPHRASTUS gives a little more exact explanation of the »outgrowth» of the hazel: »After dropping its fruit, the hazel develops a cluster-like shoot which is the size of a rather large worm. Several of these grow on the same stem, and some call them by the name *ἰουλος* (new whisker, suckling). Each of these is composed of little parts that are arranged in the fashion of leaves, like pine cones, so that it appears the same as a young, green pine cone except that it is smaller and almost uniform in thickness throughout.»⁶ The Englishman HORT has translated the word *kakhrῶs* as winter bud, but in most cases it was expressly the staminate flower cluster which was apparently in question. This, however, was not the case for the linden — the tree is mentioned in THEOPHRASTUS catalogue — the flowers of which are bisexual. Especially with respect to the oak and the hazel, the staminate catkin is clearly in question. The oak, indeed, flowers at the very time when its leaves open, and the staminate catkin of the hazel develops already in the autumn and passes the winter bare. These mysterious outgrowths were also of interest to the Roman natural scientists, who, nevertheless, did not get any nearer to a solution of the puzzle than the Greeks. The Romans, however, were noticeably rational to a greater extent than the Greeks. PLINY, for example, thought it worth affirming with respect to the hazel that the *jūlos*-formations (borrowed words were already then in use in the field of science) were completely useless (ad nihil utiles ?). THEOPHRASTUS had not advanced this sort of view.

Let us return again to HERODOTUS' above-presented explanation that the Babylonians also raise date palms in the manner of fig trees. HERODOTUS relates that in binding the flowers of the male trees of female trees it was intended that the gall-insect should ripen the date, and that the tree should not drop its fruit (c. f. reference 3 of this chapter). HERODOTUS adds that, like fig trees, the male date trees carry gall-insects in their flowers. This is probably the first mention in literature of the fig gall-insect (*Blastophaga psenes*), which produces gall-formations in the ovaries of the fig tree and brings about the pollination of the flowers on its breeding flight (Saalas 1949, p. 445).

HERODOTUS is in fact mistaken in thinking that the fig gall-insects have anything to do with the date palm. In this matter understanding appears to have

increased during the following hundred years, for THEOPHRASTUS is already more fully aware of the true nature of the matter. His explanation regarding the fertilization of date palms has already been presented above. In connection with it, he does not speak of any insects. Regarding the fig tree, he presents information of the following sort: »The fig gall-insects come out of wild figs, which are hung on them (on the cultivated trees) and eat the tips of the cultivated figs, causing them to swell to ripeness . . . Now as has already been said, the gall-insects come out of the wild figs; they have arisen from the seeds. This is said to be evidenced by the fact that when the gall-insects come out, there are no longer any seeds left. Most of them emerging leave behind a leg or a wing. There exists another species of gall-insect called the 'stinger' (*κέρτρον*). These are sluggish, like drones. They kill off individuals of another species, which are inside the figs, dying there themselves.»⁸ In this section THEOPHRASTUS is talking about the artificial pollination of fig trees, the so-called caprifigation (Gr. *ἐρωασμός*), which was very generally employed in ancient times and even later on all the way up to this century. The employment of this method has been neglected since it has been observed that figs also ripen otherwise.

A part of the fig trees are pistillate trees, the carpels of the flowers of which are long stemmed (seed flower *ficus*-trees, cultured fig trees). The other fig trees, the so-called *caprificus*-trees (wild fig trees) have staminate flowers at the mouth of the hollow floral axis, and beneath these, short-stemmed, fruitless pistillate flowers, within which the gall-insects deposit their eggs and produce their gall-formations. When leaving these »gall-flowers», the gall-insects bring pollen along with them, causing pollination when they visit the »seed flowers.» For this reason the fruit sprigs of *caprificus*-trees are hung on *ficus*-trees. This very procedure is referred to as caprifigation.

As is apparent from THEOPHRASTUS' treatment of the matter, the ancients thought that the ripening of figs was directly caused by the bites of gall-insects, even though the gall-insects did not in fact leave visible marks in the seedflower figs. This has been a very persistent conception, because in the ninth volume (p. 318) of the large encyclopedic work »Brehms Tierleben» — the volume in question deals with insects — the matter is still spoken of more or less in the manner presented by THEOPHRASTUS, nothing being said about the cause of pollination. This work appeared in 1892 and had been newly revised by prof. E. L. Taschenberg.

The conception that the gall-insects are generated from fig seeds because seeds are no longer left when they come out is simply attributable to the fact that seeds do not develop at all in *caprificus*-trees.

The other gall-insect species mentioned by THEOPHRASTUS, the »stingers», are male individuals. They are wingless and their rear body really does taper to a stingerlike appearance. They pass their entire life inside the fruit of a *caprificus*-tree and also die there, just as THEOPHRASTUS says. However, they do not kill the

winged females, but, on the contrary, fertilize them (Imms 1951, p. 576). When the fact that fig gall-insects are very tiny, only approx. 2 mm in length, is taken into account, we cannot fail to affirm that amazingly detailed observations were made on them already in ancient times. The latter part of the scientific name for the fig gall-insect, the species name *psēnes*, is the very Greek language word which HERODOTUS and THEOPHRASTUS used to designate this insect. We might nevertheless ask why it is in the plural form. That the learned ancients mentioned most frequently speak about fig gall-insects in the plural is probably not a sufficient basis for this. Ought not the singular form, *psēn* (ψήν) really be used?

Differences were also thought to occur in the wood of male and female trees, such as frequently really was the case when different tree species were in fact concerned. The wood of male trees was, for instance, more twisted, more difficult to work, and darker in colour than the wood of female trees.⁹

As has already been mentioned, all trees were definitely not considered to blossom. Non-blossoming trees might, nevertheless, bear fruit. THEOPHRASTUS, for example, did not consider the date palm which bore fruit, i. e. the pistillate tree, to blossom. In the above cited passage (reference 4) he says that the FLOWER of the male tree is shaken over the FRUIT of the female tree. Earlier in his work he expressly mentions that the female date palm bears fruit without any antecedent flowering.¹⁰ The date palm's pistillate inflorescence, which is without sheltering leaves, was thus not considered to be inflorescence. According to PLINY, two different species of cedar are encountered, one of which blossoms but does not bear fruit, whereas the other bears fruit but does not blossom¹¹. With respect to the strawberry bush, the experts were uncertain whether it was the male or female tree which did not bear fruit.¹² Conceptions of this sort, the same as uncertainty about many another matter, were ultimately quite natural. It is virtually not to be thought that noteworthy advances in questions pertaining to flowering and fertilization could have been made before the invention of a sufficiently powerful magnifying device. This did not happen until modern times.

In this connection let us recall PLINY's previously mentioned affirmation that young, growing trees do not bear fruit. Nevertheless, branch slips in nurseries might bear fruit during the same year when they would have born fruit in the tree of their origin.¹³

THEOPHRASTUS was already clear on the fact that all trees are generated either from seeds or shoots, and that coniferous trees are generated only from seeds. He notes especially that even such trees as are propagated by means of shoots can also be generated from seeds; and those trees which do not appear to have any seeds at all, for example, willows, are said to propagate sexually. This is revealed by the fact that saplings are also generated outside the root system of the original tree.¹⁴

In this respect THEOPHRASTUS has advanced much further than his precursors. He observes that certain philosophers speak of spontaneous propagation, and he

relates, along with other things, the following about the conceptions of previous writers: ANAXAGORAS (ca. 500—428 B. C.) had taught that the air contained the seeds of all entities and that these came down to ground with the rain and then generated plants and other living things. DIOGENES (ca. 412—323 B. C.), who was THEOPHRASTUS' contemporary, if of an older age class, presents the view that plants are generated when water decomposes and mixes in a given manner with earth. Having remarked that certain other philosophers also spoke about spontaneous propagation, THEOPHRASTUS says that this sort of propagation is somehow beyond the range of our powers of perception.¹⁵ It probably cannot but be affirmed that this is most scientifically stated, and on top of everything, with what tactful consideration for previous writers!

B. Growth

In expounding on the structure of plants in the first chapter of his work, which we have frequently cited above, THEOPHRASTUS says that a plant sucks nourishment from the earth by means of its roots and that the roots convey this nourishment.¹⁶ Opinions of the sort that nourishment is conveyed to the upper surface of leaves via the under surface were presented, and as a basis for this it was mentioned that the under surface of leaves is always moist and downy. THEOPHRASTUS considers this sort of conception to be erroneous. According to his own conception, the difference in the upper and under surface of the leaf was due to the fact that these surfaces did not receive the same amount of sunshine. Both surfaces, however, receive the nourishment which is conveyed by the veins and fibers in the same way.¹⁷

THEOPHRASTUS reports that most trees grow continuously after the growing season has begun, but that the growth of pine, fir, and oak is periodic. In the spring these trees initiate their growth three times.¹⁸ The first growth phase begins at the start of the month *Thargelion* (roughly corresponds to April), and the second, after an interval of about thirty days, at the latter half of the month *Skirrophorion* (around the middle of June).¹⁹ The third growth period began in the month *hekatombaion* (the Greeks' first month, the beginning of which fell at about the summer solstice) after an interval of about fifteen days. This growth phase was shorter than the previous ones by only six, or at the outside, seven days, and thereafter, the trees no longer grew in length but only in thickness.²⁰

According to PLINY, the oak, fir, and larch have three growth phases.²¹ In comparison with the information given by THEOPHRASTUS, one tree species has, therefore, changed.

Let us recollect here that previously-presented explanation of PLINY (p. 27) that in the larch, fir, and pine, the veins (the summer tree portion of the annual growth) run through the tree divided in four or in two or in a single line. The ex-

planations of THEOPHRASTUS and PLINY on the periodicity of growth in these particular trees support the interpretation that in question here are intermediary rings, the boundaries of which are more weakly discernible than the boundary of the annual ring proper. The numbers of growth phases and vein segments do not really quite correspond to each other, but when we recall the inclination of the learned ancients to generalize individual phenomena, perhaps we cannot reasonably demand greater accuracy.

The information which PLINY gives on the time of the growth phases of the trees mentioned appears to differ from the information given by THEOPHRASTUS. According to the Roman investigator, the first growth phase coincided with the start of spring, which, according to the Romans' division of the seasons, occurred already before mid February; the second growth phase began when the sun was passing through the Twins; and the third, at the time of the summer solstice.²² These times seem more credible than those presented by THEOPHRASTUS, according to which the first growth phase would begin very late for Mediterranean lands. And in the notes appended to his German translation of THEOPHRASTUS' »The History of Plants», SPRENGEL (1822) submits that the latter mentioned has made leap year the rule. Before the new calendar formulated by METON, which was adopted about a half century before the birth of THEOPHRASTUS, every other year was a leap year. Also, according to METON's calendar the leap year recurred very frequently, because this calendar, too, was based on the moon's phases. During leap year an extra *Poseideon* month (normally December) was added after the month *Skirrophorion*. When this occurred, the first days of the preceding months moved up a month earlier because the beginning of the first month of the year, *Hekatombaion*, was always linked to the summer solstice. During leap year the information given by THEOPHRASTUS meshed fairly well with the information later given by PLINY, at least better than when a normal year was taken as the point of departure.

Accordingly, the three growth phases mentioned pertained only to certain conifers and the oak, and they were considered to be part of the spring growth phase. Besides this, in several trees, and especially markedly in cultivated trees, a new, common growth phase began with the ascension of the Dog Star, or Sirius, (the end of June), and then a new one again with the ascent of Arcturus (september).²³ This information, given by THEOPHRASTUS, is repeated by PLINY as it is; however, he adds on the winter growth phase which occurs when Aquila, or the Eagle Star, appears in the heavens. He also remarks that these growth phases present themselves most clearly in Egypt.²⁴

The learned men of ancient times were quite aware that all trees did not begin their growth simultaneously in the spring.

According to THEOPHRASTUS, both dogwoods (*Cornus mas* and *C. sanguinea*) were among the earlier to start growth. The leaves of these trees opened already before the advent of the temperate westerly wind, Zephyr. This occurred in

February. After the westerly wind began to blow, the bay and the alder initiated their growth. The leaves of the lime, hornbeam, maple, Valonia oak, and fig opened a little before the spring equinox. Hazel, oak, and elder are also early in budding; likewise those trees which do not appear to bear fruit at all and which grow in grovy areas, namely, abele, elm, willow, and black poplar. The plane tree receives its leaves a bit later than these. The others which bud when spring has really come to stay are the wild fig, alaternus, cotoneaster (*Cotoneaster pyracantha*), Christ's thorn, terebinth, hazel (previously mentioned; another closely related species is probably in question here), and chestnut. The apple tree is rather late in budding, and latest of all are the cork-oak, holm-oak, broad-leaved spindle-tree (*Evonymus latifolius*), a certain juniper species (*Juniperus foetidissima*), and the yew.²⁵ In this regard PLINY presents a catalogue which is to a suspicious degree in accord with the previous one.²⁶

Individuals of the same tree species did not bud everywhere at the same time, but the time of the beginning of growth depended on the growing site. Our much-cited Greek informant tells us that individuals of the same species begin their growth first on swamps, then on plains, and last in the mountains.²⁷ His later Roman colleague is once again a faithful echo, speaking, however, of forests in place of mountains.²⁸

The rate of growth of trees did not escape notice in ancient times. Our peripatetic friend knows that trees which grow at the edge of water, such as the abele, plane tree, elm, black poplar, and willow are rapid in their growth — in addition to these are also the fir, pine (*P. laricio?*) and ordinary oak. In the original text this is followed by a gap, but before this, however, are the words »the most rapid in growth . . .» The gap is followed by a list which apparently contains trees that are primarily slow in growth. Contained in this list are the yew, a certain cherry species (*Prunus avium*), Valonia oak, a certain juniper species (*Juniperus phoenicea*), two maple species (*Acer monspessulanum* and *A. campestre*), hop-hornbeam (*Ostrya carpinifolia*), manna-ash (*Fraxinus ornus*), alder, Aleppo pine, a certain *Arbutus* species (*A. andrachne*), cornelian cherry (*C. mas*), box, (*Buxus sempervirens*), and wild pear (*Pyrus amygdaliformis*).²⁹ This may even be a case where, due to deterioration of the original text, things have taken the same course with respect to this list as in that well-known magazine article in which the instructions for morning exercises and preparation of food had got mixed up. PLINY's silence on these matters leads us to suspect that the text had already degenerated before his time. If such is the case, PLINY should be granted recognition for his caution.

As far as the age of trees is concerned, THEOPHRASTUS was already clear on the fact that trees growing on damp sites have a shorter life than those growing on dry sites.³⁰ On the other hand, cultivated trees did not live as long as those occurring in nature. The wild olive, pear, and fig were longer lived than the corresponding cultivated trees.³¹ THEOPHRASTUS probably did not receive the additional

name *philosophorum peritissimus* (especially clever philosopher)³² for nothing, because he really did philosophize, at least when pondering on the age of trees. To wit, he advances the question whether a tree which has sprouted from an old stock is to be henceforth regarded as the same tree or as a new individual.³³ He replies that in so far as we take into consideration those parts of the tree in which phases of growth and decay alternate — primarily the stump with its root system — the sprout can be deemed the same tree as that from whose stump it has arisen; for in what way does the new tree actually differ from the old one? If, on the other hand, the trunk is considered the essential part, which gives to the tree its special character, then it can be said that the whole tree becomes something new, when the trunk changes.

THEOPHRASTUS informs us that the age of an olive tree is about 200 years³⁴ if regeneration by sprouting is not taken into account. This is indeed the only specific fact on the age of a tree in his work. He mentions, to be sure, certain trees which tradition held to be especially old and still living, but observes that this information belongs to the sphere of mythology. One such tree is the plane which was planted near Delphoi by Agamemnon, the supreme commander of the Trojan War.

The age and rate of growth of trees being under discussion, PLINY's information appears to be original to a greater extent than when other matters are in point. When his Greek precursor declares that trees growing in marshy places grow rapidly, but, on the other hand, do not attain an old age, PLINY, in turn, makes the slightly generalized assertion that trees which are short lived, like the fig, pomegranate, plum, apple, pear, myrtle, and willow, are rapid in growth.³⁵ It should be observed that the list also contains other than trees growing in wet places. On the other hand, PLINY, like his precursor, also makes separate mention of the short-lived nature of the last mentioned.³⁶ In addition, he mentions that certain trees are by nature slow growers, especially those which are generated only from seeds and which are long lived (c. f. reference 35 of this chapter). Our Roman author indeed presents a thought of the sort that trees whose interior structure is curly — this apparently means a formation of curly-grained wood — age slowly.³⁷ Since he mentions in this connection, among others, the poplar, which, being a tree that thrives on damp sites, was otherwise counted among the short-lived trees, in question here is expressly the fact that the process of becoming curly-grained was responsible for prolonging the life of a tree.

In speaking about the age of trees, the normally very matter-of-fact PLINY becomes downright poetic. He says that when thinking about the expansive wilderness and inaccessible forests, one can believe the age of some trees to be immeasurable (*Vita arborum quarundam inmensa credi potest, si quis profunda mundi et saltus inaccessos cogitet*). PLINY also has information, which must already be considered to some extent historical, on the age of certain individual trees. In Campania, on the estate called Literninum, grew the olive tree which

SCIPIO AFRICANUS the elder (235—183 B. C.) had planted with his own hands, likewise, a noticeably large-sized myrtle; these were about 250 years old at the time when PLINY was writing his work. On the Lucina field at Rome, there continued to grow a »lotus« (*Celtis australis*), which had already been in existence since the year 375 B. C. The only uncertain point was how much before this time its origin could be traced. There was, namely, no doubt about the fact that it had originated earlier, for the goddess Lucina has received her name according to the grove (grove=lucus) in which the tree in question grew. PLINY himself estimates the age of this tree to be about 500 years.

It may be a bit venturesome to be of a different opinion than the Roman savant on the origin of a Latin word after the passage of so much time, but it must nevertheless be affirmed that the name of the goddess Lucina is actually considered to derive from the word *lux* (light). Lucina was, in fact, the joint worshipful appellation for the goddesses of birth, Juno and Diana. Being derived from the word *lux*, it meant Escort into Daylight, hence, giver of birth. It may be quite understandable that the domain represented by the goddess Lucina has brought groves to the mind of our Roman friend, but from an informed point of view, the interpretation presented above seems more credible.

To the real oldsters' group belonged a holm-oak growing in the Vatican — it was older than the city of Rome. A bronze plate on which Etruscan ciphers had been engraved had been fastened to it. This indicated that the tree had merited honour already during the time of the Etruscans.³⁸

THEOPHRASTUS relates certain details about the durability of trees to external damage. Topping the pine and fir caused the root system to dry up in the course of the year.³⁹ The root system of most trees stays alive even though the trunk has been severed right at the bole — if only the stump has not been yanked loose.⁴⁰ If the crown and all branches were cut away from the fir, it died quickly, but if the tree was severed at the smooth trunk portion, it remained alive.⁴¹

A bit earlier in his work, THEOPHRASTUS gives a more exact explanation of the remarkable-seeming asseveration mentioned last. It runs as follows: »And there is a peculiar thing about the silver-fir; when it is cut or broken off short by the wind or some other cause affecting the smooth part of the trunk — for up to a certain height the trunk is smooth, knotless, and plain — a certain amount of new growth forms round it, which does not, however, grow much vertically; and this is called by some *amphauxis* and by others *amphiPHYA* (both words mean growth in the round); it is black in color and exceedingly hard, and the Arcadians make their wine mixing-bowls out of it; the thickness is in proportion to the tree according as that is more or less vigorous and sappy, or again according to its thickness.»⁴² This can scarcely be a question of anything other than the so-called living stumps which are possible when the stump is in a root system alliance with a living tree that has remained standing. THEOPHRASTUS has only generalized this phenomenon, which, to be sure, is more common in the silver fir than in

other conifers. He himself surmises that the phenomenon is due to the fact that the stump of the fir is sappy and fresh, which is so because it does not generate shoots which would sap its strength. According to YLI-VAKKURI (1953), during the last century opinions were still being exchanged among investigators as to whether such stumps grew by themselves or whether the phenomenon was attributable to a root system connection.

Here, too, PLINY has attempted to copy the text of his erstwhile colleague, but this time he has blundered sadly. To wit, he has compiled gems of wisdom of the following sort: »It is a remarkable thing that this tree dies if the tops of the branches are lopped, but survives if they are cut off entirely from the trunk; also should the trunk be cut off below where the branches were, what remains lives, whereas if only the top be removed the whole tree dies.»⁴⁴ This most certainly is remarkable. This reveals that PLINY has not been able to make anything at all out of THEOPHRASTUS' explanation. That he in no way commented on these remarkable things also points to this conclusion. We are compelled to affirm that the development of human knowledge has by no means always been evenly rising. With regard to the question at hand, the low point of the wave appears to have continued for a long time, for SEIDENSTICKER, who was a professional forester supplied with rather modern information, did not apparently grasp what the matter was about, either. He does not mention the *amphauksis* at all, though he refers to the passage in question. THEOPHRASTUS' assertion that if the fir is cut at the base it remains alive has been interpreted by SEIDENSTICKER (1886 I, p. 39) to mean that if the branches are cut from the smooth bole section of the trunk, the tree remains alive; in other words, that pruning of the lower branches does not cause damage. This is a very natural thought, but it is not the right interpretation. The fact that SEIDENSTICKER had at his disposal translations into his own language of all the works of ancient writers seems to have sometimes been a stumbling block for him, for all translations are not exact or even correct. Perhaps it is for this reason that he has understood PLINY's above presented, mixed-up explanation still more incorrectly. When PLINY speaks of the removal of branches (*detruncare* = separate from the trunk), our German friend maintains that he is speaking about the cutting of the trunk into blocks (1886 II, p. 320).

Already before SEIDENSTICKER's times, however, German botanists had observed that THEOPHRASTUS knew of living stumps; in other words, they interpreted his explanation correctly. This is mentioned by GÖPPERT as early as 1846. Later, remarks on the same matter have been made by the German FABRICIUS (1927) and last by YLI-VAKKURI (1939) in Finland.

IV. Information on the factors affecting the growth of trees

A. Ground

As might be expected, attention has been directed to the fertility of the earth for as long as cultivation of the soil has been practiced. The anonymous textual sources of antiquity still contain, however, only general allusions to this question. Not even were the Greeks, who were already dealing very minutely with animals and plants, mentionably interested in factors affecting the fertility of the soil. Probably one of the rare exceptions among them is XENOPHON (ca. 430—354 B. C.), who in his work »*Oeconomicus*» — the work is customarily known by its latinized name — explains the attributes by which arable land may be known (colour, porosity, luxuriance of plants). Nevertheless, the »father of agriculture» is considered to be (according to the Roman COLUMELLA) the Carthaginian MAGO (sixth century B.C.), whose writings were later translated into both Greek and Latin. Of these neither the originals nor the translations have been preserved for posterity. There is no information on the extent to which MAGO has discussed the fertility of soil, but the Romans at any rate, were already showing strong interest in questions relating to the quality of the soil. And this interest was also reflected in their literature. This is indeed natural when we take into account the great significance which agriculture had for the Roman Empire.

The first fertility classification was probably introduced by the Roman statesman, soldier, and lawyer MARCUS PORCIUS CATO (234—139 B.C.), who, along with his other activities, also engaged in farming. In his work »*De re rustica*» (On Agriculture), he gives advice to those who intend to purchase an estate. In this regard he says: »If you ask me what the best estate is like, I reply as follows: One hundred Roman acres (about 25 hectares) of soil including all kinds of ground and the position of which is favorable. The best is vineyard land (*vinea*) if it produces good wine in abundance; in second place is irrigated orchard land (*hortus irriguus*); third is osier-bed (*salictum*), fourth is olive tree land (*oletum*); fifth is meadow land (*pratium*); sixth is grain producing land (*campus frumentarius*); seventh is forest land proper that is set aside to yield tree products (*silva caedua* = logging forest); eighth is forest-vineyard land (*arbustum*; a cross between forest and vineyard, in which living trees served as supporting posts — they were generally planted for this very purpose — and the leaf harvest of which was additionally suitable as fodder for cattle, and from which, finally, fire wood and

utility wood were obtained); and in ninth place is pasture-forest land (*glandaria silva* = acorn forest).»¹

When thinking of present-day fertility classifications, it is understandable that CATO's ranking seems inconsistent, for it contains land already under cultivation as well as land that is more or less in the natural state; and, nevertheless, the basis of classification for the cultivated portion of the land was simply what grew on the plot in question. Practice had apparently evolved in such a way that it was generally attempted to employ the land for a purpose as demanding as it was suited for, and for this reason, the classification as regards the cultivated portion of the land was, then, the result of practical experience.

Of the types of land contained in the list, the only ones that really represent uncultivated ground are *pratium*, *silva caedua*, and *glandaria silva*. Of these the first, the natural meadow, was according to PLINY originally known by the name *paratum* (ready-made, ready prepared by nature) because it was ready for cultivation as it was. This word later on took the form *pratium*, from which the modern botanical species name *pratensis* (growing in fields) has been derived. Nowadays, however, philologists do not put much stock in Pliny's linguistic explanations. *Silva caedua*, logging forest, was most vague as a fertility classification. It namely contained both sprout forests to be felled at intervals of several years (for binding purposes, vineyard poles, etc.) and old forests in which trees of large size grew and from which wood for construction was obtained. Thus, *silva caedua* in general comprised all the utility forests, whose main function was to supply wood. *Glandaria silva* was mostly old oak forest in which pigs were set to pasture.

What in the world would modern farmers think about CATO's placing of grain fields in an unassuming sixth place in his classification — after, along with other things, willow land and natural meadows? In order to understand the matter one must know a bit about the historical background of the time. After the Second Punic War, at the time when CATO was preparing his work, the spiritual and economic life of the Roman Empire was in a state of depression and degeneracy. For long years the farmers had been away on military expeditions and their farms had become desolate. The life of the battlefield had a demoralizing influence, and the one-time farmers that were returning from the war were usually not at all enthusiastic about beginning again at the beginning, but betook themselves to the centers of population. The fields wound up in the hands of rich speculators and for the most part changed into pasture land. In exceptional circumstances they had got used to importing grain from Sicily and Africa, which indeed continued to be obtainable from these regions rather favorably. It was no longer profitable to cultivate grain at home. Prominence was given to the comfort and luxury of life. The culture of wine, the cultivation of the olive tree, the growing of vegetables, as well as the keeping of cattle were held to be more important than the cultivation of grain. CATO's classification may, therefore, more appropriately be a ranking in terms of remunerativeness in accordance

with the then prevailing distribution and value relationships than a classification of the fertility of the ground.

The placing of willow land at the top of the list is not to be wondered at, for in ancient times the willow was an important and much demanded cultivated plant, serving the most varied of uses. This will be explained in more detail in the third part of this study.

Among successive generations CATO's classification did not receive unanimous approval, at least not in all respects. Alluding to this classification, MARCUS TERENTIUS VARRO (116—27 B.C.) mentions that others placed the natural meadow in first place and says that he does likewise.² In his work »De re rustica», which was written in a conversational form, he has, as a matter of fact, placed these words in the mouth of Gnaeus Tremelius Scrofa, who to all appearances represented pasturage economy. VARRO has, by the way, given to those who converse in his work names that connote the topics of the conversation (Fundanius is derived from the word *fundus* = farm, Agrius from the word *ager* = field, likewise Agrasius, Stolo itself means root shoot, and Scrofa means pig). In passing, SEIDENSTICKER (1886 I, p. 12) mentions the two last-mentioned, trumped-up individuals, Stolo and Scrofa, as highly respected Roman farmers and writers. Indeed they were the names of well-known Roman stocks.

It is probably not in vain that VARRO was called the most learned man of his time. In the division of his subject material as also in the classification that he worked out, he is more consistent than his precursors and even many a successor, too. Up to that time, the writers of antiquity had discussed agriculture with all its related questions as one disorganized whole. VARRO, on the other hand, divided his work into three books, of which the first dealt with farming (*de agricultura*), the second, cattle raising (*de re pecuaria*), and the third, the fishing and game protection that is carried out on farms (*de villaticis pastionibus*).

VARRO may also be the first one to have emphasized the significance of terminological factors. He mentions, along with other things, that the word *terra* is used in three different meanings, namely, as a general term, as a specific term, and as a combined term (*communi et proprio et mixto*). As an example of the general meaning he mentions the usage of *terra* to mean country, Italy or some other land. In the specialized meaning the word *terra* is used when no other word or additional name is linked to it (*quae nullo alio vocabulo neque cognomine adiecto appellatur*). In the combined meaning the word *terra* is used when in question is the growth bedding, the element in which the seed can be sown and in which it germinates (*in qua seri potest quid et nasci*).³ VARRO intends those three meanings which in English are primarily conveyed by the words *land*, *ground*, and *soil*, in Swedish by the words *land*, *mark*, and *jord*, and in German by the words *Land*, *Boden*, and *Erde*. It is interesting to note that the case as regards the word *land* in Latin is the same as in modern Finnish. As a matter of fact, there are in Latin two other words meaning land, namely, *humus*, which originally

probably meant the element earth, but later also ground and lastly, at least in poetic diction, land in the geographical sense; as well as *solum* (from which the Eng. soil), which originally meant ground or basis, then becoming the ground's crust and later on, also the substance earth but not land in the geographical sense. Nor, in point of fact, are the above-mentioned modern language words by any means absolutely specific in meaning (c.f. Aaltonen 1940, pp. 11—18).

Referring to the above-cited passage of VARRO's work, SEIDENSTICKER (1886 I, p. 84) has it that the Roman agricultural experts distinguished three groups as regards stone and ground types, to wit, ordinary ground, special ground, and mixed ground (*gewöhnlichen, besonderen und gemischten Boden*). Thus, he has conceived of VARRO's refined terminological explanation as some sort of classification of kinds of ground, and on top of everything, he finds fault with this classification for being vague, which is indeed understandable after such a gross error.

As an example of VARRO's systemizing, it should be mentioned that he implemented the tripart classification of varying characteristics, that is, a classification which could be most appropriately described by the words much, average, and little. Even today this classification is still very serviceable in many cases. For example, according to VARRO ground can be divided on the basis of stoniness into especially stony, averagely stony, and virtually free of stones. Correspondingly, a classification can be carried out on the basis of the ground's other components. Each of these three classes can again be divided into three subclasses, namely, into damp ground, dry ground, and the intermediate of these.⁴

The degree of the ground's roughness, or in modern terms, words indicating the class of soil particle size, is glimpsed rather frequently in the works of the writers of antiquity. The following terms, at least, can be gleaned from literature in the Latin language: *lapis* = stone, *glarea* and *rudus* = gravel, *sabulum* = coarse sand, *harena* = ordinary sand, *farina* and *terra pulvereae* = fine sand or silt, as well as *argilla* = clay. As an example of the comparison of different degrees of roughness, let us mention PLINY's explanation that the chestnut prefers ground which is easily loosened, but not necessarily sandy ground, preferably, however, damp sandy ground, lignite earth, or also finely-divided tufa earth (*quaerit solum facile nec tamen harenosum, maximeque sabulum umidum aut carbunculum vel tofi etiam farinam*).

The Roman writers know and tell about other characteristics of the ground, too. LUCIUS IUNIUS MODERATUS COLUMELLA (first century A.D.), who refers to authorities whom he does not mention by name, divides the terrain into three groups: the plain, hilly terrain, and mountainous terrain (*genera terreni*¹ tria

¹ It seems strange that in STRENG's Latin-Finnish dictionary (1933) there is no mention of the meaning terrain for the word *terrenum*, which has been derived from the word *terra*; the meaning in question is frequently exactly what is fitting for this word.

esse dixerunt, campestre, collinum, montanum); he says that to each group belong six possibilities of ground quality, namely, rich or lean, porous or compact, damp or dry (*soli pinquis vel macri, soluti vel spissi, umidi vel sicci*). Also, he observes that these different possibilities of combination cause exceedingly great variation in the quality of the ground.

The poets of ancient times generally seem to have been better informed on practical matters than certain modern poets who, without harm to their reputation, may set a female cuckoo to cuckooing and reindeer to eating moss (instead of lichen). Accordingly, VIRGIL, for example, was noteworthy as an expert both on farming as well as forestry matters. In his work »Georgics», he presents a method for determining whether untouched soil is porous or tight in composition. To be sure, whether the soil was better suited to wine culture or the cultivation of grain was dependant on this property. Here in the original are VIRGIL's lines on the matter.

Nunc quo quamque modo possis cognoscere dicam.
rara sit an supra morem si densa requires,
altera frumentis quoniam favet, altera Baccho,
densa magis Cereri, rarissima quaeque Lyaeo,
ante locum capies oculis, alteque iubebis
in solido puteum demitti, omnemque repones
rursus humum et pedibus summas aequabis harenas.
si desunt, rarum pecorique et vitibus almis
aptius uber erit; sin in sua posse negabunt
ire loca et scrobibus superabit terra repletis,
spissus ager: glaebas cunctantis crassaque terga
expecta et validis terram proscinde iuvenis.

SEIDENSTICKER (1886 II, p. 50) has interpreted the matter in such a way that VIRGIL urges that the earth which has been put back in the hole be stamped down tight; only after this has been done can a conclusion about the quality of the ground be made (»Die Frage, ob dicht, ob locker, war dadurch zu beantworten, dass man ein Loch grub und die ausgehobene Erde wieder einfüllte und mit den Füßen fest stampfte. — — —»). FAIRCLOUGH, who has done the English prose translation of the »Georgics», also speaks of stamping down the earth (»and tread the earth level at the top»). This does not seem credible, because in that case, the end result would be affected by how forcefully the earth was stamped, how heavy the individual in question was, whether there was much jumping about on top of the mound or whether the earth was only stamped down level, etc. Apparently by stamping hard enough almost any kind of earth could be compressed back into the same hole. Indeed, in translating the above passage into Finnish, the author has taken the stand that VIRGIL's expression (*pedibus summas aequabis*

harenas) means only the levelling of the earth with the aid of the feet. In his Latin-Finnish dictionary, STRENG also refers to this expression in the place where the meaning »to level» is given for the verb *aequare*. Levelling may, of course, take place by stamping, but as has been said, in this case it does not seem credible. There is no meaning connoting stamping or pressing directly associated with the verb in question.

Kinds of rock were rather little known in ancient times. About their origin nothing was known. The name was determined either according to the place where the particular type of stone was found or else on the basis of visible characteristics, primarily colour. Only a few types of stones, known since the most remote times as jewellery or as a material for implements, had names of their own, which were no longer derivable from any other known word.

In Roman literature, at least the following names of kinds of rock are encountered: *lapis syenites* = syene stone, syenite (after the city of Syene located in upper Egypt, now Assuan), from which the Egyptian obelisks were made, *lapis porphyrites* = porphyry (Gr. *πορφύρεος* = purple coloured), *marmor* = marble (Gr. *μάμαρος* = shining, glittering), *iaspis* = jasper (Gr. *ιάσπις*, in Greek the name of the precious stone in question is a loan word from the Phoenecian language), *silex* = flint (solely the name of the stone in question in Latin), *lapis arenaceus* = sandstone (arena, harena = sand), *lapis calcarius* = limestone (Gr. *χάλιξ* = lime) and *sal fossilis* = salt deposit (fossa = hole, pit).

Of the Roman writers' names for kinds of soil — these were in general determined according to the most prevalent element — the following should be mentioned: *terra glarea*, *terra sabulosa*, and *terra harenosa* = gravel, coarse sand, fine sand, *terra lutea* = silty clay, and *terra argillosa* = white clay (which PLINY calls according to the Greek name *leucargillos*), *terra marga* = marly soil, *terra calcu-losa* = calcareous earth, *terra cretosa* = chalk land, *solum carbunculosum* = lignite land, *tophus* (tofus) = earth of volcanic origin, or, tufa, *terra salsa* = salt land, *terra uliginosa* = turf, and *terra cariosa* = mire land, sinking swamp.

Sometimes the classification of soil kinds was carried to very great detail indeed. PLINY, for example, has information on the marly soil to be encountered in Gaul and Britain, that is as detailed as this: »It has previously been held to be of only two kinds, but more recently, while information has been increasing, the use of several classes has been initiated. It is customary to speak of marly soil that is white, red, pigeon gray, or that contains white clay, tufa, or fine sand. It is either rough or greasy-feeling with regard to its consistency; the quality can be determined by feeling the soil with the hand.»⁶

In expounding on what is the very best kind of soil for cultivation (dark in colour, loose and spongy, and good-smelling), PLINY mentions that land of this sort is usually newly cleared land on which an old forest has previously grown; all are unanimous in holding it to be good.⁷ The same investigator also points out that the fertility of ground is not an absolute concept. Let us cite the following

passage: »On the other hand, the white sand in the area of Ticinum as well as the black, likewise also the red sand of several other regions, is unproductive even though substantial soil might be mixed with it. The principles of those who judge the quality of ground are also frequently misleading. Ground on which tall-stemmed trees flourish is not necessarily favorable for trees other than the ones in question; what tree, for example, could grow taller than the silver fir? and what other tree would be able to thrive on the same site? Nor is a lush growth of hay always the mark of rich earth; what could be more renowned than the hay fields of Germania? Nevertheless, right under the especially thin cover of grass they have fine sand.»⁸

These excerpts are probably enough to show that we have no reason to disparage the Romans' information on ground and its fertility. Taking into consideration the level of the science of the times and its possibilities, it is rather more fitting that we wonder at the copiousness of this information and humbly admit that many of our facts come from a long way back.

B. Location and climate

The location of a place or area, which conception includes relative altitude and gradient, direction of gradient with respect to the sun, and disposition to the winds, but not geographical situation, was expressed in Greek by the word *τόπος* (from it, for example, topographical) and in Latin by the term *locorum situs* (literally, location of places).

THEOPHRASTUS has certain facts on the influence of the location of the growing site on the growth of a tree. Along with other things, he says that forests on the northern slopes of mountain ranges are more beautiful and vigorous in growth than those on the southern slopes.⁹ The same investigator mentions that in Arcadia close by the city of Crane there was a low-lying and wind-sheltered place where, according to legend, the sun never shined. Here firs were especially tall and thick, although they were not as structurally compact and pleasing in appearance as elsewhere but quite the contrary. The same state of affairs held for pines growing in especially shady places.¹⁰

As far as the distance of the growing site from the sea is concerned, it was a matter of interest for at least the Romans. This is revealed by COLUMELLA's account on the growing site requirements of the olive tree. In this connection he mentions that most experts were of the opinion that the tree does not thrive well, or at least is not fertile, farther than a distance of one hundred Roman miles (150 km) from the sea. He himself, however, asserts that in certain places it gets on just fine at greater distances also.¹¹

For climate, primarily meaning changes in temperature, relative humidity, and prevailing winds, the Greeks used the term *κρᾶσις ἀέρος* or as we would say,

»mixture of the air». The word *klima*, which is used in many modern languages, also comes from the Greek. It derives from the word *κλινεῖν* (to bend, to lean) and originally meant the curving of the earth's surface, later on, point of the compass, zone, and geographical location. SEIDENSTICKER (1886 I, p. 87) thinks that ARISTOTLE already used the word in the same meaning in which it is used in modern languages, that is, to mean climate. Whatever may be the case, it at least has not, for that matter, been used in this sense in the Greek language. The Roman VITRUVIUS POLLIO (a contemporary of Caesar and Augustus) in his work »De architectura» says that the Greeks used *klima* to refer to a conception which he himself defines by the words *inclinatio caeli*,¹² literally, the bending of the sky, which seems to allude to the original meaning of *klima* in Greek. In translating VITRUVIUS' work into English, GRANGER has interpreted this expression as meaning geographical location (region of earth), an interpretation with which we may agree. German translations take the view that the expression in question means climate. This does not seem credible because in the same connection VITRUVIUS speaks separately about the air (c.f. reference 12).

SEIDENSTICKER does not inform us where he received the notion or piece of information to the effect that ARISTOTLE could have used the word *klima* to mean climate. For my own part, I have not succeeded in corroborating this notion. One may also ask why THEOPHRASTUS, whom ARISTOTLE himself designated as his successor as master of the peripatetic school, did not use the term of his honoured teacher, using the above-mentioned expression *crasis aeris* instead. SEIDENSTICKER (1886 II, p. 57) maintains that the Romans, too, used the word *clima* for climate and he refers to the passage in VITRUVIUS' work, which we have just mentioned. Here VITRUVIUS states that the Greeks used such a word (apparently to mean something other than climate) and he has even supplied the word in question with the proper Greek ending (*climata*). The assertion that the Romans might have used the word *klima* for climate seems baseless. The doubt almost enters one's mind that the use of the word *clima* in modern languages to mean climate may be due to a mistake. Forms such as *climate* in English, *klimat* in Swedish, and *klimaatti* in Finnish may be due to the fact that the word has been obtained right from VITRUVIUS' work and that the Greek accusative ending has come to affect the form of this particular word in certain modern languages. In German the word appears in the form *Klima*. However, let us leave the closer scrutiny of this question to the professional philologists.

To indicate climate, the Romans most frequently used the above-mentioned word *caelum* (sky) or else the very descriptive expression *locorum vis* (force of the region). Among others, GAIUS CORNELIUS TACITUS (54—117 A.D.) in his work »Vita Iulii Agricola» speaks about Britain's nasty sky (*caelum foedum*), that is, about the bad climate, which, in the absence of biting frosts, manifested itself as persistent rain or fog.¹³ PLINY, for example, uses the latter term in speaking about the strength of climatic influence. According to him,

the climate in certain places in Egypt was such that there were no trees at all that shed their leaves for the winter season, not even the grape-vine (Nam locorum tanta vis est ut . . .).

In ancient times it was already a matter of knowledge that certain of man's operations that were directed at nature might effect changes in the climate. PLINY has interesting facts of the following sort: »What can be said about the fact that changes are frequently noted for phenomena which have been investigated and which have already been held to be certain? For example, in Thessaly in the neighbourhood of the city of Larissa, the climate of the area became colder after the lake was drained dry, and the olive trees, which had been there previously, disappeared and the grape-vines also began to suffer from the cold, a thing that had never happened before; and on the other hand, the city of Aenos experienced a rise in temperature after the course of the river Hebros (present day Maritza) was changed to flow past it; and in the neighbourhood of the city of Philippoi the nature of the climate changed after the ground had dried due to cultivation» (*cultura siccata regio mutavit caeli habitum*, literally, a region dried by cultivation changed the nature of the sky).¹⁴ — Thus, we have long been forwarned against disturbing the balance of nature, but have we learned from this?

In speaking of temperature, let it be noted in passing that the Romans used the same verb (*urere*) to express the effect of both heat and cold, that is, now in the meaning »to burn, to scorch», and now in the meaning »to afflict with cold, to freeze.» Might there be any connection in Finnish between the words *pala* (to burn) and *paleltua* (to freeze, v.i.)?

As regards the effect of intense cold, PLINY affirms that mild winters can cause the premature opening of buds, which if followed by intense cold, may result in the buds' freezing altogether. For this reason winters that come around a second time are harmful to trees. This also applies to forest trees, which may even suffer more than cultivated trees because they shade themselves (this apparently means that it is colder in shady forests than on plantations and in orchards where the sun manages to warm things up) and because no steps can be taken to care for them, for the protection of frail saplings by covering them with straw is not possible if we are talking about forest trees.¹⁵ On the other hand, PLINY says that frosts which have come on time greatly strengthen trees and that in this case trees sprout with especial vigor in the spring (c.f. reference 21 of this chapter). A temperate winter may be deleterious in itself, even though retarded frosts do not come at all. On this point let us allow PLINY to speak with his own mouth: »Accordingly, experience occasions the belief that a winter that is so mild that it causes the trees to become parturient directly after they have born fruit — that is, again causes the start of growth — this being followed by another exhausting period of blossoming, such a winter is especially harmful. If this happens during several consecutive years, the trees

may even die once and for all since, you see, the severity with which they are taxed and against which they must struggle with powers enfeebled by hunger, is not questioned; such being the case, the one (a poet) who says that balmy winters are to be wished for has not offered up his prayer on behalf of the trees.»¹⁶

The poet in question is apparently VIRGIL, who exhorts farmers to pray for wet summers and serene winters. We likely cannot join in PLINY's interpretation, which was probably only intended to lighten the text with good fun, because VIRGIL appears to mean expressly dry though not necessarily mild winters, as becomes apparent from his verses on the matter, which follow (Georgics I, 100—103):

Umida solstitia atque hiemes orate serenas,
agricolae: hiberno laetissima pulvere farra,
laetus ager; nullo tantum se Mysia cultu
iactat et ipsa suas mirantur Gargara messes.

And finally, it would probably not be especially surprising if the interests of agriculture and forestry had in fact conflicted with each other in this instance.

The significance of rain, and also moisture in general, for vegetation has probably right from the first been such an obvious matter that it was not much discussed in the literature of ancient times, at least not in detail. Water was apprehended to be so vital to life, that its significance was sometimes even exaggerated. Accordingly, ZARATHUSTRA (sixth century B.C.), for example, says that ground water, by which trees live, multiplies the number of tree species (Zend Avesta II, p. 247). Considered in a well-disposed manner and as being figurative, a thought which is perhaps even quite penetrating may be seen in this, but on the other hand, a very careful approach to interpretations of this sort in ancient writings would seem to be called for.

The moisture requirements of different plant species are spoken of in very old textual sources, but any generalizing comments on the effect of moisture on plants are not met with until Roman literature of the first century A.D. TACITUS, for example, is aware of the fact that copious moisture in the air and in the ground causes the fruit of trees to grow rapidly but ripen slowly.¹⁷ Our old acquaintance PLINY says that trees and cultivated plants share the hope that the blanket of snow be of long duration. This is not only due to the fact that the snow locks in and retains the expiring steamy respiration of the earth, driving it back to strengthen the roots of plants, but also that it gradually imparts a liquid to them, a liquid that is, moreover, pure and especially light, since snow is the froth of heaven's waters. For this reason snow, when it does not melt to overflowing and does not soak the ground, but gradually satisfies the ground's thirst just like a mother's breast, gives life to all vegetation.¹⁸

Concerning winds, THEOPHRASTUS mentions in passing that trees growing in a windy place have more branches and are shorter and more crooked than trees growing elsewhere; also, this is likewise the case for trees growing in a sunny place.¹⁹ The 'Olympian' wind of Chalcis in Euboea caused damage if it blew cold a little before or after the winter solstice. This wind dried up the trees more than a long spell of sunshine.²⁰

PLINY has the following sort of information on the influence of winds on the growth of trees: »Trees love the northeasterly wind most and when it is blowing they become richer in foliage and more tall-stemmed than usual, as well as stouter in structure than usual. Most persons are mistaken in this respect, for, as a matter of fact, one should not place supporting posts to protect the vines from this wind; rather, protection should be provided only against the north wind. But what is still more important: cold weather which occurs at the proper time strengthens trees to a great degree, and in this case they sprout the best in the springtime; but on the other hand, they become debilitated, especially in flowering, if a mild south wind blows. For if rains follow immediately thereafter, when the trees have ceased flowering, the fruit is spoiled completely; moreover, the almonds and pear trees drop their fruit even if it has only been cloudy or if the south wind has blown. Furthermore, rains occurring when the Pleiades constellation is ascending (late spring) are most damaging to the grape-vine and olive tree, for their fertilization period occurs at this time. This four day period decides the fate of the olive tree; this is the critical time if the south wind brings along a dirty-coloured cloud, as we have mentioned before. During these days when the south wind is blowing, grain ripens more poorly than usual, but, nevertheless, faster than otherwise (= when the south wind prevails, the grain is poorer in quality but ripens faster than otherwise). Damaging are such frosts as occur either when the north wind is blowing or at an unfavorable time (any time other than during the winter period); a winter northeasterly wind, on the other hand, is especially beneficial to everything that has been planted or sown.»²¹

This exposition of PLINY ought to serve as an example of the fact that the more or less practical knowledge of even the most learned writers of ancient times often contained beliefs. We of modern times are inclined to take a disparaging attitude toward beliefs of this sort, but it is nevertheless worth remembering that it was most frequently only a matter of not knowing the correct reason for a phenomenon, in which case the reason was hypothesized to be what seemed most apparent. Nor was it possible to know the reasons and consequences of natural phenomena — indeed, we still do not know them all — since experimental science was still toddling along in its very high-tops at the time. Thus, for example, the wind, which was easily perceivable and which caused a very concrete sensation of touch, was considered to be an independent, primary force since it was not known to be a result of differences in the temper-

ature and pressure and a sign of change in the weather. Only when quite unknown matters, strange circumstances, and distant lands were in question did the ancients bring forth real spook stories. In the last analysis, natural phenomena, just like the greater part of the globe from a geographical standpoint, were so little known in ancient times that on the strength of the knowledge of the time, it was not possible to stand up and say beforehand that one solitary thing was impossible. On closer thought, it is rather the contrary procedure which would have been more strictly unscientific at the level of human knowledge of the time.

V. Tree species

A. General

As far as the identification of the tree species mentioned in the written information sources of antiquity is concerned, let it be said right away that the present writer has had no share in the matter. Even though the ancient times' portion of the history of matters pertaining to forestry has been largely overlooked, the names of plant and also tree species, however, have interested philologists and botanists so much that it has been attempted to identify them in so far as this is possible.

Trees are large in size and easily noticed, and on account of their fruit, the shade they provide, the usefulness of their trunk, etc., they have been associated with man's everyday life since prehistoric times; hence, there have been fewer difficulties involved in their identification than for smaller plants. It can be generally affirmed that the modern scientific genus names of most tree species come directly from Latin. These names in general indicated the same trees in ancient times as they do nowadays. There is cause to bear in mind that neither Latin nor Greek ever completely slipped into oblivion. Upon the disintegration of the Roman Empire, Latin was preserved — though, in fact, continually changing and absorbing influences from the newer languages — right up to the time of the Renaissance as the written and spoken language of the clergy and the learned, the so-called Monks' Latin. At this time attempts to restore Latin to its original classical form began to be noticed, and also at this time, the first noteworthy Latin grammars and bilingual dictionaries made their appearance. The vocabulary of Latin was then translated into the modern languages and preserved in writing before Latin finally became a dead tongue. As for Greek, the most common names of tree species can be identified with the Latin names through the references made by Roman writers to Greek literature. PLINY in particular has freely cited THEOPHRASTUS, preserving the arrangement of material and often even of the words. In addition, he very frequently makes direct mention of the name by which the Greeks designated the tree in question. Whatsoever, many Greek names for tree species were transferred just as they were from Greek into Latin.

Although we have many certain cases of nomenclature for the part of Latin and Greek, considerable confusion has nevertheless been caused by the fact

that in ancient times, as has already been mentioned, it was attempted to distinguish a male and a female tree for each tree species. In this instance it was sometimes actually a matter of different tree species. The ambiguous cases, however, have generally been cleared up following the scrutiny and cataloguing of Mediterranean flora, that was the result of studies which were just getting into full swing at the start of the 19th century and which have continued until recently.

SPRENGEL (1822) made the first significant attempt at identifying the plant species mentioned by THEOPHRASTUS. At this time, however, knowledge of the Greek flora was still very insufficient. In this regard, a firm foundation was later on laid by de HALÁCSY'S (1901—04, 1908, and 1912) work »Conspectus florae Graecae». This extensive publication has served as the most important source for the Englishman THISELTON-DYER, who has prepared the newest and most complete catalogue of the plants mentioned by THEOPHRASTOS. This catalogue has been prepared in connection with HORT'S English translation of »The History of Plants» (Loeb Classical Library, Theophrastus II 1949).

RIKLI'S work (1943 and 1946) »Das Pflanzenkleid der Mittelmeerländer» should be mentioned as a noteworthy plant species study dealing with all Mediterranean lands. Significant special works limited to Italy are FIORI'S (1923—29) »Nuova flora analitica d'Italia» and BARONI'S (1932) »Guida botanica d'Italia». Upon these works JONES has founded his catalogue of the plant species mentioned by PLINY (Loeb Classical Library, Pliny VII, 1956). He has had A.C. ANDREWS, who is a professor in Miami University, as his authority in botany.

As for Egypt and the Fertile Crescent, whose languages had for a long while sunk into complete oblivion, the identification of the plant species mentioned in their written sources of information has brought forth considerable difficulties, and many plants have remained unidentified for the present. For example, of the thirteen tree species mentioned in the Gudea A cylinder five are still unidentified in the German translation by FALKENSTEIN and von SODEN (1953). Cultivated trees, whose names are already frequently encountered in ancient Sumerian texts (DEIMEL 1925 and 1931, SALONEN 1945), have naturally been the easiest to identify. There is reason to mention the exposition given by SALONEN (1939) in his work »Die Wasserfahrzeuge in Babylonien» as being a special study on the tree species used in shipbuilding.

Among the investigators of the tree species of ancient Egypt, SCHWEINFURTH (works published in 1883, 1883—4, 1886, and 1904) and LAURENT-TÄCKHOLM (works published in 1941, 1950, and 1951) are especially deserving of merit.

The following case, which has been commented on by LAURENT-TÄCKHOLM, should be related as an example of the difficulties arising in the identification of some tree species. In Egypt, in the vicinity of the temples, the sacred *shoab* tree, which was dedicated to the goddess Isis, was cultivated since the earliest

times. Its leaves and branches were used as offerings of great value. Along with other things, a bundle of *shoab* tree branches has been found in the tomb of Tutankhamon. THEOPHRASTUS gave the Greek name *περσέα* to this tree and ever since, it has been known by the name *persea* — in Roman literature, too. The spread of Christianity to Egypt was not able to put an end to the cult connected with the *shoab* tree; on the contrary, before long the sacredness of the tree in question was recognized even at the national level. Around 400 A.D. the emperor Arcadius instituted a law which prohibited the destroying of the *persea* tree. This law was later preserved in the second part of the group of laws known by the name *Corpus Iuris Civilis*, or, *Codex Iustinianus* (XI. 77: De cupressis ex luco Daphnensi vel perseis per Aegyptum non excidendis vel vendendis.)

When Mohammedanism subsequently attained supremacy in the seventh century, the *persea* tree gradually came to be called by the Arabic name *lebbakh*. In arabic written sources this tree is carefully described, and it is expressly mentioned that it was previously known by the name *persea*. The *lebbakh* was not a sacred tree to the Arabs and because of this it did not receive special care. And so, this tree gradually disappeared altogether from Egypt. As early as 1670 the well-known traveller MICHAEL VANSLEB complains that he has not found a single *lebbakh* tree in Egypt.

In 1750 the stately lane tree, which is a foreign tree belonging to the pea plant family and which is native to the lower slopes of the Himalayas, was imported to Egypt. The people began to call it by the name *lebbakh* and later it received the scientific name *Albizzia lebbek*. No one know any longer what the latter-day Arabians' *lebbakh* was, or the *persea* of the Greeks and Romans, or the *shoab* tree of the ancient Egyptians. The question was nevertheless of interest to botanists. It received the consideration of the abovementioned SCHWEINFURTH, the first noteworthy commentator on the plants of ancient Egypt. In 1881 he came by bunches of leaves and garlands that had been discovered in the excavations at Thebes. These were used as decorations for the deceased. Most of these were of the branches of a tree which he was able to identify. This tree was the *Mimusops Schimperii*, which grows in Arabia and Ethiopia. Schweinfurth then made the hypothesis that the *Mimusops* and the sacred *shoab* were the same tree. In 1882 he made his surmise known in writing, though he was, nevertheless, unable to present any evidence in support of his assumption.

Seven years later Schweinfurth journeyed to Arabia and among the places he visited was Yemen, where the *Mimusops* grows in the natural state. He had known the leaves of the bundles of branches found in the tomb of the Egyptian king only on the basis of literature, and now he got a chance to see this stately tree, which grows to a height of about 20 m., as it occurs in nature. On one of his excursions he ended up in the tiny village of Wolledje, in which

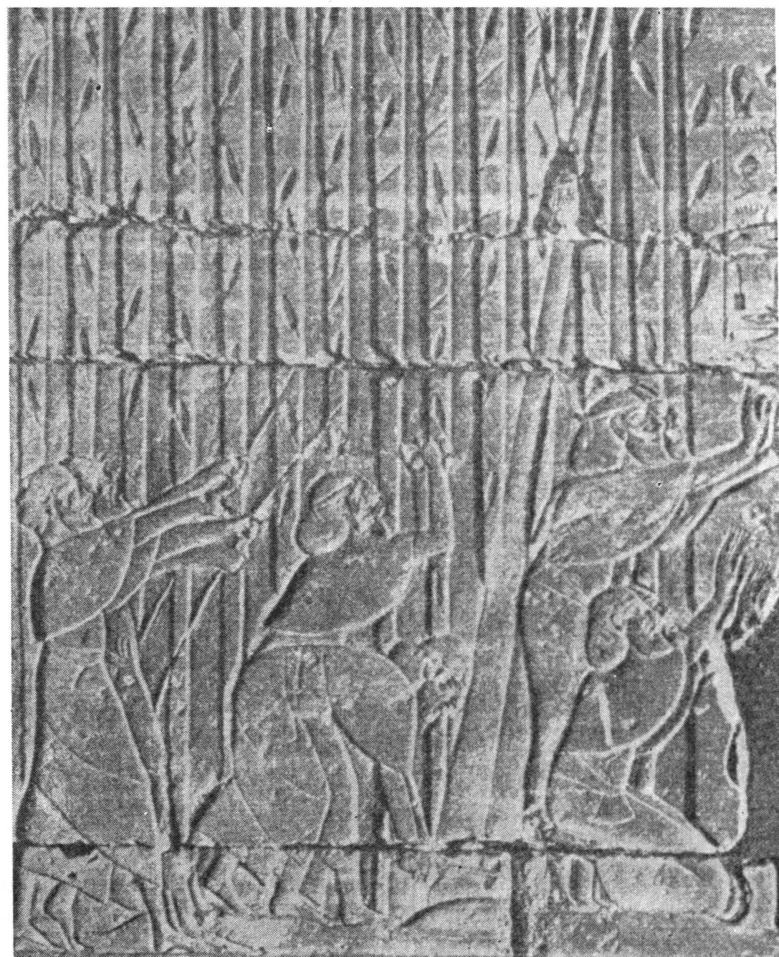


Fig. 2. Lydians felling Lebanon cedars (Beekman 1949)

there was a fair at the time. There he noticed that certain hawkers were offering the fruit of the *Minusops* tree for sale. He did not have the faintest idea that they were comestible and in his amazement he inquired about the name of the fruit in question. He was quite speechless when he received the reply »lebbakh». This was proof positive. The *Lebbakh* had retained its old name in Arabia. The chain was complete: *Shoab- Persea- Lebbakh- Mimusops*.

In view of the exceptionally mingled nature of the nomenclature for tree species in modern language translations of the Bible, it is not likely that attention has been focused to any speakable extent on the tree species therein mentioned, especially in the Old Testament (the cedars of Lebanon are here excepted). The Bible's religious aspect has naturally been responsible for the fact



Fig. 3. The Lebanon cedar today (Beekman 1949).

that matters of this sort have been held to be of secondary importance. It indeed seems obvious that bickering over such matters as, for example, whether Absalon was left hanging by his locks on an oak or on a turpentine tree — this has actually been a point of contention — is insignificant from both a religious as well as a historical standpoint. Perhaps the only significant Old Testament fact concerning a specific tree species is that the cedars of Lebanon were especially in demand for large construction jobs. This points to a circumstance which certain reliefs found in excavations have corroborated; namely, that the Lebanon cedar was really a slender, straight-trunked, and narrow-crowned tree at that time (fig. 2). The present-day left-overs of this venerable stock are thick-limbed and branching all the way from the base and they are thus everything else than suitable as construction timbers (fig. 3). Since Lebanon cedars have been felled from the first half of the third millennium B.C. onward, and since the very best trees have always been selected, this tree species has in the course of millenia deteriorated to such an extent that it would apparently require tree improvement work of long duration in order to return it to its former state.

The tree species mentioned in other parts of the Bible generally do not have any historical significance worth mentioning; nor will it be attempted to catalogue them here.

The following is a presentation of the names of tree species encountered in Greek and Roman literature; source references accompany each item. Those texts or works which have been referred to only in so far as the name of a tree species is concerned have not been mentioned in the bibliography at the end. Abbreviations generally used in dictionaries pertaining to the field are used in the references. These are by nature such that they are comprehensible without further explanation. The Gr. in parentheses following the Latin name for a tree species means that the word is of Greek origin. To shorten the list the author names have not been included in the scientific names of the tree species.

B. Tree species mentioned in Greek literature

ἄγνος, *Vitex agnus castus*, chaste-tree, withy. Aristot., HA 627^ag; Chionides 2; Dioscor. 1.103; Hippocr., Intern. 30; Nicander, Theriaca 71; Plato, Phaedrus 230 b; Theophr. HP 1.3.2, 1.14.2, 3.12.1—2, 4.10.2, 9.5.1;

ἀγριελαία (ἀγριέλαιος), *Olea oleaster*, wild olive. Dioscor., 1.105; Hippocr., Mul. 2.112; N.T. Rom. 11: 17; Odys.; Theocr. 7.18; Theophr., HP 2.2.5; and elsewhere.

αἰγειρος, *Populus nigra*, black poplar. Aristot., Mund. 401^a3; Euripides, Hipp. 210; Iliad 4.482; Odys. 7.106, 10.510; Sophocles, Fr. 23; Theophr., HP 1.2.7, 1.5.2, 2.2.10 etc.; and elsewhere.

αἰγίλων, *Quercus cerris*, Turkey oak. Theophr., HP 3.2.2.

ἀκακία, *Acacia arabica*, acacia. The original meaning of the word is «innocence». Aretaeus, CD 2.6; Dioscor. 1.101;

ἄκανθα, a general term for different kinds of thorn. Aristot., PA 655^a19; Arrian 6.22; Dioscor. 3.12; Herodotus 2.96; N.T. Matt. 27:29 etc.; Theophr., HP 6.1.3; and elsewhere.

ἄκανθα ἢ διπράς, *Acacia tortilis*. Theophr., HP 4.7.1;

ἄκανθα ἢ Ἰνδική, *Balsamodendron Mukul*, Theophr., HP 9.1.2;

ἄκανθα ἢ λευκή, *Acacia albida*. Theophr., HP 4.2.8;

ἄκανθα ἢ μέλαινα, *Acacia arabica*. Theophr., HP 4.2.8;

ἀκτέα (ἀκτῆ), *Sambucus nigra*, elder. Bachylides 8.34; Dioscor. 4.173; Empedocles 93; Hippocr., Nat. mul. 1.34; Theophr., HP 3.13.4;

ἀκτέα ἢ ἔλειος, *Sambucus ebulus*, dwarf elder. Dioscor. 4.173;

ἀλίφλοιος, *Quercus pseudo-suber*, sea-bark oak. Theocr., Scholia 9.20; Theophr., HP 3.8.5;

ἄμπελος, *Vitis vinifera*, grape-vine. Alcaeus 44; Herodotus 4.195; Odys. 9.110; Theophr., HP 4.4.11; and elsewhere.

ἄμυγδαλέα (ἄμυγδαλή), *Prunus amygdalus*, almond. Dioscor. 1.123; Eupolis 70; Theophr., HP 1.6.3;

ἀνδράχλη, *Arbutus andrachne*, andrachne. Helladius (according to Photius, Bibl. s. 533); Sophocles, Fr. 823; Theophr., HP 1.5.2, 1.9.3;

ἄπιος, *Pirus communis*, pear-tree. Aristot., HA 552^b2; Dioscor. 1.116; Galen 11.834; Theophr., HP 1.3.3;

ἀρία, *Quercus ilex*, holm-oak. Theophr., HP 3.16.3;

ἄρκενθος, *Juniperus* sp. (*J. communis*, *J. macrocarpa*, *J. oxycedrus*, *J. Phoenicea*) juniper, cedar. Dioscor. 1.75; Hippocr., Nat. Mul. 63; Musaeus, Fr. 2 D; Nicander, Th. 584; Theocr. 5.97; Theophr., HP 3.3.1, 3.12.3, AP 6.253;

ἄσπρις = αἰγίλων, *Quercus cerris*. Theophr., HP 3.8.7;

ἀφάρκη, *Arbutus hybrida*, of the nature of a cross between a cultivated strawberry bush and a wild strawberry bush, hybrid arbutus. Theophr., HP 1.9.3, 3.3.1;

ἄχεδος, *Pirus amygdaliformis*, wild pear. Aristot., Mir. 845^a15; Odys. 14.10; Pherecrates 164; Pherecydes 33 J; Sophocles, OC 1596; Theocr. 24.90;

ἄχερωῖς, *Populus alba*, abele. Apollonius Rhodius 4.1476; Iliad 13.389;

ἄχράς = ἄχεδος, *Pirus amygdaliformis*. Aristot., HA 627^b17; Aristoph., Ec. 355; Dioscor. 1.116; Teleclides 32; Theophr., HP 1.4.1;

βάλανος, *Balanites aegyptiaca*. The word βάλανος also means oak tree acorn, nut, and fruit of the date-palm. Dioscor. 4.157; Theophr., HP 4.2.1;

βάλσαμον, *Balsamodendron opobalsamum*, balsam of Mecca. Dioscor. 1.19; Theophr., HP 9.6.1;

βονμέλιος (βονμελία), *Fraxinus excelsior*, ash. Theophr., HP 3.11.4, 4.8.2;

βράβυλον, *Prunus spinosa*, sloe. Antyllus (According to Oribasius, 10.20.4); Galen 6.621; Theocr. 7.146;

βράθν, *Juniperus sabina*, a certain juniper species, savin. Dioscor. 1.76;

βρόα, *Tamarix tetrandra* and *T. articulata*, tamarisk. The tree species name βρόα is not encountered in the Greek literature which has been preserved, but Pliny (NH 13.116) says that the Greeks used it.

γλεῖνος, *Acer creticum*, Cretan maple. Theophr., HP 3.3.1, 3.11.2;

δάφνη, *Laurus nobilis*, sweet bay. Aristoph., Plutus 213; Callimachus, Hymnus in Delum 94; Hesiod, Theogonia 30; Odys. 9.183; Theophr., HP 5.9.7; and elsewhere.

δάφνη ἢ ἀργία, *Nerium oleander*, oleander. Theophr., HP 1.9.3;

δάφνη ἢ Ἀλεξανδρεῖα, *Ruscus hypophyllum*, Alexandrian laurel. Dioscor. 4.145; Theophr., HP 1.10.8, 3.17.4;

διοσβάλανος, *Castanea vesca*, chestnut-tree. Dioscor. 1.106; Theophr., HP 4.5.1;

δοῦς, *Quercus robur*, oak. Aeschylus, Iliad, Odys., Plato, Septuagint, Sophocles, Theophr. and elsewhere. The word δοῦς also means tree in general, and especially, the sort of large tree which bears acorns of nuts.

δοῦς ἢ ἀργία, *Quercus aegilops*, Valonia oak. Theophr., HP 1.5.2, 3.8.2;

δοῦς ἢ ἀλίφλοιος = ἀλίφλοιος, *Quercus pseudo-suber*. Theophr., HP 3.8.2—7, 5.1.2;

δοῦς ἢ εὐδύφλοιος, *Quercus pseudo-suber*. Theophr., HP 3.8.2;

δοῦς ἢ ἡμερος = δοῦς, *Quercus robur*. Theophr., HP 3.8.2;

δρῶς ἢ θαλασσία = ἀλίφλοιος, *Quercus pseudo-suber*. Pseudo-Democritus, Symp. Ant. s. 5 G;

δρῶς ἢ πλατύφυλλος, *Quercus lanuginosa*, broad-leaved oak. Theophr., HP 3.8.2, 5—6;

ἔβηνη (ἔβενοσ), *Diospyros ebenum* and *D. melanoxylon*, ebony. Aristot., Meteorologica 384^b17; Herodotus 3.97; Theocr. 15.123; Theophr., HP 1.5.4;

ἐλάα (ἐλαία), *Olea europaea*, olive. Aristoph., Ranae 995; Herodotus 8.55; Iliad; Odys.; Pindar, Olymp. od. 3.13; Theophr., HP 1.3.1, 1.5.4 etc.; and elsewhere.

ἐλαίαγνος (ἐλέαγνος), *Salix caprea*, goat willow. Theophr., HP 4.10.1—2;

ἐλάτη, *Abies pectinata* and *A. cephalonica*, silver-fir. Iliad; Odys.; Theophr.; and elsewhere.

ἐλίκη, *Salix fragilis*, crack willow. Theophr., HP 3.13.7;

ἔλιξ, *Hedera helix*, ivy. Theophr., HP 3.18. 7—8, 7.8.1;

ἔρινεός (ἔρινώσ, ἔρινάς), *Ficus caprificus*, wild fig-tree. Aristot., HA 557^b25; Hesiod, Fr. 160; Iliad 6.433; Lycophron 741; Nicander, Theriaca 854; Strattis 42; Theocr. 25.250; Theophr., HP 2.2.4;

ἐτυμόδρος = δρῶς, *Quercus robur*. Theophr., HP 3.8.2;

εὐόνημος, *Evonymus europaea*, spindle-tree. Theophr., HP 3.18.13;

ζυγία, *Acer campestre*, maple. Dicaearchus 2.2; Theophr., HP 3.3.1, 5.3.3;

ἡμερίς, *Quercus infectoria*, nut-gall oak. Theophr., HP 3.8.2;

θηλοκράνεια, *Cornus sanguinea*, cornel. Theophr., HP 1.8.2, 3.3.1;

θνία (θύεια), *Juniperus foetidissima*, odorous cedar. Dioscor. 1.26; Theophr., HP 1.9.3, 4.1.3, 3.4.2, 3.4.6;

θύον, *Callitris quadrivalvis*, thyme-wood tree. Aelianus, Varia Historia 5.6; Moschus (According to Athenaeus); Odys.; Theophr., HP 5.3.7;

ἰτέα, *Salix* sp., willow. Hecataeus Milesius 292 (a) J; Herodotus 1.194; Theophr. 3.13.7;

ἰτέα ἢ λευκή, *Salix alba*, white willow. Theophr., HP 3.13.7;

ἰτέα ἢ μέλαινα, *Salix amplexicaulis*. Theophr., HP 3.13.7;

ἴρος, *Quercus suber*, cork-oak. Theophr., HP 3.4.2;

κάλαμος, *Ammophila*, *Arundo*, *Bambusa*, *Dendrocalamus* etc., reed. Dioscor. 1.18, 5.92; Herodotus 3.98; Odys.; Theophr., HP 4.8.4 etc;

καρόα, *Corylus avellana*, hazel. Plutarch; Sophocles; Theophr.; and elsewhere.

καρόα ἢ Εἰθβοική = διοσβάλανος, *Castanea vesca*. Theophr., HP 5.4.2 etc.;

καρόα ἢ Περσική, *Juglans regia*, walnut-tree. Theophr., HP 3.6.2, 3.14.4;

κασία, *Cinnamomum iners*, cassia. Dioscor. 1.13; Herodotus 2.86, 3.110; Odys.; Sappho, Sup. 20 c. 2; Theophr., HP 9.4.2; and elsewhere.

καστανέα (καστανος), *Castanea vesca*. Geoponica 2.8; Hesychius;

κεδρελάτη, *Juniperus excelsa* and *Cedrus Libani*, Syrian cedar and Lebanon cedar. The word is not encountered in the Greek literature which has been preserved, but Pliny mentions it.

κεδρίς = ἄρκενθος, *Juniperus communis*, juniper. Theophr., HP 1.9.4 etc. Elsewhere in Greek literature the word generally means juniper berry.

κέδρος, *Cedrus Libani*, *Juniperus excelsa* and *J. oxycedrus*, Lebanon cedar, Syrian cedar and prickly cedar. Dioscor. 1.77; Herodotus 2.87; Odys.; Strabo (In question is apparently the Himalayan juniper, *Juniperus macropoda*) 15.1.29; Theophr., HP; and elsewhere.

κέδρος ἢ Φοινική, *Juniperus phoenicea*. Phoenician cedar. Theophr., HP 3.12.3, 9.2.3;

κερασός (κερασέα, κερασία), *Prunus avium*, bird-cherry. Geoponica 3.4.4, 10.41.2; Theophr., HP 3.13.1 etc.; Xenophanes 39;

κερατωνία (κερωνία, κερατέα), *Ceratonia siliqua*, carob-tree. Aetius 1.201; Galen 12.23; Geoponica 11.1; Hesychius; Theophr., HP 4.2.4;

κερκίς, I. *Cercis siliquastrum*, Judas-tree. Theophr., HP 1.11.2. II. *Populus tremula*, aspen. Aristot., HA 595^a2; Theophr., HP 3.14.2;

κήλαστρος (κήλαστρον), *Ilex aquifolium*, holly. Hesychius; Theophr., HP 3.4.5, 4.1.3 etc.;

κινάμωνον (κίναμον, κινάμωνον), *Cinnamomum cassia*, cinnamon. Dionysius Periegeta 945; Herodotus 3.111; Theophr., HP 9.5.1;

κιτροφόρον (κιτρέα, κίτριον), *Citrus medica*, citron-tree. Geoponica 10.7.8, 10.8.1, 10.8.2;

κιττός (κισσός) = ἔλιξ, *Hedera helix*. Aristoph., Thesmoph. 999; Dioscor. 2.179; Euripides, Bacchae 81; Sophocles, Antigone 826, OC 674; Theophr., HP 3.18.6;

κλήθρα (κλήθρος, κλήθρον), *Alnus glutinosa*, alder. Odys. 5.64, 5.239; Philostratus Junior, Imagines 6; Theophr., HP 1.4.3, 3.3.1;

κλινότροχος, *Acer pseudo-platanus*, mountain maple. Theophr., HP 3.11.1;

κόιξ, *Hyphaene thebaica*, doum-palm. Theophr., HP 1.10.5 etc;

κοκκινγέα, *Rhus cotinus*, wig-tree. Theophr., HP 3.16.6;

κοκκινμηλέα, *Prunus domestica*, plum-tree. Ararus 20; Dioscor. 1.121; Galen 12.32; Theophr., HP 3.6.4;

κολοιτέα (κολοιτία, κολοιτέα, κολωτέα, κολώτεα), I. *Salix cinerea*, sallow. Theophr., HP 3.17.3; II. *Cytisus aeolicus*, cytisis. Hesychius; Theophr., HP 1.11.2, 3.17.2;

κολυτέα, *Colutea arborescens*, bladder-senna. Theophr., HP 3.14.4;

κόμαρος, *Arbutus unedo*, arbutus, strawberry-tree. Alciphron 3.12; Amphis 38; Aristoph., Aves 620; Galen 12.34; Theocr. 5.129, 9.11; Theophr., HP 1.5.2, 3.16.4;

κότινος = ἀργιέλαιος, *Olea oleaster*. Aristoph., Aves 621, Plutus 943; Dioscor. 1.105; Plato, Phaedrus 236 b; Theocr. 5.32; Theophr., HP 4.13.2;

κοῦκι = κόιξ, *Hyphaene thebaica*. The word is known as a tree species name only through Pliny. It means the fruit of the palm in question, c.f. the following entry.

κουκιάφορον = κούξ, κοῦκι, *Hypbaene thebaica*. The name of the fruit of this palm was »koko» in ancient Egypt. The Greek word κουκιάφορον means »bearing koko-fruit». This tree is not the same as the cocoa-nut palm. Theophr., HP 4.2.7;

κράνεια (κράνία, κρανέα), *Cornus mas*, cornelian cherry. Aelianus, NA 1.23, 12.43; Arrian 2.3.7; Demetrius Troezenius 1; Dioscor. 1.119; Euripides. Fr. 785; Galen 12.41; Geoponica 10.87.4; Hippocr., μοχλικόν 42; Odys. 10.242; Theophr., HP 5.6.4;

κράταιγος, *Crataegus Heldreichii*, a kind of thorn. Theophr., HP 3.15.6; κωπάριπτος (κωπάρισσος), *Cupressus sempervirens*, cypress. Arrian 7.19.4; Dioscor. 1.74; Hermippus Comicus 63.14; Herodotus 4.75; Odys. 5.64; Philodemus, Mort. 38; Pindar, Fr. 154; Theocr. 11.45; Theophr., HP 1.8.2; Xenophon, Anabasis V. 3;

κότησος, I. *Laburnum vulgare*, laburnum. Theophr., HP 1.6.1, 5.3.1; II. *Medicago arborea*, tree-medick. Aristot., HA 522^b28; Cratinus 98.8; Dioscor. 4.112; Eupolis 14.3; Hippocr., Nat.Mul. 93; Theocr. 5.128; Theophr., HP 4.16.5, CP 5.15.4;

λακάρη (λακάρη) = κερασός, *Prunus avium*. Hesychius; Theophr., HP 3.3.1, 3.6.1;

λάριξ, *Larix europaea*, larch. This Greek word has been preserved only through Pliny (NH 16.43).

λεύκη = ἀχερωίς, *Populus alba*. Aristoph., Nubes 1007; Demosthenes 18.260; Eupolis 14.4; Hippocratica 22; Theocr. 2.121; Theophr., HP 1.10.1 etc;

λίβανος, *Boswellia Carteri*, frankincense-tree. Dioscor. 1.68; Herodotus 4.75; Theophr., HP 9.4.2;

λιβανωτός = λίβανος, *Boswellia Carteri*. Theophr., HP 9.1.6;

λόγος = ἄγνος, *Vitex agnus castus*. Arrian, Fr. 153; Euripides, Cyclops 225 etc; Iliad 11.105; Longus 3.27; Odys. 9.427;

λωτός, I. *Celtis australis*, nettle-tree. Dioscor. 1.117 etc; Theophr., HP 1.5.3, 4.3.1; II. *Zizyphus lotus*, Jew thorn. Herodotus 2.96, 4.177; Odys. 9.94; Polybius Historicus 12.2.2; Theophr., HP 4.3.1—4; Besides these two tree species, several other plant species were named lotus; for example, a well-known water plant (*Nymphaea stellata*) related to the water lily. It is to this plant that the name mentioned primarily refers nowadays.

μελία, *Fraxinus ornus*, manna-ash, mountain ash. Hesiod, Op. 145; Iliad 13.178, 16.767; Musaeus, Fr. 5 D; Sophocles, Tr. 759; Theophr., HP 3.11.3 etc;

μεσπίλη, *Mespilus germanica*, medlar. Theophr., HP 3.12.5;

μεσπίλη ἢ ἀνθηδονοειδής, *Crataegus oxyacantha*, hawthorn. Theophr., HP 3.12.5;

μεσπίλη ἢ ἀνθηδών, *Crataegus orientalis*, oriental thorn. Theophr., HP 3.12.5;

μέσπιλον σητάμιον = μεσπίλη, *Mespilus germanica*. Dioscor. 1.118;

μηλέα (μηλείη), *Pirus malus*, apple-tree. Athenaeus 3.82 c; Nicander, Al. 230; Nonnus, Dionysiaca 12.275; Odys. 7.115; Theophr., HP 3.3.1, CP 2.11.6 etc; and elsewhere.

μηλέα ἢ Μηδική (or Περσική) = κισσόφυτον, *Citrus medica*. Theophr., HP 1.11.4, 1.13.4, CP 1.11.1, 1.18.5;

μίλος, *Taxus baccata*, yew. Cratinus 98; Theophr., HP 3.4.2, 5.7.6;

μορέα (μορέη), *Morus nigra*, mulberry-tree. Galen 11.631; Nicander, Al. 69, Fr. 75;

μορίκη, *Tamarix tetrandra* and *T. articulata*, tamarisk. Alcaeus Lyricus 119; Herodotus 2.96; Iliad 10.466—467, 21.18, 21.350; Nicander, Th. 612; Theocr. 1.13, 5.101; Theophr., HP 1.4.3, 1.9.3, 3.3.1, 3.3.3 etc;

μοροίνη (μοροίνη, μύρονος, μύροτος), *Myrtus communis*, myrtle. Alexander Rhetor 98.25; Aristot., HA 627^b18; Archilochus 29; Euripides, Alc. 172; Lysippus 9; Pindar, Isthm. 8(7). 74; Septuagint, Isa. 41: 19; Theophr., HP 1.14.4 etc;

όγγρη, I. *Pirus communis* v. *pyraster*, a kind of wild pear. Theophr., HP 2.5.6; II. *Pirus communis*, pear-tree. Odys. 7.115, 11.589, 24.234;

όη (όα, οή), *Sorbus domestica*, sorb, service-tree. Hesychius; Theophr., HP 2.2.10, 2.7.7, 3.12.9, 3.15.4, CP 3.1.4;

οινάνθη ἢ ἀργία, *Vitis silvestris*, wild vine. Οινάνθη literally means the flowering of the grape-vine, also, figuratively, wine as a drink. Theophr., HP 5.9.6;

οἶσος = ἄγνος, *Vitex agnus castus*. Aelius Dionysius, Fr. 76; Theophr., HP 3.18.1, 6.2.2 etc;

ονοθήρας (ονόθουρίς) = δάφνη ἢ ἀργία, *Nerium oleander*. Dioscor. 4.117; Theophr., HP 9.19.1;

όξυακάνθος (όξυάκανθα), *Cotoneaster pyracantha*, cotoneaster. Dioscor. 1.93; Galen 6.643, 12.90; Theophr., HP 1.9.3, 3.3.1;

όξύη (όξύα), *Fagus silvatica*, beech. Dicaearchus Geographus 2.2; Phrynichus Atticistes, PS s. 96 B; Theophr., HP 3.3.8, 3.10.1, 3.10.3, 5.1.2 etc; Xanthus 8;

όξύκεδρος, *Juniperus oxycedrus*, prickly cedar. Theophr., HP 3.12.3;

όρειπτελέα, *Ulmus montana* (*U. scabra*), wych-elm. The Greek name literally means mountain elm. Theophr., HP 3. 14.1;

όστρά (όστράις, όστρας), *Ostrya carpinifolia*, hop-hornbeam. Theophr., HP 1.8.2, 3.10.3 etc;

πάδος, *Prunus mahaleb*, a kind of cherry. Theophr., HP 4.1.3;

παλίουρος, *Paliurus australis* and *Zizyphus spina Christi*, Christ's thorn. Agatharchides 34; Dioscor. 1.92; Theocr. 24.89; Theophr., HP 1.3.2, 4.3.3; Theopompus Historicus 129; and elsewhere.

περσέα (περσία, περσειά, περσειή), *Mimusops Schimperi*, an Egyptian tree. Diodorus Siculus 1.34; Dioscor. 1.129; Hippocr., Mul. 1.90; Nicander, Al. 99; Pausanias Periegeta 5.14.3; Plutarch 2.378 c; Strabo 17.2.2; Theophr., HP 3.3.5, 4.2.5;

πέυκη, *Pinus* sp., fir, pine. Aristoph., Eq. 1310; Dioscor. 1.69; Euripides, Medea 4; Iliad 11.494, 23.328; Septuagint; Theophr., HP 3.9.5; and elsewhere.

πέυκη ἢ ἄκαρπος, *Pinus laricio*, Corsican pine. Theophr., HP 3.9.2, 3.9.4; πέυκη ἢ ἄκαρπος, which Theophrastus designated as being female is *P. halepensis*. Other auxiliary names for the Corsican pine are θήλεια and Ἰδαία.

πεύκη ἢ ἄροην, *Pinus halepensis*, Aleppo pine. Theophr., HP 3.9.3—4; also, πενκη ἢ παραλία is used by Theophrastus to mean Aleppo pine.

πεύκη ἢ ἡμερος, *Pinus pinea*, stone pine. Theophr., HP 3.9.1; another auxiliary name is κωνόφορος (cone-bearing).

πηδός (πηῆδος), an unknown tree species, from which wheel axels and parts for plows were fashioned. Possibly the same as πάδος (*Prunus mahaleb*). Theophr., HP 5.7.6;

πίτυς, *Pinus halepensis* and *P. laricio*, Aleppo pine and Corsican pine. Callixenus 2; Dioscor. 1.69, 72; Geoponica 2.8.2; Iliad 13.390; Nicander, Al. 301; Odys. 9.186; Pausanias Periegeta 5.6.4, 6.9.1; Plutach 2.675 e; Septuagint, Isa. 44:14; Theocr. 5.49; Theophr., HP 1.9.3, 3.3.1, 3.9.5;

πίτυς ἢ φτειροποιός, *Pinus brutia*, small-seeded pine. Theophr., HP 2.2.6;

πλάτανος (πλατάνιστος), *Platanus orientalis*, oriental plane. Aristoph., Eq. 528, Nubes 1008; Dioscor. 1.79; Herodotus 5.119, 7.27, 7.31; Iliad 2.307, 2.310; Nicander, Th. 584; Plato, Phaedrus 229 a; Theocr. 18.44 etc; Theophr., HP 4.5.6;

ποντικόν δένδρον = κερασός, *Prunus avium*. Herodotus 4.23;

πρῖνος, I. *Quercus coccifera*, kermes-oak. Amphis 38; Aratus 1122; Eupolis 14; Theophr., HP 3.7.3; II. *Quercus ilex*, holm-oak. Aristoph., Ranae 859; Callimachus, Iambi 1.261; Hesiod. Op. 436; Theocr. 5.95;

προόμνη, *Prunus insititia*, bullace. Theophr. HP 9.1.2;

πτελέα (πτελέη), *Ulmus glabra* (*U. laevis*, *U. effusa*), elm. Aristoph., Nubes 1008; Dioscor. 1.84; Hesiod, Op. 435; Iliad 6.419, 21.242, 21.350; Theophr., HP 3.14.1; and elsewhere.

πύξος, *Buxus sempervirens*, box-tree. Aristot., Mund. 401^a3, Mir. 831^b23; Septuagint, Isa. 41: 19; Theophr., HP 3.15.5; and elsewhere.

ῥάμνος, *Rhamnus* sp., buckthorn. The word also means ather knotty trees and shrubs. Dioscor. 1.90; Eupolis 14.5; Pausanias Periegeta 3.14.7; Polybius Historicus 12.2.2; Theocr. 4.57; Theophr., HP 1.5.3, 1.9.4 etc;

ῥάμνος ἢ λευκή, *Rhamnus graeca*, a kind of buckthorn. Theophr., HP 3.18.2;

ῥάμνος ἢ μέλαινα, *Rhamnus oleoides*, a kind of buckthorn. Theophr., HP 3.18.2;

ῥόα (ῥοιά), *Punica granatum*, pomegranate. Aristot., Col. 796^a21, Probl. 923^b25 etc.; Galen 6.605; Odys. 7.115; Theophr., HP 1.6.3;

σαρκοκόλλα, *Penaea sarcocolla*, a Persian tree. Dioscor. 3.85; Galen 12.118;

σημύδα = κερκίς, *Cercis siliquastrum*. Theophr., HP 3.14.4, 5.7.7;

σμῖλαξ (μῖλαξ), I. *Quercus ilex typica*, a kind of holm-oak. Theophr., HP 3.16.3; By this term Theophrastus also means a certain vine shrub, the sarsaparilla. (*Smilax aspera*, HP 3.18.11—12 etc.). II. *Taxus baccata*. Dioscor. 4.79; Plato, Republic 372 b; Plutarch 2.647 f; certain other plants (*Phaseolus vulgaris*, *Convolvulus sepium*) are also known by the name σμῖλαξ.

σμύρα, I. *Balsamodendron myrrha*, myrrh-tree. Antonius Liberalis 34.5; Apollodorus 3.14.4; the word also occurs in several other sources, but it generally means the secretion of the tree in question. II. *Balsamodendron mukul*. Arrian, Anabasis 6.22.4;

σποδιάς = προόμνη, *Prunus insititia*. Theophr., HP 3.6.4;

στούραξ, *Storax officinalis*. Herodotus 3.107; Plutarch, Lys. 28; Strabo 12.7.3; Theophr., HP 9.7.3;

συνκάμινος (συνκαμινέα) = μορέα, *Morus nigra*. Aesop 71; Amphis 38; Dioscor. 1.126; Galen 6.589; Septuagint, 1. Kings 10: 27; Theophr., CP 6.6.4, HP 1.6.1 etc.;

συνκάμινος ἢ Ἰαγυπτία, *Ficus sycamorus*, sycamore. Diodorus Siculus 1.34; N.T. Luke 17:6; Strabo 17.2.4; Theophr., HP 1.1.7;

συκῆ (συκέα), *Ficus carica*, fig-tree. Aristoph., Eq. 708; Archilochus 19; Athenaeus 3.74 c etc.; Herodotus 1.193, 4.23; Odys. 7.116, 24.246, 24.341; Pausanias Periegeta 1.37.2; Philostratus, Vitae Sophistarum 2.20.3; Theophr., HP 1.3.1, 3.9.3. etc.; and elsewhere.

συνκόμορος (συνκομορέα) = συνκάμινος ἢ Ἰαγυπτία, *Ficus sycamorus*. Celsus, Ἰαγυθῆς λόγος 5.18.7; N.T. Luke 19: 4;

σφένδαμνος, *Acer monspessulanum*, Montpellier maple. Dicaearchus 2.2; Theophr., HP 3.3.1, 3.11.1;

σχῖνος, *Pistacia lentiscus*, mastich-tree. Babrius 3.4; Galen 6.644; Herodotus 4.177; OT, Apocr., Susanna 54; Soranus 1.121 etc.; Theocr. 5.129; Theophr., HP 9.1.2;

τέρμινθος (τερέβινθος), *Pistacia terebinthus*, terebinth. Aristot., Mir. 837^a33; Dioscor. 1.71; Galen 6.351 etc.; Hippocr., Mul. 2.192; Septuagint, Joshua 24: 26; Theocr., Ep. 1.6; Theophr., HP 3.2.6, 9.2.2;

τετραγωνία, *Eurogymus latifolius*, broad-leaved spindle-tree. Theophr., HP 3.4.2; the name is derived from the fruit of the tree, a crosssection of said fruit being square in shape.

φελλόδορος, *Quercus ilex v. agrifolia*, a kind of holm-oak. Theophr., HP 1.9.3, 3.3.3, 3.16.3;

φελλός = ἵφος, *Quercus suber*. Theophr., HP 1.2.7, 1.5.2 etc.;

φηγός (φαγός) = δοῦς ἢ ἀγρία, *Quercus aegilops*. Hesiod, Fr. 134.7, 134.212; Iliad 5.693, 7.60 etc.; Sophocles, Trachiniae 171; Theocr. 9.20; Theophr., HP 3.3.1, 3.8.2 etc.;

φιλύκη, *Rhamnus alaternus*, alaternus. Theophr., HP 1.9.3, 3.3.1 etc.;

φίλυρα, *Tilia platyphyllos*, lime. Cornutus, De Natura Deorum 24; Dioscor. 1.96; Herodotus 4.67; Theophr., HP 1.12.4 etc.;

φίλυρα ἢ ἄροην, *Phillyrea media*, mock-privet. Theophr., HP 1.9.3;

φίλυρα ἢ θήλεια, *Tilia tomentosa*, silver-lime. Theophr., HP 3.10.4;

φοῖνιξ, *Phoenix dactylifera*, date-palm. Diodorus Siculus 2.53; Euripides, Hecuba 458; Herodotus 1.193, 4.172 etc.; Odys. 6.163; Pindar, Fr. 75.14; Theophr., HP 2.6.6, 2.8.4;

χαμαιάκτη = ἀκτέα ἢ ἔλειος, *Sambucus ebulus*. Pseudo-Dioscor. 4. 173;

χαμαικέρασος, *Prunus prostrata*, dwarf cherry-tree. The word has been preserved only through Pliny.

C. Tree species mentioned in Roman literature

ABELLANA (Avellana), *Corylus avellana*, hazel. Cato, Rust. 8.2; Catullus 8; Celsus 3.27.4; Columella 5.10.14; Macrobius 2; Oribasius, Syn. 2.58; Pliny, NH 16.120 etc.; and elsewhere.

ABIES, *Abies pectinata* and *A. cephalonica*, silver-fir. Caesar, BGal. 5.12; Cicero, Tusc. 3.19.44; Ovid, Met. 10.94; Palladius 12.15.1; Pliny, NH 16.39 etc; Virgil, Aen. 8.599; Vitruvius 2.9—10; and elsewhere.

ACACIA (Gr.), *Acacia arabica*, Egyptian acacia. Caelius Aurelianus, Chron. 2.165; Celsus 5.6; Lactantius, Phoen. 85; Oribasius, Syn. 1.19.2; Petronius 23; Pliny, NH 24.109 etc; Scribonius Largus 41.85; Servius, Georg. 2.119; and elsewhere.

ACER, *Acer monspessulanum*, Montpellier maple. Ovid, Met.; Pliny, NH 16.66 etc; Virgil, Aen. 2.112, ibid. 9.87; and elsewhere.

ACHRAS (Gr.), *Pirus amygdaliformis*, wild pear. Columella 7.9.6 etc.;

ACTE (Gr.), *Sambucus nigra*, elder. Oribasius, Eup. 2.12; Pliny, NH 26.73; Pseudo-Apuleius, Herb. 91;

AEGILOPS (Gr.), *Quercus cerris*, Turkey oak. Pliny, NH 16.22 etc.;

AESCULUS, *Quercus sessiliflora*, chestnut oak. Calpurnius, Ecl. 5.59; Horace, Carm. 3.1017; Macrobius, Sat. 3.20.2; Ovid, Met. 10.91; Palladius 1.9.3; Pliny, NH 16.127 etc; Silius Italicus 5; Suetonius, Galba 3; Virgil, Georg. 2.16; and elsewhere.

AGNOS (Gr.), *Vitex agnus castus*, chaste-tree. Pliny, NH 13.14, 24.59.

ALATERNUS, *Rhamnus alaternus*, alaternus. Columella 7.6.1; Pliny, NH 16.108.

ALNUS, *Alnus glutinosa*, alder. Catullus 17; Cicero, Leg. Agr. 4; Claudianus 10.68 etc; Columella 10.250; Ovid, Met. 13.790; Palladius 9.8.4 etc; Pliny, NH 16.67 etc; Seneca, Phaedr. 10; Serenus Sammonicus 410; Varro 1.7.7; Virgil, Eclogues 6.63; Vitruvius 2.9.10 etc; and elsewhere.

AMYGDALA (Gr.), *Prunus amygdalus*, almond. Columella 5.10.20 etc; Gargilius Martialis, Pom. 3.4; Palladius 1.37.2 etc; Pliny, NH 12.25 etc; and elsewhere.

ANTHEDON (Gr.), *Crataegus orientalis*, oriental thorn. Pliny, NH 15.84.

APHARCE (Gr.), *Arbutus hybrida*, hybrid arbutus. Pliny, NH 13.121.

AQUIFOLIA (aquifolium), *Ilex aquifolium*, holly. Pliny, NH 15.101, 16.32, 16.73 etc.

ARATIA, *Ficus sp.*, a kind of fig-tree. Pliny, NH 15.70.

ARBUTUS, *Arbutus unedo*, arbutus, strawberry-tree. Calpurnius, Ecl. 7.46; Columella 7.6.1 etc; Horace, Carm. 1.17.5; Lucretius 5.940; Ovid, Met. 10.101; Palladius 13.13.8; Pliny, NH 15.99 etc; Propertius 1.2.11; Varro, Rust. 1.6.4; Virgil, Eclogues 3.82 etc, Georg. 3.300 etc; and elsewhere.

ARMENIACA, *Armeniaca vulgaris*, apricot-tree. Columella 11.2.96; Pliny, NH 16.103.

ATINIA, *Ulmus glabra*, elm. Columella 5.6.2. etc; Pliny, NH 16.72 etc.

BALANITIS (Gr.), *Castanea vesca*, chestnut. Pliny, NH 15.93.

BALANOS (Gr.), *Balanites aegyptiaca*, Egyptian balsam. Pliny, NH 13.61. The word also means acorn of the oak tree.

BALANOS SARDINIANOS = balanitis, *Castanea vesca*. Dioscorides 1.116; Pliny, NH 15.93.

BALSAMUM (Gr.), *Balsamodendron opobalsamum*, balsam of Mecca. Florus, Epit. 3.5.29; Pliny, NH 16.135 etc; Tacitus, Hist. 5.6; Virgil, Georg. 2.119; and elsewhere.

BASILICON (Gr.), *Juglans regia*, walnut. Dioscorides uses the name *κάρνα βασιλική* for the walnut. The word »basilicon» (»royal») used by Pliny stems from this name. »Regia», the latter part of the present-day scientific name, means the same thing.

BDELLIUM (Gr.), *Borassus flabelliformis*, vine-palm. Pliny, NH 12.35.

BETULLA, *Betula sp.*, birch. Pliny, NH 16.74, 16.176, 16.209. This word of Gallic origin is not encountered in the Latin language except in the writings on Pliny. The birch was a most exotic and unknown tree species to the Romans.

BRABILLA (Gr.), *Prunus spinosa* or *P. insititia*, sloe or bullace. Pliny, NH 27.55.

BRATUS, a tree resembling the cypress. Pliny, NH 12.78.

BRYA (Gr.), *Tamarix africana* and *T. orientalis*, tamarisk. Pliny, NH 13.116, 24.69. This word is not encountered in the Greek literature which has been preserved, but Pliny says that the Greeks used it. It derives from the word *βρύειν* = to flower abundantly.

BUMELIA (Gr.), *Fraxinus excelsior*, ash. Pliny, NH 16.63.

BUXUS (Gr.), *Buxus sempervirens*, box-tree. Ennius, Ann. 263 Vahl; Martial 3.20.13; Ovid, Ars am. 3.691; Palladius 11.14.11; Pliny, NH 16.70 etc; Virgil, Georg. 2.437; Vulgate, Isa. 41:10; and elsewhere.

CALAMUS (Gr.), *Arundo sp.*, reed. Cato, Rust. 105.2; Columella 2.2.20; Ovid, Met. 1.706; Palladius 12.22.3; Plautus, Persa 88; Pliny, NH 5.44, 6.166, 12.104—106 etc; and elsewhere.

CAPRIFICUS, *Ficus caprificus*, wild fig. Horace, Epod. 5.17; Macrobius, Sat. 1.11.36; Martial 10.2.9; Palladius 4.10.28; Pliny, NH 16.95 etc; and elsewhere.

CARPINUS, *Carpinus betulus*, hornbeam. Cato, Rust. 31.2; Columella 5.7.1; Pliny, NH 16.193 etc; Vitruvius 2.9.12.

CASIA (Gr.), *Cinnamomum sp.*, cassia, cinnamon. Columella 3.8.4; Pliny, NH 16.136; and elsewhere.

CASTANEA (Gr.), = balanitis, *Castanea vesca*. Columella 4.30.2; Martial 10.79.6; Pliny, NH 17.59; Virgil, Georg. 2.14; and elsewhere.

CEDRELATE (Gr.), *Cedrus Libani*, Lebanon cedar. Pliny, NH 13.53, 24.17.

CEDRUS (Gr.), *Juniperus oxycedrus*, prickly cedar. Claudianus, Rapt. Pros. 3.360; Columella 9.4.3; Fronto p. 7.18 N; Itala, Isa. 41:19; Ovid, Am. 14.12; Pliny, NH 12.125, 13.2, 14.112 etc; Vitruvius 2.9.13; Vulgate, 4. Moses 24:6 etc; and elsewhere. This term probably also applied to the cedar proper.

CEDRYS (Gr.), *Juniperus communis*, juniper. Pliny, NH 13.53.

- CELTHIS (Gr.), *Celtis australis*, nettle-tree. Pliny, NH 13.104.
- CERASUS (Gr.), *Prunus avium*, bird-cherry. Pliny, NH 15.102 etc; Varro, Rust. 1.39.3; Virgil, Georg. 2.18; etc. *P. cerasus*, *P. mahaleb* and *P. padus* were probably also known by the name *cerasus*.
- CERATIA (Gr.), *Ceratonia siliqua*, carob-tree. Columella, Arb. 25.1; Dioscorides 1.121; Pliny, NH 26.52.
- CERONIA (Gr.), = *ceratia*, *Ceratonia siliqua*. Pliny, NH 13.59.
- CERRUS = *aegilops*, *Quercus cerris*. Columella 7.9.6; Palladius 1.8.3; Pliny, NH 16.17 etc; Vitruvius 2.9.9.
- CHAMAEACTE (Gr.), *Sambucus ebulus*, dwarf elder. Dioscorides 4.168; Oribasius, Eup. 2 1A 12; Pliny, NH 24.51 etc; Pseudo-Apuleius, Herb. 91.
- CHAMECERASUS (Gr.), *Prunus prostrata*, dwarf cherry-tree. Pliny, NH 15.104.
- CHAMAEROPS (Gr.), *Chamaerops humilis*, dwarf palm. Pliny, NH 13.39.
- CITRUS (Gr.), I. CITRUS MEDICA, citron-tree. Pliny, NH 12.15, 13.103, 16.107 etc; Servius, Georg. 2.126. II. *Callitris quadrivalvis*, thyme-wood tree. Lucan 9.428; Pomponius Mela 3.104; Pliny, NH 13.2, 13.91, 16.129 etc; Varro, Sat. Men. 182.
- COECA (Gr.), *Hyphaene thebaica*, doum-palm. Pliny, NH 13.47.
- COIX (Gr.) = *coeca*, *Hyphaene thebaica*. Pliny, NH 13.47.
- COMAROS (Gr.) = *arbutus*, *Arbutus unedo*. Dioscorides 1.33; Pliny, NH 15.99; Pseudo-Apuleius, Herb. 38.
- CORNUS, *Cornus mas* and *C. sanguinea*, cornelian cherry and cornel. Columella 5.7.1, 7.9.6; Grattius, Cyn. 129; Macrobius, Sat. 3.20.2; Pliny, NH 16.74 etc; Seneca, Phaedra 547; Serenus Sammonicus 14; Valerius Flaccus 3.156; Varro, Rust. 3.16.22; Virgil, Aen. 6.695 etc., Georg. 2.448; and elsewhere.
- CORYLUS (corulus) (Gr.) = *abellana*, *Corylus avellana*. Cato, Rust. 18.9; Columella 7.9.6; Macrobius, Sat. 3.18.5; Ovid, Met. 10.93; Pliny, NH 16.74 etc; Virgil, Eclogues. 1.14, 5.3 etc, Georg. 2.65 etc; and elsewhere.
- COTINUS = *coccygia*, *Rhus cotinus*. Dioscorides 1.114; Pliny, NH 16.73.
- CRATAEGOS (Gr.), *Crataegus Heldreichii*, a kind of thorn. Pliny, NH 27.36.
- CUCI = *coeca*, *Hyphaene thebaica*. Pliny, NH 13.62.
- CUPRESSUS (cyparissus) (Gr.), *Cupressus sempervirens*, cypress. Cato, Rust. 28.1 etc; Catullus 64.291; Horace, Carm. 1.9.11 etc, Epod. 5.18; Ovid, Trist. 3.13.21; Petronius 120.75; Pliny, NH 16.215 etc; Varro, Rust. 1.15.1, 1.26.1 etc; Virgil, eclogues 1.25, Georg. 1.20 etc; Vitruvius 2.9.5; and elsewhere.
- CYTISUS (Gr.). *Medicago arborea*, tree-medick. Celsus 4.16; Columella 2.10.24, 5.12.1 etc; Ennodius, Carm. 1.9.149; Oribasius, Syn. 5.4; Ovid, Ars Am. 3.692; Pliny, NH 16.92 etc; Varro, Rust. 1.23.1, 2.1.17 etc; Virgil, Eclogues 1.78 etc; and elsewhere.
- DIOS BALANUM (Gr.) = *castanea*, *Castanea vesca* Pliny, NH 15.93.
- EBULUM = *chamaeacte*, *Sambucus ebulus*. Cato, Rust. 37.2; Columella 10.10; Palladius 1.5.2; Pliny, NH 17.55; Virgil, Eclogues 10.27; and elsewhere.

- ELATE (Gr.) = *abies*, *Abies pectinata* and *A. cephalonica*. Pliny, NH 12.134. The same source also mentions a palm by the name *palma elate*.
- ERINEOS (Gr.) = *caprificus*, *Ficus caprificus*. Pliny, NH 23.131.
- EUONYMUS (Gr.), *Evonymus europaea*, spindle-tree. Pliny, NH 13.118.
- FAGUS (Gr.), *Fagus sylvatica*, beech. Caesar, BGal. 5.12.5; Calpurnius, Eclogues 7.5 etc; Catullus 64.289; Columella 7.9.6; Ovid, Epist. 5.21; Pliny, NH 16.16, etc; Propertius 1.18.20; Seneca, Phaedra 510; Sidonius, Carm. 4.1; Varro, Ling. 5.152; Virgil, Eclogues 1.1 etc, Georg. 4.566; Vitruvius 2.9.9; and elsewhere.
- FARNUS = *bumelia*, *Fraxinus excelsior*. Palladius 1.9.3; Vitruvius 7.1.2.
- FIGUS, *Ficus carica*, fig-tree. Cato, Rust. 40.1; Cicero, Orat. 2.278; Columella 3.21.11 etc; Horace, Sat. 1.8.47; Itala, Gen. 3: 7; Livy 1.4.5; N.T. Matt. 21: 19; Ovid, Fasti 2.253; Palladius 1.35.3; Pliny, NH 7.21, 11.118 etc; Varro, Rust. 1.39.2 etc; and elsewhere.
- FRAXINUS = *bumelia*, *farnus*, *Fraxinus excelsior*. Columella 5.6.4 etc; Ennius, Ann. 189; Gellius 19.12.7; Horace, Carm. 3.25.16; Ovid, Met. 7.677; Palladius 3.10.4; Pliny, NH 11.77, 13.117 etc; Serenus Sammonicus 382; Statius, Theb. 4.281; Virgil, Aen. 11.136, Eclogues 7.65 etc, Georg. 2.66; Vitruvius 2.9.11; and elsewhere.
- GLINON (Gr.), *Acer creticum*, a kind of maple. Pliny, NH 16.67.
- GRANATUM, *Punica granatum*, pomegranate. Pliny, NH 16.86; Vulgate, 4. Moses 20: 5.
- HALIPHLOEOS (Gr.), *Quercus pseudo-suber*, sea-bark oak. Pliny, NH 16.24.
- HARUNDO (arundo) = *calamus*, *Arundo sp.* An exceptionally common word, which occurs in the works of most Roman writers.
- HEBENUS (ebenus) (Gr.), *Diospyros ebenum* and *D. melanoxylon*, ebony. Celsus 3.21.7; Claudianus, Carm. Min. 28.22; Lucan 10.117; Ovid, Met. 11.610; Pliny, NH 24.89, 6.197 etc; and elsewhere.
- HEDERA (edera), *Hedera helix*, ivy. Catullus 61.34; Columella 11.2.30; Horace, Epod. 15.5; Ovid, Met. 4.365; Palladius 9.8.4; Pliny, NH 8.117, 12.74, 15.100, 16.79, 16.144, 16.151 etc; Virgil, Georg. 2.258; Vitruvius 8.1.3; and elsewhere.
- HELIX (Gr.) = *hedera*, *Hedera helix*. Dioscorides 2.165; Pliny, NH 16.145 etc.
- HEMERIS (Gr.), *Quercus infectoria*, gall-oak. Pliny, NH 16.22, 16.26.
- ILEX, *Quercus ilex*, holm-oak. Columella 9.3.2; Horace, Epod. 15.5; Ovid, Amor. 2.6.49, Ars Am. 3.149, Fasti 165; Pliny, NH 16.19, 16.32, 16.73 etc; Virgil, Eclogues 7.1; and elsewhere.
- IUGLANS = *basilicon*, *Juglans regia*. Cicero, Tusc. 5.20.58; Columella 5.10.4; Macrobius, Sat. 2.14; Palladius 2.15.14; Pliny, NH 15.86 etc; Varro, Rust. 1.16.6; and elsewhere.
- IUNIPERUS = *cedrys*, *Juniperus sp.* Columella 7.9.6; Pliny, NH 16.80 etc; Virgil, Eclogues 10.76.
- LARIX (Gr.), *Larix europaea*, larch. Palladius 12.15; Pliny, NH 16.43, 16.73, 16.190; Vitruvius 2.9.14,

LAURUS, *Laurus nobilis*, sweet bay. Cicero, Mur. 41.88; Claudianus, Rapt. Pros. 2.109; Horace, Od. 2.7.19; Livy 23.11; Ovid, Fasti 3.137; Pliny, NH 15.127, 16.120 etc; Propertius 2.21.36; Tibullus 2.5.81; and elsewhere.

LENTISCUS, *Pistacia lentiscus*, mastich. Cato, Rust. 7; Cicero, De Divinatione 1.9.15; Columella 12.49.1; Martial 14.22; Pliny, NH 15.21, 18.228; Varro, Rust. 1.60.1.

LOTOS (Gr.), I. *Celtis australis*, nettle-tree. Columella 7.9.6; Pliny, NH 16.123, 24.6. II. *Zizyphus lotus*, Jew thorn. Ovid, Met. 15.159; Pliny, NH 13.104; Propertius 3.10.27; Tibullus 4.1.55; Virgil, Georg. 2.34, 3.394, As in Greek, too, the term lotus was also used for several other plants; to wit: *Eugenia caryophyllata*, *Trifolium fragiferum*, *Lotus corniculatus*, *Nymphaea lotus*, *N. caerulea* and *Nelumbo nucifera*.

LYGOS (Gr.) = agnos, *Vitex agnus castus*. Pliny, NH 24.59.

MALUS, *Pirus malus*, apple-tree. Varro, Rust. 1.76; Pliny, NH 7.25, 12.14, 15.39, 16.74 etc; Virgil, Georg. 2.70; and elsewhere.

MALUS ASSYRIA = citrus, *Citrus medica*. Pliny, NH 11.278, 12.15—16, 14.7, 16.135.

MALUM GRANATUM = granatum, *Punica granatum*. Pliny, NH 13.9 etc.

MALUS MEDICA = citrus, *Citrus medica*. Pliny, NH 12.15—16, 15.47.

MALUS PUNICA = granatum, *Punica granatum*. Pliny, NH 12.48 etc.

MESPILA (Gr.), a generic term for various thorn trees (*Mespilus* and *Crataegus*). Palladius 3.25; Pliny, NH 15.84.

MORUS, *Morus nigra* and *M. alba*, mulberry-tree. Ovid, Met. 4.89; Pliny, NH 16.102; Virgil, Eclogues 6.22; and elsewhere.

MURRA (myrrha) (Gr.), *Balsamodendron myrrha*, myrrh-tree. Ovid, Met. 10.310, 15.399; Pliny 12.66.

MYRICE (myrica) (Gr.), *Tamarix tetrandra* and *T. articulata*, tamarisk. Ovid, Ars Am. 3.691, Met. 10.97; Pliny, NH 13.116; 24.67; Virgil, Eclogues 4.2.

MYRTUS (Gr.), *Myrtus communis*, myrtle-tree. Cato, Rust. 8. 125, 133; Horace, Od. 1.4.9; Ovid, Ars Am. 2.733; Pliny, NH 15.122 etc; Virgil, Eclogues 7.61; and elsewhere.

OLEA, *Olea europaea*, olive-tree. Cato, Rust. 61; Cicero, De Divinatione 6.16; Columella 5.8.3; Livy 24.30; Macrobius, Sat. 2.16; Ovid, Fasti 4.741; Palladius 3.18; Pliny, NH 2.108, 2.226, 3.41, 6.131 etc; Seneca, Herc. Fur. 193; Statius, Theb. 12.492; Varro, Rust. 24.2; Virgil, Georg. 2.86; and elsewhere.

OLEASTER, *Olea oleaster*, oleaster. Columella 8.10.4 etc; Cicero, In Verrem 5.23.57; Pliny, NH 5.3, 8.101, 12.26, 13.114, 15.19 etc; Venantius, Carm. 5.2.30; Virgil, Georg. 2.182.

OPULUS, *Acer sp.*, a kind of maple. Columella 5.6.4 etc, De Arb. 16; Pliny, NH 14.12, 17.201; Varro, Rust. 1.8.3.

ORNUS, *Fraxinus ornus*, mountain ash, manna-ash. Columella, De Arb. 16; Horace, Od. 3.27.58; Pliny, NH 16.73; Virgil, Aen. 10.766, Eclogues 6.71, Georg. 2.111.

OSTRYS (ostrya) (Gr.), *Ostrya carpinifolia*, hop-hornbeam. Pliny, NH 13.117.

PALIURUS (Gr.), *Zizyphus spina Christi* and *Paliurus aculeatus*, Christ's thorn. Columella 7.9.6; 11.3.4; Pliny, NH 16.121, 24.115; Virgil, Eclogues 5.39.

PALMA, *Phoenix dactylifera*, date-palm. Cicero, De Leg. 1.1.2; Columella 5.5.15; Lucan 3.216; Ovid, Fasti 1.185; Pliny, NH 13.27, 13.40, 16.223 etc; Varro, Rust. 1.22.1; Virgil, Georg. 3.12; and elsewhere. The word *palma* also sometimes meant other trees. The original meaning of the word is palm; also, derived from this is the meaning »whole hand». The date-palm reminds one of an erect arm with its palm and fingers. The latter part of the modern scientific name means finger-bearing, fingered. It should be mentioned that the shift in meaning of the word *palma* did not become fixed at the meaning palm tree, but later it began to be used to mean expressly the branch of the palma, and finally, branch in general, irregardless of the tree species.

PERSEA (Gr.), *Mimusops Schimperii*. Pliny, NH 13.60, 15.44.

PERSICUM CARYON = iuglans, *Juglans regia*. Pliny, NH 15.87.

PERSICUS, *Amygdalus persica*, peach-tree. Columella 10.1.410; Macrobius, Sat. 2.15; Palladius 12.7; Pliny, NH 12.14, 13.60, 15.39—45 etc.

PEUCE (Gr.), a generic term for firs and pines. Pliny, NH 11.118.

PHOENIX ELATE (Gr.), *Chamaerops humilis*, dwarf-palm. Pliny, NH 24.56.

PICEA, *Picea abies*, (possibly also *P. omorica* and *P. orientalis*), spruce. Ovid, Heroid. 12.67; Pliny, NH 3.122, 14.123, 14.127, 15.36, 16.30, 16.35 etc; Virgil, Aen. 9.78.

Opinions differ regarding the identification of this tree species. According to SEIDENSTICKER (1886 II, p. 31), it means silver fir, but this is by no means likely, because the word »picea» means resinous and there is not the least resin in the silver fir. »Picea» is not originally a tree name in itself but, according to STRENG'S Latin-Finnish dictionary, the first part of the tree species designation »picea abies», or resinous silver fir. In English sources (for example, Jones' catalogue of the plants mentioned by PLINY) the counterpart of the word »picea» is the pine: primarily, *Pinus silvestris*. STRENG has taken the same view in his dictionary. This does not seem credible because it does not make sense to begin to use the term resinous silver fir for the pine, which is so different from this in appearance. Apparently the term »picea abies» was used to mean a tree which is similar in appearance to the silver fir and which is resinous; in this case it is primarily a matter of the Norway spruce, or at any rate, some species of the present *Picea* genus. It should be noted that if the word »picea» is made the synonym of the word »pinus», then there is no word at all in Latin meaning Norway spruce. The spruce, however, could not have been unknown to the Romans. Furthermore, let us bear in mind that PLINY gives certain distinct distinguishing marks to these two trees. In the first place, he explains that the »pinaster» (c.f. below) is distinguished from the »pinus» in that it is shorter and that its branch system begins half way up the trunk and not just

at the crown as in the »pinus.» (Nat. Hist. 16.39: pinaster nihil est aliud quam pinus silvestris minor altitudine at a medio ramosa sicut pinus in vertice). However, the branches of the »picea» were moderately strong almost right at the butt of the stem and they hung at the side of the tree like arms (Nat. Hist. 16.41: Piceae rami paene statim ab radice modici velut brachia lateribus inhaerent). The distinguishing characteristics are probably sufficiently clear, but at this point, too, JONES in his English translation has equated »picea» with the pitch-pine. The modern scientific name of the Norway spruce, at any rate, points to the generalization of the notion that »picea» originally meant the Norway spruce.

PINASTER, *Pinus pinaster*, cluster pine. Pliny, NH 16.39.

PINUS, *Pinus silvestris* and *P. halepensis*, Scotch pine and Aleppo pine. Cato, Rust. 17 and 31; Horace, Od. 3.22.1; Macrobius, Sat. 6.9; Ovid, Met. 10.103 etc; Palladius 4.10; Pliny, NH 16.39, 16.79, 16.95, 17.89, 23.142 etc; Propertius 2.15.17; Silius Italicus 13.331; Virgil, Aen. 11.136, Eclogues 7.65, Georg. 2.389 etc; and elsewhere.

PIRUS, *Pirus communis*, pear-tree. Cato, Rust. 7; Celsus 2.24; Columella, Rust. 5.10.18; Macrobius, Sat. 2.15; Pliny, NH 16.90, 16.109, 16.117 etc; Virgil, Eclogues 1.74; and elsewhere.

PISTACIA (Gr.), *Pistacia vera*, pistachio. Palladius 3.25; Pliny, NH 15.91.

PLATANUS (Gr.), *Platanus orientalis*, oriental plane. Cato, Rust. 51; Cicero, Orat. 1.7.28; Curtius Rufus 5.4; Horace, Od. 2.15.4; Ovid, Met. 10.95, 13.794; Pliny, NH 12.6, 13.98, 15.29, 16.30, 16.90 etc; Varro, Rust. 1.7; Virgil, Culex 124; and elsewhere.

POPULUS, *Populus alba* and *P. nigra*, abele (white poplar) and black poplar. Cato, Rust. 6; Columella 11.2.13; Curtius Rufus 5.4; Horace, Od. 2.3.9, Epod. 2.9; Macrobius, Sat. 3.12; Ovid, Heroid. 5.27 etc; Pliny, NH 16.85, 16.108, 17.78 etc; Varro, Rust. 1.6; Virgil, Aen. 8.276, Eclogues 6.64 etc; and elsewhere.

PRUNUS (Gr.), *Prunus domestica*, plum-tree, sometimes apparently also *P. spinosa*, sloe, blackthorn. Columella 2.2.20; Palladius 3.25; Pliny, NH 13.51, 13.66, 15.41, 16.74, 16.104 etc.

PUNICA = granatum, *Punica granatum*. Columella 10.243; Pliny, NH 13.112, 15.39, 15.112, 23.106 etc.

QUERCUS, *Quercus robur*, oak. Cato, Rust. 5; Cicero, De Leg. 1.1.2; Columella 5.8.7 etc; Horace, Epod. 1.16.9; Iuvenal 14.183; Livy 3.25; Lucan 1.357; Lucretius 5.937; Ovid, Met. 13.798; Pliny, NH 4.18, 8.81, 9.32, 12.108, 13.63, 14.126, 16.5, 16.11, 16.16 etc. etc; Seneca, Herc. Oet. 1474; Silius Italicus 7.190; Valerius Flaccus 5.65, 6.243; Valerius Maximus 2.8; Varro, Rust. 1.6; Virgil, Aen. 3.680, Eclogues 6.28, Georg. 3.332 etc; Vitruvius 2.9.9; Vulgate; and elsewhere.

RHAMNOS (Gr.), *Rhamnus sp.*, a kind of buckthorn. Pliny, NH 24.124.

RHODODAPHNE (Gr.), *Nerium oleander*, oleander. Palladius 1.35; Pliny, NH 16.79, 24.90; Virgil, Culex 402.

RHODODENDRON (Gr.) = rhododaphne. *Nerium oleander*. Pliny, NH 16.79, 17.98, 21.77, 24.90.

RHUS (Gr.), *Coriaria myrtifolia* and *Rhus coriaria*, myrtle-leaved sumach and tanner's sumach. Pliny, NH 13.55, 24.91, 24.129, 29.50 etc.

ROBUR (robor), *Quercus aegilops*, Valonia oak. Columella 11.2.13; Pliny, NH 11.151, 12.35, 13.119, 16.6, 16.17, 16.19 etc. The word *robur* also means an old, thick tree in the general sense, as well as in the figurative sense such meanings as: strength, durability, strongest part, an elect class, the heart of a matter, etc.

RUMPOTINUS, *Acer sp.*, a kind of maple. Pliny, NH 14.12.

SABINA, *Juniperus sabina*, savin. Apuleius, Herb. 86; Ovid, Fasti 1.343, 4.741; Pliny, NH 10.157, 16.79, 17.98, 24.112; Propertius 4.3.58; Virgil, Culex 404.

SABUCUS (sambucus), *Sambucus nigra*, elder. Columella 4.26.1; Pliny, NH 15.64, 16.74, 16.180, 17.68, 24.51 etc; Serenus Sammonicus 7.100, 19.337 etc.

SALIX, *Salix sp.*, willow. Cato, Rust. 6; Columella 4.30.2; Lucan 4.131; Lucretius 2.361; Ovid, Met. 10.96; Pliny, NH 2.108, 11.14, 14.110, 16.77 etc; Varro, Rust. 1.24.4; Virgil, Eclogues 3.83 etc, Georg. 1.265, 3.175; and elsewhere.

SARCOCOLLA (Gr.), *Penaea sarcocolla*, a Persian tree. Pliny, NH 13.67, 24.127.

SETANIA = mespila, *Mespilus germanica*. Pliny, NH 15.84, 23.141. The red onion is also known by the name setania.

SILER, *Salix vitellina*, brookwillow. Pliny, NH 16.77, 24.73; Venantius, Carm. 3.7.23; Virgil, Georg. 2.12.

SILYUA = ceratia, *Ceratonia silyua*. Columella, Rust. 5.10.20, 7.9.6, De Arb. 25; Palladius 3.25; Pliny, NH 13.59; 14.103, 15.95, 17.136, 23.151.

SORBUS, *Sorbus domestica*, sorb, service-tree. Columella, Rust. 5.10.19; Pliny, NH 13.58, 14.103, 15.43, 16.74, 16.92 etc.

SPINA, *Acacia*, *Crataegus*, *Rhamnus*, *Rosa* and others, different kinds of thorn. Columella 7.7.2, 7.9.6; Pliny, NH 13.115, 16.75, 24.108; and elsewhere.

STOBRUS, an unidentified tree imported from Carmania (present-day Pakistan) for use as an incense. Pliny, NH 12.79.

STORAX (styrax) (Gr.), *Storax officinalis*, officinal storax. Pliny, NH 12.124 etc; Serenus Sammonicus 46.864; Virgil, Ciris 168; and elsewhere.

SUBER, *Quercus suber*, cork-oak. Avienus, Perieg. 11.89; Columella, Rust. 4.26.1; Pliny, NH 16.34, 16.98, 17.234 etc; Virgil, Aen. 7.742; and elsewhere.

SYRTICA ARBOR = celthis, *Celtis australis*. Pliny, 24.6.

TAEDA, *Pinus cembra*, stone pine. Pliny, NH 16.44, 16.52, 17.253, 24.41 etc.

TAMARIX (tamarice) = myrice, *Tamarix articulata*. Columella, Rust. 8.15.4; Lucan 9.916; Pliny, NH 13.116, 24.67 etc; and elsewhere.

TARUM, *Aloe vera*, aloe. Pliny, NH 12.98.

TAXUS, *Taxus baccata*, yew. Caesar, BGall. 6.30; Calpurnius, Eclogues 8.77, 11.52; Claudianus, Rapt. Pros. 386; Lucan 6.645; Nemesianus, Ecl. 4.52; Pliny,

NH 16.50—51, 16.80, 22.97 etc; Silius Italicus 13.595; Suetonius, Vita Claudii 16; Virgil, Eclogues 9.30.

TEREBINTHUS (Gr.), *Pistacia terebinthus*, terebinth. Marcellinus Empiricus c. 20 p. 114; Pliny, NH 11.77, 12.25, 12.56, 13.9, 14.112, 16.55, 16.58 etc; Virgil, Aen. 10.136; Vulgate, Gen. 43:11, 1. Kings 17:2 and 17:19.

THYA (thyon) (Gr.), *Callitris quadrivalvis*, thyine-wood tree. Macrobius, Sat. 3.19; Pliny, NH 13.100; Propertius 3.5.63.

TIBULUS, a kind of pine. Pliny, NH 16.39.

TILIA, *Tilia tomentosa* and *T. platyphyllos*, lime. Ovid, Met. 10.92; Pliny, NH 11.32, 16.30, 16.35, 16.65 etc; Virgil, Georg. 1.173, 2.449, 4.183.

TUS, *Boswellia Carteri*, frankincense-tree. Pliny, NH 12.55—57, 12.67, 16.136 etc. The word is fairly common in Roman literature in the meaning of an incense substance in general.

ULMUS, *Ulmus glabra* (*U. effusa*, *U. laevis*), elm. Calpurnius, Ecl. 2.59; Columella, Rust. 5.6; Horace, Od. 1.2.9, Epod. 1.16.3; Iuvenal 8.78; Ovid, Met. 10.100; Plautus, Amph. 4.2.9; Pliny, NH 11.14, 13.55, 13.58, 14.12, 15.57, 16.72, 16.74 etc; Quintilianus 8.28; Virgil, Georg. 2.440 etc; and elsewhere.

UNEDO = *arbutus*, *Arbutus unedo*. Columella, Rust. 8.17.13; Pliny, NH 12.15, 13.120, 15.96, 16.80, 16.126, 23.151.

VITEX = *agnos*, *Vitex agnus castus*. Pliny, NH 16.209, 24.59—64, 26.97 etc.

VITIS, *Vitis vinifera*, vine. Catullus, Columella, Cicero, Martial, Ovid, Palladius, Pliny, Tibullus, Varro, Virgil etc. etc.

XYLOBALSAMUM (Gr.), *Commiphora opobalsamum*, a kind of balsam-tree. The word means the wood of the very tree in question. Marcellinus Empiricus 22 p. 118; Pliny, NH 12.118, 13.13 etc; Scribonius, Compos. 110 and 269.

ZYGIA (Gr.), = *carpinus*, *Carpinus betulus*. Pliny, NH 16.67; Vitruvius 2.9.

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Abbreviations

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SCBO = Scriptorum Classicorum Bibliotheca Oxoniensis

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- II 1. THEOPHRASTUS I. I. 9: *Ἀυτὰ δὲ τὰ μέρη διαριθμησάμενος πειρατέον περὶ ἑκάστου λέγειν. ἔστι δὲ πρῶτα μὲν καὶ μέγιστα καὶ κοινὰ τῶν πλείστων τάδε, ῥίζα κανλὸς ἀκρεμῶν κλάδος — — —*
Ἔστι δὲ ῥίζα μὲν δι' οὗ τὴν τροφήν ἐπάγεται, κανλὸς δὲ εἰς ὃ φέρεται. κανλὸν δὲ λέγω τὸ ὑπὲρ γῆς πεφυκὸς ἐφ' ἑνὶ τοῦτο γὰρ κοινότατον ὁμοίως ἐπετελοῖς καὶ χρονοῖς, ὃ ἐπὶ τῶν δένδρων καλεῖται στέλεχος· ἀκρεμῶνας δὲ τοὺς ἀπὸ τοῦτον σχιζομένους, οὓς ἔνιοι καλοῦσιν ὄζους. κλάδον δὲ τὸ βλάστημα τὸ ἐκ τούτων ἐφ' ἑνὶ οἷον μάλιστα τὸ ἐπέτειον.
- II 2. THEOPHRASTUS I. VI. 4: *Ἔστι δὲ καὶ τὰ μὲν βαθύροζα, καθάπερ δοῦς, — — —*
- II 3. THEOPHRASTUS III. XVI. 1: *βαθύροζον δὲ ἐπιεικῶς καὶ πολύροζον.*
- II 4. PLINY XVI. LVI. 127: *robora suas in profundum agunt: si Vergilio quidem credimus, aesculus quantum corpore eminent tantum radice descendit.*
- II 5. PLINY XVI. LVI. 130: *visa enim est annosa quercus eversa tempestatis vi iugerum soli amplexa.*
- II 6. THEOPHRASTUS I. VI. 3: *τὰ δὲ μονόροζα, καθάπερ ἐλάτη πεύκη· μονόροζα δὲ οὕτως, ὅτι μίαν μεγάλην τὴν εἰς βάθος ἔχει μικρὰς δὲ ἀπὸ ταύτης πλείους.*
- II 7. THEOPHRASTUS I. VIII. 3: *Εἰσὶ δὲ τῶν μὲν ἄτακτοι καὶ ὡς ἔτυχεν οἱ ὄζοι, τῶν δὲ τεταγμένοι καὶ τῶ διαστήματι καὶ τῶ πλήθει καθάπερ εἴρηται· δι' ὃ καὶ ταξιοζῶτα ταῦτα καλοῦσιν. τῶν μὲν γὰρ οἷον δι' ἴσον τῶν δὲ μείζον αἰεὶ τὸ πρὸς τῶ πάχει.*
- II 8. THEOPHRASTUS I. IX. 1: *σημεῖον δ' ὅτι ταυτὰ πυκνὰ μὲν ὄντα μακρὰ καὶ λεπτὰ γίνεται, μανὰ δὲ παχύτερα καὶ βραχύτερα· καὶ ἐὰν μὲν εὐθύς τις ἀφῆ τὸς ὄζους βραχεά, ἐὰν δὲ ἀνακαθαίρη μακρὰ, καθάπερ ἡ ἄμπελος.*
- II 9. PLINY XVI. LXXVI. 195: *Larici et magis abieti succisis umor diu defluit. hae omnium arborum altissimae ac rectissimae.*
- II 10. PLINY XVI. LXXVI. 200: *Amplissima arborum ad hoc aevi existimatur Romae visa quam propter miraculum Tiberius Caesar in eodem ponte naumachiario exposuerat advectam cum reliqua materie, duravitque ad Neronis principis amphitheatrum. fuit autem trabs ea e larice, longa pedes cxx, bipedali crassitudine aequalis, quo intellegebatur vix credibilis reliqua altitudo fastigium ad cacumen aestimantibus.*
- II 11. PLINY XVI. LXXVI. 202: *arboris eius crassitudo quattuor hominum ulnas complectentium implebat;*
- II 12. PLINY XVI. LXXVI. 203: *At in Aegypto ac Syria reges inopia abietis cedro ad classes feruntur usi; maxima in Cypro traditur, ad undeciremem Demetrii succisa, cxxx pedum, crassitudinis vero ad trium hominum complexum.*
- II 13. THEOPHRASTUS III. XV. 6: *Πλήθει δὲ πολὺ κράταιγός ἐστιν — — — ἔχει δὲ φλοιὸν λεῖον ὁμοῖον μεσπίλη.*
- II 14. THEOPHRASTUS III. XIV. 3: *Μονογενὲς δὲ καὶ ἡ κλήθηρα. — — — τραχύφλοιον δὲ καὶ ὁ φλοιὸς ἔσωθεν ἐρνυθρός, — — —*
- II 15. THEOPHRASTUS III. XVII. 1: *Ἔνια δὲ ἰδιώτερα, καθάπερ καὶ ὁ φελλός. — — — τὸν δὲ φλοιὸν παχὺν σφόδρα καὶ καταροηγνόμενον, ὥσπερ ὁ τῆς πίτυος, πλὴν κατὰ μείζω.*
- II 16. THEOPHRASTUS I. V. 2: *πάντα δὲ νέα μὲν ὄντα λειοφλοιότερα, ἀπογηράσκοντα δὲ τραχύφλοιότερα, — — —*

- II 17. THEOPHRASTUS I. V. 2: ἔστι δὲ καὶ τῶν μὲν σαρκώδης ὁ φλοιός, οἷον φελλοῦ δρυὸς αἰγείρου· τῶν δὲ ἰνώδης καὶ ἄσαρκος ὁμοίως δένδρων καὶ θάμνων καὶ ἐπετείων, οἷον ἀμπέλου καλάμου πυροῦ.
- II 18. THEOPHRASTUS I. V. 2: καὶ τῶν μὲν πολύλοπος, οἷον φιλόρας ἐλάτης ἀμπέλου λινოსπάρτου κρομύων, — — —
- II 19. PLINY XVI. LV. 126: Cortex aliis tenuis, ut lauro, tiliae, aliis crassus, ut robori, aliis levis, ut malo, fico, idem scaber robori, palmae, omnibus in senecta rugosior. quibusdam rumpitur sponte, ut viti, quibusdam etiam cadit, ut malo, unedoni. carnosus suberi, populo, membranaceus viti, harundini, libris similis ceraso, multiplex tunicis vitibus, tiliae, abieti, quibusdam simplex, ut fico, harundini.
- II 20. THEOPHRASTUS I. I. 8: Διαφέρει δὲ ἔνια καὶ τῆ τάξει· τὰ μὲν ὡς ἔτυχε, τῆς δ' ἐλάτης οἱ κλώνες κατ' ἀλλήλους ἐκατέρωθεν.
- II 21. PLINY XVI. LIII. 122: quibusdam ramorum ordo, sicut piceae, abieti — — —
- II 22. PLINY XVI. LIII. 123—124: faba Graeca, quam Romae a suavitate fructus, silvestris quidem sed cerasorum paene natura, loton appellant. — — — nullis rami longiores validioresque aut plures, — — —
- II 23. THEOPHRASTUS VI. I. 4: ἡ γὰρ τῶν φύλλων ἀνωμαλία μεγέθει καὶ μικρότητι καὶ σχήμασιν ἄπειρος καὶ ἄσαφής.
- II 24. THEOPHRASTUS I. X. 1: Τὰ δὲ φύλλα τῶν μὲν ἄλλων δένδρων ὅμοια πάντων αὐτὰ ἑαυτοῖς, τῆς δὲ λεύκης καὶ τοῦ κιττοῦ καὶ τοῦ καλουμένου κρότωνος ἀνόμοια καὶ ἑτεροσχήμονα. τὰ μὲν γὰρ νέα περιφερῆ τὰ δὲ παλαιότερα γωνοειδῆ, καὶ εἰς τοῦτο ἡ μεταστάσις πάντων. τοῦ δὲ κιττοῦ ἀνάπαλιν νέου μὲν ὄντος ἐγγωνιώτερα πρεσβυτέρον δὲ περιφερέστερα μεταβάλλει γὰρ καὶ οὗτος.
- II 25. PLINY XVI. XXXV. 85: Foliorum unitas in suo cuique genere permanet, praeterquam populo, hederæ, crotoni.
- II 26. THEOPHRASTUS I. IX. 5: Πάντα δὲ καὶ τῶν ἄλλων τὰ ἀείφυλλα στενοφυλλότερα καὶ ἔχοντά τινα λιπαρότητα καὶ εὐωδία.
- II 27. THEOPHRASTUS I. X. 1: ἴδιον δὲ καὶ τὸ τῆ ἐλάα καὶ τῆ φιλόρα καὶ τῆ πελέα καὶ τῆ λεύκη συμβαῖνον· στρέφειν γὰρ, δοκοῦσιν τὰ ὕπτια μετὰ τροπὰς θερινάς, καὶ τοῦτω γνωρίζουσιν ὅτι γεγένηται τροπαί.
- II 28. PLINY XVI. XXXVI. 87: Mirum in primis id quod ulmo tiliaeque et oleae et populo albae et salici evenit: circumaguntur enim folia earum post solstitium, nec alio argumento certius intellegitur sidus confectum.
- II 29. PLINY XVIII. LXVIII. 265—267: quam ob rem eas manibus ipsis agriculturalium ingessit, vertique iussit ea ipsa die folia et esse confecti sideris signum, nec silvestrium arborum remotarumque, ut in saltus devios montesque eundem esset querentibus signa, non rursus urbanarum quaeque topiario tantum coluntur, quamquam his et in villa visendis; vertit oleae ante pedes satae, vertit tiliae ad mille usus petendae, vertit populi albae etiam vitibus nuptae. adhuc parum est. 'Ulmum', inquit, 'vite dotatam habes; et huius vertam. pabulo folia eius stringis aut deputas: aspice et tenes sidus, alia parte caelum rescipiunt quam qua spectavere pridie. salice omnia alligas, humillima arborum ipse toto capite altior; et huius circumagam'.
- II 30. GELLII IX. VII: Vulgo et scriptum et creditum est, folia olearum arborum brumali et solstitiali die converti et quae pars eorum fuerit inferior atque occultior, eam supra fieri atque exponi ad oculos et ad solem. Quod nobis quoque semel atque iterum experiri volentibus ita esse propemodum visum est.
- II 31. THEOPHRASTUS I. X. 5: καὶ ταῦτα μὲν ἄσχιστα < τὰ δὲ σχιστά > καὶ οἷον προιονώδη, καθάπερ τὰ τῆς ἐλάτης καὶ τὰ τῆς περσίδος.
- II 32. THEOPHRASTUS I. XIII. 1: ἐπεὶ καὶ τῶν ἀνθῶν τὰ μὲν ἐστὶ χρωώδη, καθάπερ τὸ τῆς ἀμπέλου καὶ σακαμίνου καὶ τοῦ κιττοῦ· τὰ δὲ φυλλώδη, καθάπερ ἀμυγδαλῆς μηλέας ἀπίου κοκκνηλέας.

- II 33. THEOPHRASTUS I. XIII. 3: τὰ μὲν γὰρ ἔχει περὶ αὐτὸν τὸν καρπὸν, οἷον ἄμπελος ἐλάα. — — — σχεδὸν δὲ καὶ τὰ πολλὰ τῶν < ἀνθῶν > ἐν μέσῳ τὸ περικαρπίον ἔχει, τάχα δὲ καὶ ἐπ' αὐτοῦ τοῦ περικαρπίου, καθάπερ ῥόα μηλέα ἄπιος κοκκνηλέα μύρρινος, καὶ τῶν γε φρυγανικῶν ῥοδωνία καὶ τὰ πολλὰ τῶν στεφανωτικῶν.
- II 34. PLINY XVI. XLVI. 109: Novellae arbores carent fructu quamdiu crescunt.
- II 35. PLINY XVI. L. 116: Est vero et in ipsis arboribus etiam onustus peculiaris differentia: summa sui parte fertiliores arbutus, quercus, inferiore iuglandis, fici mariscae.
- II 36. THEOPHRASTUS V. V. 2: Μήτραν δὲ πάντα μὲν ἔχειν φασὶν οἱ τέκτονες φανερὰν δ' εἶναι μάλιστα ἐν τῆ ἐλάτῃ φαίνεσθαι γὰρ οἷον φλοιώδη τινὰ τὴν σύνθεσιν αὐτῆς τῶν κύκλων.
- II 37. THEOPHRASTUS V. V. 3: τοῦτο δὲ κατὰ συμβεβηκός, ὅτι χιτώνας ἔχει πλείους, ἰσχυρότατον δὲ καὶ λεπτότατον δὲ τὸν ἔσχατον, ξηρότατον γὰρ, καὶ τοὺς ἄλλους ἀνὰ λόγον.
- II 38. THEOPHRASTUS V. I. 9: ἔπειτα καθ' ἑκατέραν τὴν κτηδόνα ποιῶνται τὴν πελέκησιν ἐναντίας τὰς πληγὰς κατὰ κτηδόνα φέροντες, ὅταν ἐφ' ἑκάτερα τῆς ἐντεριώνης ἢ πελέκησις ἀναστρέφῃ. τοῦτο γὰρ ἐξ ἀνάγκης συμβαίνει διὰ τὴν φύσιν τῶν κτηδόνων.
- II 39. THEOPHRASTUS III. X. 2: πᾶν γὰρ εἶναι καρδίαν, ὅταν ὁ φλοιὸς περιαιρωθῆ.
- II 40. THEOPHRASTUS III. X. 5: μήτραν δ' ἔχει τὸ ξύλον μικρὰν καὶ οὐ πολὺ μαλακωτέραν τοῦ ἄλλου μαλακὸν γὰρ καὶ τὸ ἄλλο ξύλον.
- II 41. THEOPHRASTUS III. IX. 3: γίνεται δὲ ἐν τοῖς μέγεθος ἔχουσι τῶν δένδρων, ὅταν ἐκπεσόντα περισπῆ τὰ λευκά τὰ κύκλω.
- II 42. THEOPHRASTUS III. XV. 2: ἔχει δὲ καὶ ἐντεριώνην λεπτήν ξανθὴν, ἣ κοιλαίνεται.
- II 43. THEOPHRASTUS III. XIII. 4: τὸ δὲ ξύλον χαῦνον καὶ κοῦφον ξηρανθὲν, ἐντεριώνην δὲ ἔχον μαλακὴν, ὥστε δι' ὄλον καὶ κοιλαίνεσθαι τὰς ῥάβδους, — — —
- II 44. THEOPHRASTUS III. XII. 1: τὸ δὲ ξύλον τὸ μὲν τῆς κραναίας ἀκάρδιον καὶ στερεὸν ὄλον, ὅμοιον κέρατι τὴν πυκνότητα καὶ τὴν ἰσχύν, τὸ δὲ τῆς θηλυκραναίας ἐντεριώνην ἔχον καὶ μαλακώτερον καὶ κοιτανόμενον.
- II 45. THEOPHRASTUS III. XVII. 5: ἄσαπὲς δὲ ἐστὶ τὸ δένδρον καὶ καρδίαν ἔχει στερεὰν οὐκ ἐντεριώνην.
- II 46. THEOPHRASTUS I. II. 1: καὶ τὰ τούτων δὲ ἔτι πρότερα καὶ ἐξ ὧν ταῦτα, ὑγρὸν ἴς φλέψ σάραξ· ἀρχαί γὰρ αὐταί. πληρὸν εἴ τις λέγοι τὰς τῶν στοιχείων δυνάμεις, αὐταὶ δὲ κοινὰ πάντων. ἢ μὲν ὄν οὐσία καὶ ἡ ὅλη φύσις ἐν τούτοις.
- II 47. PLINY XVI. LXXII—LXXIII: Umor et corpori arborum est, qui sanguis earum intellegi debet, non idem omnibus: ficis lacteus — huic ad caseos figurandos coaguli vis — cerasis cumminosus, ulmis salivosus, lentus ac pinguis, malis, vitibus, piris aquosus. vivaciora quibus lentior. atque in totum corpori arborum ut reliquorum animalium cutis, sanguis, caro, nervi, venae, ossa, medullae. pro cute cortex; mirum, is in moro medicis succum quaerentibus vere hora diei secunda lapide incussus manat, altius fractus siccus videtur. proximi plerisque adipēs; hi vocantur a colore alburnum, mollis ac pessima pars ligni, etiam in robore facile putrescens, teredini obnoxia, quare semper amputabitur. subest huic caro, carni ossa, id est materiae optimum. alternant fructus quibus siccius lignum, ut olea, magis quam quibus carnosus, ut cerasus. nec omnibus adipēs carnesve largae, uti nec animalium acerrimis; neutrum habent buxus, cornus, olea, nec medullam minimumque etiam sanguinis, sicuti ossa non habent sorba, carnem sabuci — at plurimam ambae medullam — nec harundines maiore ex parte.
- In quarundam arborum carnibus pulpae venaeque sunt. discrimen earum facile, venae latiores candidioresque pulpa. fissilibus insunt; ideo fit ut aure ad caput trabis quamlibet praelongae admota ictus ab altero capite vel graphii sentiantur penetrante rectis meatibus sono, unde deprehenditur an torta sit materies nodisque concisa. quibus sunt tubera sicut sunt in carne glandia, in iis nec vena nec pulpa, quodam callo carnis in se convoluta; hoc pretiosissimum in citro et acere. cetera mensuram genera fissis arboribus circinantur in pulpam, alioqui fragilis esset vena in orbem

arboris caesa. fagis pectines traversi in pulpa; apud antiquos inde et vasis honos: M'. Curius iuravit se nihil ex praeda attigisse praeter guttum faginum quo sacrificaret.

Lignum in longitudinem fluitat, utque quaeque pars propior fuit ab radice, validius sidit. quibusdam pulpa sine venis mero stamine et tenui constat; haec maxime fissilia. alia frangi celeriora quam findi, quibus pulpa non est, ut oleae, vites. at e contrario totum e carne corpus fico, tota ossea est ilex, cornus, robur, cytusus, morus, hebenus, lotos et quae sine medulla esse diximus. ceteris nigricans color, fulva cornus in venabulis nitet incisuris nodata propter decorem. cedrus et larix et iuniperus rubent. larix femina habet quam Graeci vocant aegida mellei coloris; inventum pictorum tabellis immortale nullisque fissile rimis hoc lignum: proximum medullae est; in abiete lusson Graeci vocant. cedri quoque durissima quae medullae proxima, ut in corpore ossa, deraso modo limo. et sabuci interiora mire firma traduntur, quidamque venabula ex ea praeferunt omnibus, constat enim ex cute et ossibus.

- II 48. PLINY XVI. LXXVI. 195: commune et his et pino quoque ut quadripertitos venarum cursus bifidosve habeant vel omnino simplices. fabrorum in intestina opera medulla sectilis optima quadripertitis... materies et mollior quam ceterae, intellectus in cortice protinus peritis.
- III 1. THEOPHRASTUS III. IX. 4: Πεύκης μὲν οὖν ταῦτα γένη ποιούσιν, ἡμερόν τε καὶ ἄγριον, καὶ τῆς ἀργίας ἄρρενά τε καὶ θήλειαν καὶ τρίτην τὴν ἄκαρπον.
- III 2. THEOPHRASTUS III. III. 7: σχεδὸν δὲ ὅσα καλοῦσιν ἄρρενα τῶν ὁμογενῶν ἄκαρπα· καὶ τούτων τὰ μὲν πολλὰ ἀνθεῖν φασὶ τὰ δ' ὀλίγον τὰ δ' ὄλωσ' οὐδ' ἀνθεῖν· τὰ δὲ ἀνάπαλιν, τὰ μὲν ἄρρενα μόνον καρποφορεῖν, οὐ μὴν ἀλλ' ἀπὸ γε τῶν ἀνθῶν φύεσθαι τὰ δένδρα, καθάπερ καὶ ἀπὸ τῶν καρπῶν ὅσα κάρπιμα.
- III 3. HERODOTUS I. 193: τοὺς σκνέων τρόπον θεραπεύουσι τὰ τε ἄλλα καὶ φοινίκων τοὺς ἔρσενας Ἕλληνας καλέουσι, τούτων τὸν καρπὸν περιδέουσι τῆσι βαλανηφόροις τῶν φοινίκων, ἵνα πεπαίνῃ τε σφι ὁ ψῆν τὴν βάλανον ἐσθύνων καὶ μὴ ἀπορρέῃ ὁ καρπὸς τοῦ φοινίκου· ψῆνας γὰρ δὴ φέρουσι ἐν τῷ καρπῷ οἱ ἔρσενες, κατὰ περ δὴ οἱ ὀλονθοί.
- III 4. THEOPHRASTUS II. VIII. 4: γίνεται δὲ τόνδε τὸν τρόπον. ὅταν ἀνθῆ τὸ ἄρρεν, ἀποτέμνουσι τὴν σπάθην ἐφ' ἧς τὸ ἄνθος εὐθὺς ὡσπερ ἔχει, τὸν τε χροῦν καὶ τὸ ἄνθος καὶ τὸν κονιορτὸν κατασεύουσι κατὰ τοῦ καρποῦ τῆς θηλείας· κἂν τοῦτο πάθῃ, διατηρεῖ καὶ οὐκ ἀποβάλλει.
- III 5. THEOPHRASTUS III. V. 5: ἴδιον δ' ἐνίοις ὑπάρχει καὶ τὸ τῆς καλουμένης κάκρονος, οἷον τοῖς [τε] προειρημένοις· ἔχει γὰρ καὶ ἐλάτην καὶ πεύκην καὶ δρυῖν, καὶ ἔτι φίλυρα καὶ καρύνα καὶ διοσβάλανος καὶ πίτυς. αὗται δὲ γίνονται δρυὶ μὲν πρὸ τῆς βλαστῆσεως ὑποφαινούσης τῆς ἡρινῆς ὥρας. ἔστι δ' ὡσπερὶ κήσις φυλλικὴ μεταξὺ πίπτουσα τῆς ἐξ ἀρχῆς ἐποιδήσεως καὶ τῆς φυλλικῆς βλαστήσεως.
- III 6. THEOPHRASTUS III. V. 5 and 6: ἡ δὲ Ἑρακλεωτικὴ μετὰ τὴν ἀποβολὴν τοῦ καρποῦ φύει τὸ βοτρυνῶδες ἡλικὸν σκώληξ εὐμεγέθης, ἐξ ἐνὸς μίσχου πλείω δὴ, ἃ καλοῦσι τινες ἰούλους. τούτων ἕκαστον ἐκ μικρῶν σύγκειται μορίων φολιδωτῶν τῆ τάξει, καθάπερ οἱ στρόβιλοι τῆς πεύκης, ὥστε μὴ ἀνομοίαν εἶναι τὴν ὄψιν στρόβιλον νέφ καὶ χλωρῷ πλὴν προμηκέστερον καὶ σχεδὸν ἰσόπαχος διάλιν.
- III 7. PLINY XVI. LII. 120: ferunt et abellanae iulos compactili callo, ad nihil utiles;
- III 8. THEOPHRASTUS II. VIII. 1 and 2: ἐκ γὰρ τῶν ἐκεῖ κρεμαννυμένων ἐρινῶν ψῆνες ἐκδύομενοι κατεσθίουσι καὶ πιαίνουσι τὰς κορυφάς. — — —

Οἱ δὲ ψῆνες ἐκδύονται μὲν ἐκ τοῦ ἐρινεοῦ, καθάπερ εἴρηται· γίνονται δ' ἐκ τῶν κεγχραμίδων. σημεῖον δὲ λέγουσιν, ὅτι ἐπειδὴν ἐκδύωσιν οὐκ ἐνεῖσι κεγχραμίδες. ἐκδύονται δὲ οἱ πολλοὶ ἐγκαταλιπόντες ἢ πόδα ἢ πτερόν. γένος δὲ τι καὶ ἐτερόν ἐστὶ τῶν ψηνῶν, ὃ καλοῦσι κεντρῖνας. οὗτοι δ' ἀργοὶ καθάπερ κηφήνες. καὶ τοὺς εἰσδουμένους τῶν ἐτέρων κτείνουσιν αὐτοὶ δὲ ἐναποθνήσκουσιν.

- III 9. THEOPHRASTUS III. IX. 3: Σχεδὸν δὲ κοινή τις ἡ διαφορὰ πάντων τῶν ἄρρενων καὶ θηλειῶν, ὡς οἱ ὑλοτόμοι φασίν. ἅπαν γὰρ τὸ ἄρρεν τῆ πελεκήσει καὶ βραχύτερον καὶ ἐπεστραμμένον μᾶλλον καὶ δυσεργότερον καὶ τῷ χρώματι μελάντερον, τὸ δὲ θῆλυ εὐμηκέστερον.
- III 10. THEOPHRASTUS I. XIII. 5: Φασὶ δὲ τινες καὶ τῶν ὁμογενῶν τὰ μὲν ἀνθεῖν τὰ δ' οὐ, καθάπερ τῶν φοινίκων τὸν μὲν ἄρρενα ἀνθεῖν τὸν δὲ θῆλυ οὐκ ἀνθεῖν ἀλλ' εὐθὺ προφαίνειν τὸν καρπὸν.
- III 11. PLINY XIII. XI. 53: et maioris cedri duo genera: quae floret fructum non fert, fructifera non floret, et in ea antecedentem fructum occupat novus.
- III 12. PLINY XV. XXVIII. 98: mas sit an femina sterilis inter auctores non constat.
- III 13. PLINY XVII. XXXV. 155: hac de causa et in plantariis aliquando eodem anno ferunt quos fuere laturi fructus in arbore, — — —
- III 14. THEOPHRASTUS III. I. 2: Τούτων μὲν οὖν πρὸς τῆ σπερματικῇ καὶ τῆ ἀπὸ τῶν ῥιζῶν καὶ αὐτῆ γένεσις ἐστὶ· τῶν δὲ ἄλλων ἐκείναι· πλὴν ὅσα μόνον ἀπὸ σπέρματος φύεται, καθάπερ ἐλάτην πεύκην πίτυς. ὅσα δὲ ἔχει σπέρμα καὶ καρπὸν, κἂν ἀπὸ ῥίζης γίνηται, καὶ ἀπὸ τούτων· ἐπεὶ καὶ τὰ δοκοῦντα ἄκαρπα εἶναι γεννᾶν φασιν, οἷον πετελέαν ἰτέαν. σημεῖον δὲ λέγουσιν οὐ μόνον ὅτι φύεται πολλὰ τῶν ῥιζῶν ἀπηρητημένα καθ' οὗς ἂν ἡ τόπος, — — —
- III 15. THEOPHRASTUS III. I. 5: Ἄλλ' αὐτῆ μὲν ἀπηρητημένη πῶς ἐστὶ τῆς αἰσθήσεως.
- III 16. THEOPHRASTUS I. I. 9: Ἔστι δὲ ῥίζα μὲν δι' οὗ τὴν τροφήν ἐπάγεται, καυλὸς δὲ εἰς ὃ φέρεται.
- III 17. THEOPHRASTUS I. X. 3: Οἴονται δὲ τινες καὶ τὴν τροφήν τῷ ὑπὲρ διὰ τοῦ πρανοῦς εἶναι, διὰ τὸ ἐνικμον αἰεῖ τοῦτο καὶ χροῶδες εἶναι, οὐ καλῶς λέγοντες. ἀλλὰ τοῦτο μὲν ἴσως συμβαίνει χωρὶς τῆς ἰδίας φύσεως καὶ διὰ τὸ μὴ ὁμοίως ἠλιοῦσθαι, ἢ δὲ τροφήν διὰ τῶν φλεβῶν ἢ ἰνῶν ὁμοίως ἀμφοτέροις.
- III 18. THEOPHRASTUS III. V. 1: Συμβαίνει δ' ὅταν ἄρξωνται βλαστάνειν τὰ μὲν ἄλλα συνεχῆ τὴν τε βλάστησιν καὶ τὴν αὐξῆσιν ποιῆσθαι, πεύκην δὲ καὶ ἐλάτην καὶ δρυῖν διαλείπειν, καὶ τρεῖς ὁρμᾶς εἶναι καὶ τρεῖς ἀφίενα βλαστούς, δι' ὃ καὶ τρισλοποὶ.
- III 19. THEOPHRASTUS III. V. 1: πρῶτον μὲν ἄκρον ἕαρος εὐθὺς ἰσταμένου τοῦ Θαργηλιῶνος, — — — μετὰ δὲ ταῦτα διαλιπόντα περὶ τριάκοντα ἢ μικρῷ πλείους — — — γίνονται δὲ τοῦτο περὶ τὸν Σκιροφοριῶνα λήγοντα.
- III 20. THEOPHRASTUS III. V. 2: Διαλείποντα δὲ μετὰ τοῦτο περὶ πεντεκαίδεκα ἡμέρας πάλιν τὸ τρίτον ἐπιβάλλεται βλαστούς Ἑκατομβαιῶνος, ἐλαχίστας ἡμέρας τῶν πρότερον ἴσως γὰρ ἐξ ἢ ἐπτὰ τὸ πλείστον. — — — παρελθουσῶν δὲ τούτων οὐκέτι εἰς μῆκος ἀλλ' εἰς πάχος ἢ αὐξῆσιν τρέπεται.
- III 21. PLINY XVI. XLI. 100: et reliquae quidem arbores, ut primum coepere, continuant germinationem, robur et abies et larix intermittunt tripertito ac terna germina edunt;
- III 22. PLINY XVI. XLI. 100—101: est autem prima earum incipiente vere circiter XV diebus, iterum germinant transeunte geminis sole; — — — tertia est earundem a solstitio brevissima, nec diutius septenis diebus;
- III 23. THEOPHRASTUS III. V. 4: Ταῦτα μὲν οὖν ἴδια τῶν προειρημένων δένδρων. αἱ δὲ βλαστήσεις αἱ ἐπὶ Κυνί καὶ Ἀρκτοῦρι γινόμεναι μετὰ τὴν ἑαρινὴν σχεδὸν κοιναὶ πάντων· ἐνδηλοὶ δὲ μᾶλλον ἐν τοῖς ἡμέροις — — —
- III 24. PLINY XIV. XLI. 99: sunt aliae naturales quibusdam praeterque vernam, quae suis constant sideribus — hiberna aquilae exortu, aestiva canis ortu, tertia arcturi. — — — maxime tamen in Aegypto apparet haec ratio.
- III 25. THEOPHRASTUS III. IV. 2: καὶ πρὸ ζεφύρου μὲν κρανεῖα καὶ θηλυκρανεῖα, μετὰ ζεφύρου δὲ δάφνην κλήθρα, πρὸ ἰσμερίας δὲ μικρὸν φίλυρα ζυγία φηγὸς σκυῆ· πρωῖβλαστα δὲ καὶ καρύνα καὶ δρυῖν καὶ ἀκτέος· ἔτι δὲ μᾶλλον τὰ ἄκαρπα δοκοῦντα καὶ ἀλσώδη, λεύκη πετελέα ἰτέα αἰγίωρος· πλάτανος δὲ μικρῷ ὀφιαίτερον τούτων. τὰ δὲ ἄλλα ὡσπερ ἐνισταμένου τοῦ ἥρος, οἷον ἐρινεὸς φιλικὴ ὀξυάκανθος παλιουρος τέρμινθος καρύνα διοσβάλανος.

- μηλέα δ' ὀψίβλαστος· ὀψίβλαστότατον δὲ σχεδὸν ἕψος ἀρία τετραγωνία θύεια μίλος. αἱ μὲν οὖν βλαστήσεις οὕτως ἔχουσιν.
- III 26. PLINY XVI. XLI. 97—98: primo favonio cornus, proxime laurus pauloque ante aequinoctium tilia, acer, inter primas vero populus, ulmus, salix, alnus, nuces; festinat et platanus. ceterae vere coepturo, aquifolium, terebinthus, paliurus, castanea, glandes, serotino autem germine malus, tardissimo suber.
- III 27. THEOPHRASTUS III. IV. 1: αὐτὰ δ' αὐτῶν τὰ ὁμογενῆ τῶ πρότερον καὶ ὕστερον διαφέρει κατὰ τοὺς τόπους· πρῶτα μὲν γὰρ βλαστάνει τὰ ἐν τοῖς ἔλεσιν, ὡς οἱ περὶ Μακεδονίαν λέγουσι, δεύτερα δὲ τὰ ἐν τοῖς πεδίοις, ἔσχατα δὲ τὰ ἐν τοῖς ὄρεσιν.
- III 28. PLINY XVI. XLI. 97: magna et locorum differentia, quippe cum ex eodem genere quae sunt in palustribus priora germinent, mox campestria, novissima in silvis;
- III 29. THEOPHRASTUS III. VI. 1: Ἔστι δὲ καὶ τὰ μὲν εὐανξῆ τὰ δὲ δυσανξῆ. εὐανξῆ μὲν τὰ τε πάρουδρα, οἶον πελέα πλατάνος λεύκη αἰγυριος ἰτέα· καὶ τοὶ περὶ ταύτης ἀμφισβητοῦσιν ὡς δυσανξοῦς· καὶ τῶν καρποφόρων δὲ ἐλάτη πεύκη δοῦς. εὐανξέστατον δὲ. μίλος καὶ λακάρια φηγὸς ἄρκενθος σφένδαμνος ὄστραγα ζυγία μελία κλήθρα πίτυς ἀνδράχλη κρανεία πύξος ἀχράς.
- III 30. THEOPHRASTUS IV. XIII. 1: Περὶ δὲ βραχυβιότητος φυτῶν καὶ δένδρων τῶν ἐν ὄρεσιν ἐπὶ τοσοῦτον ἔχουσι ὡς ἂν καθ' ὅλον λέγοντες, ὅτι βραχυβιώτερα τῶν χειρσαίων ἐστὶ, καθάπερ καὶ τὰ ζῶα.
- III 31. THEOPHRASTUS IV. XIII. 1: τὰ δὲ ἡμερᾶ φανερώς διαφέρει τῶ τὰ μὲν εἶναι μακροβία τὰ δὲ βραχύβια· ὡς δ' ἀπλῶς εἰπεῖν τὰ ἄγρια τῶν ἡμέρων μακροβιώτερα καὶ ὅλως τῶ γένει καὶ τὰ ἀντιδιηρημένα καθ' ἕκαστον, οἶον κότινος ἐλάας καὶ ἀχράς ἀπλῶν ἐρινοῦς σκῆς.
- III 32. GELLIIUS XVI. XV. 1: Theophrastus, philosophorum peritissimus, omnes in Paphagonia — — —
- III 33. THEOPHRASTUS IV. XIII. 3: Ἔνια δὲ γηράσκει μὲν καὶ σήπεται ταχέως, παραβλαστάνει δὲ πάλιν ἐκ τῶν αὐτῶν, ὡσπερ αἱ δάφναι καὶ αἱ μηλέαι τε καὶ αἱ ῥόαι καὶ τῶν φιλόδρων τὰ πολλά· περὶ ὧν καὶ σκέπαιτ' ἂν τις πότερα ταυτὰ δεῖ λέγειν ἢ ἕτερα.
- III 34. THEOPHRASTUS IV. XIII. 5: δοκεῖ δὲ ὁ βίος τῆς γε μᾶς εἶναι, καθ' ὃν τὸ στέλεχος δεῖ τὴν ἀρχὴν τιθέντα μέτρον ἀναμετρεῖν τὸν χρόνον, μάλιστα περὶ ἔτη διακόσια.
- III 35. PLINY XVII. XX. 95: Quaedam autem natura tarde crescunt, et in primis semine tantum nascentia et longo aevo durantia. at quae cito occidunt velocia sunt, ut ficus, punica, prunus, malus, pirus, myrtus, salix — — —
- III 36. PLINY XVI. XC. 241: videntur et aquaticae celerius interire.
- III 37. PLINY XVI. LI. 119: contra morus tardissime senescit, fructu minime laborans; tarde et ea quorum crispa materies, ut palma, acer, populus.
- III 38. PLINY XVI. LXXXVII. 237: Vetustior autem urbe in Vaticano ilex in qua titulus aereus litteris Etruscis religione arborem iam tum dignam fuisse significat.
- III 39. THEOPHRASTUS III. VII. 1: πεύκη δὲ καὶ ἐλάτη τελῶς ἐκ ῥιζῶν αὐτοατεῖς ἀδαινούνται καὶ ἐὰν τὸ ἄκρον ἐπικοπή.
- III 40. THEOPHRASTUS III. VII. 1: Ἀποκοπέντος δὲ τοῦ στελέχους τὰ μὲν ἄλλα πάνθ' ὡς εἰπεῖν παραβλαστάνει, πλὴν ἐὰν αἱ ῥίζαι πρότερον τύχῳσι πεπονηκῶσαι.
- III 41. THEOPHRASTUS III. VII. 2: συμβαίνει δὲ κακείνο ἴδιον ἐν ταῦτῳ περὶ τὴν ἐλάτην· ὅταν μὲν γὰρ τις τοὺς ὄρους ἀπαντας ἀφελὼν ἀποκόψη τὸ ἄκρον, ἀποθνήσκει ταχέως· ὅταν δὲ τὰ κατωτέρω τὰ κατὰ τὸ λεῖον ἀφέλη, ζῆ τὸ κατάλοιπον, — — —
- III 42. THEOPHRASTUS III. VII. 1—2: συμβαίνει δὲ ἴδιον τι περὶ τὴν ἐλάτην· ὅταν γὰρ κοπή ἢ κολουσή ὑπὸ πνεύματος ἢ καὶ ἄλλον τινὸς περὶ τὸ λεῖον τοῦ στελέχους — ἔχει γὰρ μέγχι τινὸς λεῖον καὶ ἄορον καὶ ὀμαλὸν ἱκανὸν ἴστω πλοῖον — περιφύεται μικρόν, ὑποδεέστερον εἰς ὕψος, καὶ καλοῦσιν οἱ μὲν ἀμφανξιν οἱ δὲ ἀμφίφραν, τῶ μὲν χρώματι μέλαν τῆ δὲ σκληρότητι ὑπερβάλλον, ἐξ οὗ τοὺς κρατήρας ποιοῦσιν οἱ περὶ Ἀρκαδίαν· τὸ δὲ πάχος οἶον ἂν τύχη τὸ δένδρον, ὅσῳ περ ἂν ἰσχυρότερον καὶ ἐγγυλότερον ἢ παχύτερον.

- III 43. THEOPHRASTUS III. VII. 2: ζῆ δὲ δῆλον ὅτι τῶ ἐγγυλον εἶναι καὶ χλωρόν, εἴπερ ἀπαράβλαστον.
- III 44. PLINY XVI. LIII. 122—123: et abieti quidem subrecta divisura ramique in caelum tendentes, non in latera proni. mirum, cacuminibus eorum decisis moritur, totis vero detruncatis durat; et si infra quam rami fuere praecidatur, quod superest vivit, si vero cacumen tantum auferatur, tota moritur.
- IV 1. CATO I. I. 7: Praedium quod primum siet, si me rogabis, sic dicam: de omnibus agris optimoque loco iugera agri centum, vinea est prima, si vino bono et multo est, secundo loco hortus inriguus, tertio salictum, quarto oletum, quinto pratium, sexto campus frumentarius, septimo silva caedua, octavo arbustum, nono glandaria silva.
- IV 2. VARRO I. VII. 10: Scrofa, Scio, inquit, scribere illum; sed de hoc non consentiunt omnes, quod alii dant primatum bonis pratis, ut ego, a quo antiqui prata parata appellarunt.
- IV 3. VARRO I. IX. 1—2: Ea tribus modis dicitur, communi et proprio et mixto. Communi, ut cum dicimus orbem terrae et terram Italiam aut quam aliam. In ea enim et lapis et harena et cetera eius generis sunt in nominando comprehensa. Altero modo dicitur terra proprio nomine, quae nullo alio vocabulo neque cognomine adiecto appellatur. Tertio modo dicitur terra, quae est mixta, in qua seri potest quid et nasci, ut argillosa aut lapidosa, sic aliae, — — —
- IV 4. VARRO I. IX. 3—4: Horum varietatis ita genera haec, ut praeterea subtiliora sint alia, minimum in singula facie varia, quod alia terra est valde lapidosa, alia mediocriter, alia prope pura. Sic de aliis generibus reliquis admixtae terrae tres gradus ascendunt eosdem. Praeterea hae ipsae ternae species ternas in se habent alias, quod partim sunt umidiores, partim aridiores, partim mediocres.
- IV 5. VIRGIL, GEORGICS II. 226—237: Nunc quo quamque modo possis cognoscere dicam. rara sit an supra morem si densa requires, altera frumentis quoniam favet, altera Baccho, densa magis Cereri, rarissima quaeque Lyaeo, ante locum capies oculis alteque iubebis in solido puteum demitti, omnemque repones rursus humum et pedibus summas aequabis harenas. si desunt rarum pecorique et vitibus almis aptius uber erit; sin in sua posse negabunt ire loca et scrobibus superabit terra repletis, spissus ager: glaebas cunctantis crassaque terga expecta et validis terram proscinde iuvenis.
- IV 6. PLINY XVII. IV. 43: Duo genera fuerant, plura nuper exerceri coepit proficientibus ingeniis: est enim alba, rufa, columbina, argillacea, tofacea, harenacea. natura duplex, aspera aut pinquis: experimenta utriusque in manu.
- IV 7. PLINY XVII. III. 39: talis fere est in novalibus caesa vetere silva, quae consensu laudatur.
- IV 8. PLINY XVII. III. 25—26: invicem sabulum album in Ticiniensi multisque in locis nigrum itemque rubrum, etiam pinqui terrae permixtum, infecundum est. argumenta quoque iudicantium saepe fallunt. non utique laetum solum est in quo procerae arbores nitent praeterquam illis arboribus; quid enim abiete procerius? at quae vixisse possit alia in loco eodem? nec luxuriosa pabula pinguis soli semper indicium habent: nam quid laudatius Germaniae pabulis? at statim subest harena tenuissimo caespi um corio.
- IV 9. THEOPHRASTUS I. IX. 2: ἅπαντα δὲ ταῦτα καὶ ὅλως ἢ ἕλη ἢ ἀργία καλλίων, καὶ πλείων τοῦ ὄρους ἐν τοῖς προσβορείοις ἢ ἐν τοῖς πρὸς μεσημβρίαν.
- IV 10. THEOPHRASTUS IV. I. 2: Ἐν Ἀρκαδίᾳ γοῦν περὶ τὴν Κράνην καλουμένην τόπος ἐστὶ τις κοῖλος καὶ ἄπνους, εἰς ὃν οὐδέποθ' ὅλως ἤλιον ἐμβάλλειν φασίν· ἐν τούτῳ δὲ πολὺ διαφέρουσιν αἱ ἐλάται καὶ τῶ μῆκει καὶ τῶ πάχει, οὐ μὴν ὁμοίως γε πυκναὶ οὐδ' ὠραῖαι ἀλλ' ἠκίστα, καθάπερ καὶ αἱ πεῦκαι αἱ ἐν τοῖς παλισκοῖσι.
- IV 11. COLUMELLA V. VIII. 5: Hanc arborem plerique existimant ultra milliarium centesimum a mari aut non vivere aut non esse feracem. Sed in quibusdam locis recte valet.

- IV 12. VITRUVIUS I. 1. 10: Disciplinam vero medicinae novisse oportet propter inclinationem caeli, quae Graeci climata dicunt et aeris et locorum, qui sunt salubres aut pestilentes, aquarumque usus;
- IV 13. TACITUS, VITA IUL. AGRIC. 12. 3: caelum crebris imbribus ac nebulis foedum; asperitas frigorum abest.
- IV 14. PLINY XVII. III. 30: quid quod mutantur saepe iudicata quoque et diu conperta? in Thessalia circa Larisam emisso lacu frigidior facta ea regio est, oleaeque desierunt quae prius fuerant, item vites aduri, quod non antea, coeperunt, contra calorem augeri Aenos sensit admoto Hebro, et circa Philippos cultura siccata regio mutavit caeli habitum.
- IV 15. PLINY XVII. II. 16: in maiore parte orbis, cum praecoces excurrere germinationes evocatae indulgentia caeli, secutis frigoribus exuruntur. qua de causa serotinae hiemes noxiae, silvestribus quoque, quae magis etiam dolent urgente umbra sua nec adiuvante medicina, quando vestire teneras intorto stramento in silvestribus non est.
- IV 16. PLINY XVII. II. 13: quare tepidam esse hiemem, ut absumpto partu arborum sequatur protinus conceptus, id est germinatio, ac deinde alia florescendi exinanitio, inutilissimum experimentis creditur. quin immo si plures ita continentur anni, etiam ipsae moriantur arbores, quando nemini dubia poena est in fame laborantium; ergo qui dixit hiemes serenas optandas non pro arboribus vota fecit.
- IV 17. TACITUS, VITA IUL. AGR. 12. 5: tarde mitescunt, cito proveniunt; eademque utriusque rei causa, multus umor terrarum caelique.
- IV 18. PLINY XVII. II. 14—15: alioqui vota arborum frugumque communia sunt nives diutinas sedere. causa non solum quia animam terrae evanescentem exhalatione includunt et conprimunt retroque agunt in vires frugum atque radices, verum quod et liquorem sensim praebent, purum praeterea levissimumque, quando aquarum caelestium spuma pruina est. ergo umor ex his non universus ingurgitans diluensque, sed quomodo sititur destillans velut ex ubere, alit omnia quia non inundat.
- IV 19. THEOPHRASTUS IV. I. 5: *ὁζωδέστερα γὰρ καὶ βραχύτερα καὶ ἤττον εὐθέα τὰ ἐν τοῖς ἐδείλοις ἢ τοῖς προσηνέμοις.*
- V 20. THEOPHRASTUS IV. XIV. 11: *ὁῖον ἐν Χαλκίδι τῆς Εὐβοίας Ὀλυμπίας ὅταν πνεύση μικρὸν πρὸ τροπῶν ἢ μετὰ τροπὰς χειμερινὰς ψυχρὸς· ἀποκάει γὰρ τὰ δένδρα καὶ οὕτως αὐὰ ποιεῖ καὶ ξηρὰ ὡς οὐδ' ἂν ὑφ' ἡλίου καὶ χρόνον πολλοῦ γένοιτ' ἂν, δι' ὃ καὶ καλοῦσι κωνθμόν.*
- IV 21. PLINY XVII. II. 10—12: Aquilone maxime gaudent, densiores ab adflatu eius laetioresque et materiae firmiores. qua in re plerique falluntur, cum in vineis pedamenta non sint a vento eo opponenda et id tantum a septentrione servandum. quin immo tempestiva frigora plurimum arborum firmitati conferunt et sic optime germinant, alioqui, si blandiantur austri, defetiscentes, ac magis etiam in flore. nam si cum defloruere protinus sequantur imbres, in totum poma depereunt, adeo ut amygdalae et piri, etiam si omnino nubilum fuit austrinusve flatus, amittant fetus. circa vergilias quidem pluere inimicissimum viti et oleae, quoniam tum coitus est earum; hoc est illud quadriduum oleis decretorium, hic articulus austrinus nubili spurci quod diximus. fruges quoque peius maturescunt austrinis diebus, sed celerius. illa sunt noxia frigora quae septentrionibus aut praeposteris fiunt horis; hiemem quidem aquiloniam esse omnibus satis utilissimum.