

Plant Systematics and Economic Botany: Background Packet

for Msc Archaeobotany options

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Major categories of plant food use and/ or crop types

Grain crops (cereals and pseudo-cereals)

Pulses (beans and bean-like crops, consumed as dried seeds, many can also be grown for green pods)

Root foods/ tubers

Oilseeds (for edible oils, although many plant produce oils with other functions)

Tree fruits

Nuts

other Herbaceous seed/ fruit crops

Squashes, cucumbers, melon (Cucurbitaceae)

Leafy vegetables

Spices/ condiments

Not eaten:

Fibre crops.

The pages at the end of this packet include basic illustrations of flowering plant structure, including flower, stem, root, and a classification of diaspore types (diaspore= the main shed unit of reproduction, including seeds, fruits and false fruits).

The following a listing of major families (grouped into orders and other important macro-taxonomic groups) and *selected* economic species that fall into various of the above categories. This is accompanied by selected illustration, particular attention is given to the Rosaceae, Fabaceae, and cereals (Graminae).

A Note on Macrosystematics

The basic macro-systematic arrangement of families within orders and orders within subclasses follows that of A. Cronquist (1988). *The Evolution and Classification of Flowering Plants*, second edition. New York Botanic Garden, which is a well-respected standard. This differs only in minor ways from the system followed by Heywood's *Flowering Plants of the World*. It should be noted, however, that macrosystematics (the hierarchical arrangement of families within larger evolutionary groups) is prone to revision, and in the past decade has seen suggestions for fairly major realignments. Although this is beyond the scope of archaeobotany, one should be aware that many macrosystematic groupings are not set in stone. Luckily for us, however, very few families have been prone to significant revision in terms of what is in them and what their essential characteristics are. Important evidence has come from the fossil record (see, e.g. D. W. Taylor and L. J. Hickey (eds. 1996) *Flowering Plant Origin, Evolution, and Phylogeny*. Plenum Press). In addition, DNA sequences have been used in recent years to suggest some fairly significant changes in our picture of flowering plant evolution. These have been incorporated into a recent textbook: W. S. Judd, C. S. Campbell, E. A. Kellogg and P. F. Stevens (1999) *Plant Systematics. A Phylogenetic Approach*. An even more recent and extensive reanalysis is: Soltis et al. (2000) Angiosperm phylogeny inferred from 18S rDNA, *rbcL*, and *atpB* sequences, *Botanical Journal of the Linnean Society* 133: 381-461. These latter two sources have been used as the basis for the simplified phylogeny ("roadmap") handouts. Thus the hierarchy in these handouts differs from the Cronquist system employed below, although the families remain stable. There have been further revisions proposed for many orders and families based on genetic datasets in recent years, which means that systematic arrangements at the higher levels have become somewhat unstable. Updated reasoning and relationships, together with some descriptive data can be found on the following website at Missouri Botanical Garden:

<http://www.mobot.org/MOBOT/Research/APweb/welcome.html>

standard family descriptions and some old anatomical illustrations can be found here:

<http://www.csdll.tamu.edu/FLORA/newgate/cronang.htm>

selected plant taxonomy, with emphasis on (a selection of) economic plants

Plant Kingdom

non-vascular plants: 3 divisions: **Hepatophytes** (liverworts 600 spp.), **Anthocerophytes** (hornworts 100 spp.), and **Bryophytes** (mosses 9000 spp.). These groups are traditionally united under the term 'cryptogams' together with lichens.

vascular plants (Trachaeophytes):

Trachaeophyta (plant with vascular system)

Division Pteridophytes (ferns, etc. reproduce by spores, not seeds)

includes ferns and fern-allies, as well as seed plants. Living ferns and fern-like plants are now divided into 4 divisions: Psilophyta (2 genera), Lycophyta ('club mosses' 1000 spp.), Sphenophyta ('horsetails' 15 spp.), Pterophyta ('ferns' about 11,000 spp.).

seed plants (Spermatophytes)

Super-Division Gymnospermae ('naked seed' plant)

Division Coniferophyta (Conifers and allies)

includes conifers. Very important in many world environments: high mountains, high latitudes; and very important as timber (pine, redwood, cedar, etc.) Little of food interest, but the seeds of several pine species are edible (Pine nuts). About 50 genera with 550 spp.

Division Cycadophyta (cycads) about 100 living species

Division Ginkophyta (ginkos)

The extract of Ginko leaves is used herbally, medicinally. One living species.

Division Gnetophyta (*Gnetum*, *Ephedra*, *Welwitschia*)

The sister-group to flowering plants, Not of major economic interest. *Ephedra* spp. produce stimulant ('Mormon Tea'). About 70 species.

Angiospermae ('jacketed seed' plants, i.e. with fruits)

Division Anthophyta (flowering plants)

divided into two major, well-recognised classes: Monocotyledons and Dicotyledons, each of which can be divided into a few major subclasses.

Dicots (=Magnoliopsida) (170,000 spp.):

subclass Magnoliidae. 8 orders: Magnoliales, Laurales, Piperales, Aristolochiales, Illiciales, Nymphaeales (water lilies), Ranunculales (includes buttercups), Papaverales.

Magnoliales, 10 families, including

Annonaceae

some edible fruits: *Annona* spp. (South America), soursop and soursop

Artanotrys spp. (Palaeotropics)

Myristicaceae

Myristica fragrans, nutmeg and mace (Molluccas)

Laurales, 8 families, including

Lauraceae

Persea americana, Avocado

Cannamomum zeylanicum, cinnamon

Laurus nobilis, Bay laurel, bay leaves

Piperales, 3 families, including

Piperaceae

Piper nigrum Black Pepper (South/Southeast Asia)

Piper methysticum, kava (traditional drink, Melanesia, Polynesia)

Piper betle, Betel leaf (stimulant, SE Asia)

Illiciales

Illiciaceae

Illicium verum Chinese Star Anise (China)



Papaverales

Papaveraceae

Papaver somniferum, opium poppy, poppy seeds

subclass **Hamamelidae**, 11 orders and 25 families, including

[actually falling in higher Hamemelids which are now separated by most experts, and may belong with Rosids]

Urticales, 7 families, including

Ulmceae

Celtis australis, hackberry

Moraceae

Ficus spp., figs

Morus, mulberries, some edible

Artocarpus altilis, breadfruit

(SE Asia, pacific)

Artocarpus hetrophyllus, jackfruit (South

Asia)

Brosimum alicastrum, breadnut (Tropical

America)

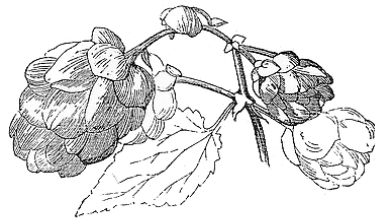
Cannabaceae

Cannabis sativa, hemp, marihuana

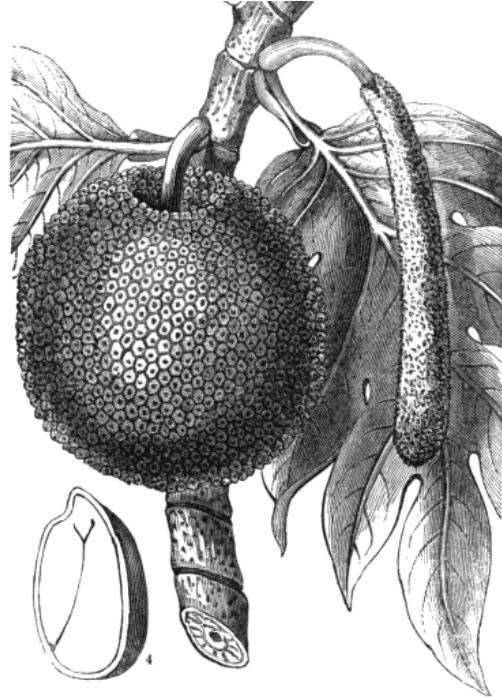
Humulus lupulus, hops



Hemp. (*Cannabis sativa*)
♂ plant.



Hop.



Fagales, 4 families, including

Betulaceae (Birch family)

Corylus spp., hazel nuts and filberts

Fagaceae (beech family)

Quercus spp., oaks/ acorns

Castanea sativa, sweet chestnut

Fagus spp., beeches/ beech-nuts

Juglandales

Oak. Juglandaceae

Fruit *Juglans*, walnuts

Carya, hickory nuts, including *C. illinoensis*, pecan (N. America)



subclass **Caryophyllidae**, 3 orders and 14 families, including

Caryophyllales, 12 families, including

Amaranthaceae

Amaranthus hypochondriacus

Amaranth

(Mesoamerica)

A. cruentus

“

(Mesoamerica)

A. caudatus

“

(Andes)

A. blitoides, Malabar spinach (Mediterranean, W. Africa, Asia)

Chenopodiaceae

Chenopodium nuttalliae

Huauzontle

(Mesoamerica)

C. quinoa Quinoa

(Andes)

C. pallidicaule

Canawa

(Andes)

C. berlanderii (Eastern North America)
C. album (in Eurasia, often used as a famine food or occasional seed crop)
Beta vulgaris, beet root (Europe)

Polyanales, 1 family

Polygonaceae

Fagopyrum esculentum, buckwheat (Yunnan, mountains)
F. tataricum, tartary buckwheat (Yunnan or Central Asian mountains)
Rheum raphonticum, rhubarb
Coccoloba uvifera, West Indian seaside grape

subclass **Dilleniidae**, 13 orders and 75 families, including

Theales

Clusiaceae (Guttiferae)

Garcinia mangostana, mangosteen, SE Asia

Violales

Passifloraceae

Passiflora edulis, passion fruit (Neotropics)
P. quadrangularis, gant granadilla

Cucurbitaceae

Cucurbita spp., pumpkins, squashes, marrows, courgettes (New World origins)

Cucumis melo, melons like cantaloupe, Southwest Asia
Cucumis sativus, cucumber, North India
Cucumis anguria, West Indian gherkin
Citrullus lanatus, watermelon, Southwest Asia or North Africa
Lagenaria siceraria, bottle gourd (South America)
Luffa cylindrica, loofah, young fruits ed.
Trichosanthes cucumerina var. *anguina*, snake gourd (S. & SE Asia)
Acanthosicyos spp., naras, South Africa including Kalahari
Momordica charantia, bitter melon, balsam apple, balsm pear (India, Southwesrt China)



Capparales

Brassicaceae mustard family, Crucifers

Brassica oleracea, kale, broccoli, cauliflower, collards, cabbage, brussels sprouts, kohlrabi
B. hirta, white or yellow mustard
B. carinata, Texsel greens, NE Africa
B. juncea, Indian mustard
B. napus, rape, colza, swede, rutabaga
B. rapa, oilseed (India), Chinese cabbage, turnip
Raphanus sativus, radish

Malvales

Malvaceae

Gossypium arboreum, tree cotton, Chinese cotton (South Asia)
G. herbaceum, Levant cotton (sub-Saharan Africa)
G. hirsutum, upland cotton (Mesoamerica)
G. barbadense, Sea-isalnd cotton (coastal Peru)
Abelmoschus esculentus, okra (hybrid origin, India)
Abelmoschus tuberculatus, wild okra (India)
Abelmoschus ficulneus, wild okra (India)
Abelmoschus moschatus, Musk mallow (Eastern India, Burma)
Hibiscus cannabinus, kenaf, Bimli Jute, fibre crop (India)
H. sabdariffa, roselle, rama, fibre crop (South East Asia)

Abutilon theophrasti, Indian mallow, china Jute, fibre crop (China)

Lechythidales

Lechythidaceae

Bertholletia excelsa, Brazil nut (South America)

Subclass Rosidae, 18 orders and 116 families, including

Euphorbiales (3 families)

Euphorbiaceae (ca. 5,000 species)

Hevea brasiliensis rubber (South American origin)
Manihot esculenta cassava, manioc, tapioca (South American origin)
Ricinus communis castor oil (African origin)
Aleurites spp. Candlenuts, food and candlenut oil (SE Asia, Pacific)
Ricinodendron rautanenii mongongo nut, Dobe !Kung staple (S. Africa)

Pandaceae

Panda oleosa oily seeds used for cooking (West Africa)

Rosales, 24 families, including

Grossularuaceae

Ribes spp., gooseberries and currants

Rosaceae

Subfamily Rosoideae

tribe Potentilleae

Fragaria spp., strawberries (Europe, North America)
Rubus spp. blackberries, raspberries (Europe, North America)

tribe Roseae

Rosa spp., roses, incl. rosehips

Subfamily Prunoideae

Prunus spp., several fruits: *P. domestica* (plum), *P. avium* (sweet cherry), *P. cerasus* (morello cherry), *P. armeniaca* (apricot), *P. persica* (peach, nectarine)
Amygdalus communis, almonds

Subfamily Maloideae

Malus spp., apples and crab-apples
Pyrus communis, pear
Cydonia vulgaris, quince
Eriobotrya, loquats
Mespilus, medlars

Fabales, formerly one family Leguminosae, now three related families, including

Fabaceae, 32 tribes, including

Indigofereae

Cyamopsis tetragonoloba, cluster bean, gaur (Africa)
Indigo tinctoria, indigo dye (South Asia)

Phaseolae

Cajanus cajan, pigeon pea (South Asia)
Canavalia, sword bean (Neotropics)
Glycine max, soy bean (East Asia)
Lablab purpureus, hyacinth bean (African origin?)
Macrotyloma uniflorum, horsegram (India)
Mucuna pruriens var. *utilis*, velvet bean (Africa)
Phaseolus, New World beans, including *P. vulgaris* (common bean, kidney bean, French bean), *P. lunatus* (lima bean, butter bean), *P. coccineus* (runner bean), *P. polyanthus* (the year bean), *P. acutifolius* (teparty bean)
Vigna, Old World Tropical pulses, *V. radiata* (mungbean, India), *V. mungo* (urid, India), *V. aconitifolia* (moth, India), *V. umbellata* (Rice bean, SE Asia), *V. angularis* (Adzuki bean, Japan), *V. unguiculata* (cowpea, black-eyed pea, West Africa)

Aeschynomeneae

Arachis hypogaea, ground nut, peanut (South America)

Cicereae

Cicer arietinum, chickpea, garbanzo bean, Bengal gram (SW Asia)

Viceae

Lathyrus sativus, grasspea (SW Asia)
Lens culinaris, lentils (SW Asia)
Pisum sativum, peas (SW Asia)
Vicia faba, broad bean (SW Asia)
Vicia sativa, common vetch (SW Asia)

Myrtales

Myrtaceae

Psidium guajava, guava (Neotropics)
Eucalyptus spp. (Australia)
Syzygium aromaticum, clove (Moluccas)
Syzygium cumini, jamobolan, Java plum (India, SE Asia)
Pimento diocia, allspice, pimento
Myrciaria caulifloa, jaboticaba (fruit), (Brazil)

Punicaceae: *Punica granatum*, pomegranate

Trapaceae: *Trapa natans*, water chestnut (Europe, N. Africa);

Trapa bicornis, ling nut, Asian water chestnut (East Asia)

Rhamnales

Vitaceae

Vitis vinifera, grape vine (SW Asia)

Rhamnaceae

Ziziphus mauritania, jujube (S. Asia)
Z. spina-christi, christ's thorn (Near East)
numerous medicinal plants in other genera

Sapindales

Meliaceae

Lansium domesticum, langsat (SE Asia)
Sandoricum koetjaope, santol (SE Asia)

Rutaceae

Citrus spp., citrus fruits (mostly from SE Asia)
Fortunella, kumquats
numerous aromatic and medicinal oils

Sapindaceae

Blighia sapida, akee or akye (West Africa)
Litchi chinensis, lychee (S. China)
Nephelium lappaceum, rambutan (SE Asia)
Melicocca bijuga, mamoncillo (Neotropics)
Paullina cupana, gaurana (Brazil)

Hippocastaneaceae

Aesculus spp., horse chestnut (not edible), fish poisons

Bruseraceae

Boswellia carteris, frankincense (Somalia)
Commiphora spp., Myrrh (Arabia, Ethiopia)

Anacardiceae

Anacardium occidentale, cashew
Pistacia vera, pistachio
Mangifera indica, mango
Semecarpus anacardium, Dhobi's nut
Spondias spp., hog plum, Otaheite apple, Jamica plum

Gerianales

Linaceae

Linum usitattisimum, flax, linseed (SW Asia)

Oxalidaceae

Oxalis spp., some with edible tubers, including *O. tuberosa*, oca (Peru)
Averrhoa carambola, carambola, star fruit

Apiales

Apiaceae (Umbelliferae)

Angelica spp.
Archangelica spp.
Apium graveolens, celery

Daucus carota, carrot (Europe)
Pastinaca sativa, parsnip (Europe)
Bunium bulbocastanum, earthnut (Europe)
Conopodium majus, pignut (European root food)
Lomatium ambiguum, cous root (W. North America, root food)
Anthriscus cerefolium, chervil
Foeniculum vulgare, fennel
Petroselinum crispum, parsley
Anethum graveolens, dill
Coriandrum sativum, coriander
Cuminum cyminum, cumin
Caum carvi, caraway
Pimpinella anisum, aniseed
Conium maculatum, hemlock

subclass Asteridae, 11 orders and 49 families, including
Polemoniales (also called Solanales)

Solanaceae

Solaneae

Lycopersicon esculentum, tomato
Capsicum annum, bell peppers and some chilli peppers
 other chilli peppers fall into *C. frutescens*, *C. baccatum* and *C. pubescens*
Solanum tuberosum, potato
Solanum melongena, aubergine, egg-plant
 numerous *Solanum* spp., nightshades (poisons)
Hyosycamus niger, henbane (poison)
Mandraga officinarum, mandrake (medicinal/ herbalist root)
Atropa belladonna, deadly nightshade (poison)

Datureae

Datura stramonium, thorn apple (hallucinogen)

Cestreae

Nicotiana tabacum, tobacco

Convulvaceae (Morning glory family)

Ipomea batates Sweet potato [=U.S. thanksgiving 'yam'] (South American Origin)

Asteraceae (Compositae), ca. 21,000 spp.

Helianthus annuus, sunflower (North America)
Helianthus tuberosus, jerusalem artichoke
Carthamus tinctorius, safflower (SW Asia)
Guizotia abyssinica, niger seed (Ethiopia)
Lactuca sativa, lettuce
Cichorium endiva, endive
Chicorium intybus, chicory
Cynara scolymus, globe artichoke
Schorzonera hispanica, salsify
Tragopogon porrifolius, salsify
Artemisia spp., wormwood
Arctium lappa, gobo (edible roots), (Japan)

Monocots (65,000 spp.) = **Liliopsida**:

subclass Alismatidae, 4 orders, 16 families

subclass Arecidae, 4 orders, 6 families, including

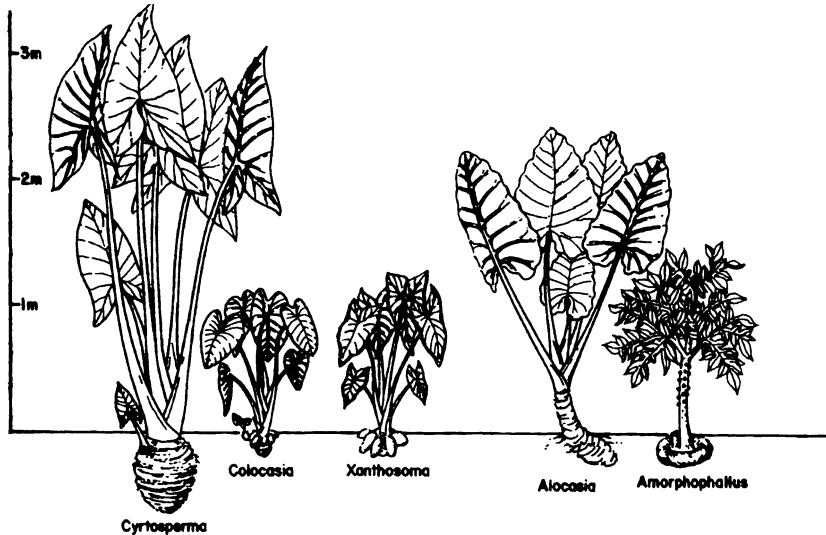
order Arecales, family Arecaceae (Palms). Numerous economics, including

Cocos nucifera, coconut
Elaeis guineensis, oil palm
Phoenix dactylifera, date
Borassus flabellifer, palmyra palm, jaggery, toddy

Caryota spp., jaggery, toddy
Metroxylon, sago (starch source, SE Asia, Pacific)
Areca catechu, Areca nut, betel nut (SE Asia)

order Arales

Araceae, several tuberous species, gathered wild and cultivated in tropics, including
Colocasia esculentum, taro (S. or SE. Asia)
Xanthosoma spp., tannier (S. America)
 also (mostly SE Asia, Indonesia and Pacific): *Alocasia* spp., *Amorphophallus*
campanulatus, and *Cyrtosperma chamissonis*



edible Araceae

subclass Commelinidae

order Poales or Cyperales

Cyperaceae-- sedges

Poaceae (or Graminae) – grasses, including all true cereals, about 9000 spp.

subfamily Bambusoideae, 13 tribes, including

Tribe Oryzeae

- Oryza sativa* (domestic Asian rice)
- O. glaberrima* (African rice)
- Zizania aquatica* (American Wild rice)

sub family Chloridoideae, 5 tribes, including

Eragrostideae, subtribe Eleusininae

- Eragrostis tef*, Tef (Ethiopia, Yemen)
- Eleusine coracana*, finger millet

subfamily Panicoideae, 7 tribes, including

Tribe Paniceae, subtribe Setariinae

- Bracharia ramosa*, browntop millet (South India)
- Brachiaria deflexa*, fonio (West Africa)
- Digitaria cruciata*, Raishan (Assam)
- Digitaria exilis*, fundi (West Africa)
- Echinochloa colona*, Sawa millet (India)
- Echinochloa crus-galli*, Barnyard millet (Japan)
- Panicum miliaceum*, Proso or common millet (Eurasia)
- Panicum sumatrense* (=P. miliare, in older literature)
samai, little millet (India)
- Paspalum scrobiculatum*, kodo millet (India)
- Pennisetum glaucum* (numerous synonyms), pearl millet (African origin, also important in South ASIA)
- Setaria italica*, foxtail millet (Eurasia)
- Setaria macrostycha*, ancient cereal of Mesoamerica
- Setaria pumila* (often *S. glauca*), yellow foxtail millet
- Setaria verticillata*, Bristley Foxtail (ancient South India)

tribe Andropogonae, 11 subtribes including Sorghinae
Sorghum bicolor, sorghum, great millet
subtribe Tripsacinae
Zea mays, maize
subtribe Coincinae
Coix lacryma-jobi, Job's tears (Southeast Asia)
subfamily Pooideae, 10 tribes, including
Aveneae
Avena sativa, common oat
Avena strigosa, black/ bristle oat
Triticeae
Hordeum vulgare, barley
Secale cereale, rye
Triticum spp., wheats
Triticum monococcum, einkorn (diploid)
Triticum turgidum sensu lato, tetraploids
Triticum aestivum sensu lato, hexaploids
other grass subfamilies: Centothecoideae and Arundinoideae

subclass Zingiberidae, 2 orders, 9 families

Bromeliales

Bromeliaceae

Ananas comosus, pineapple, Neotropics

Zingiberales

Zingiberaceae

Zingiber officinale, ginger (India/ SE Asia)

Curcuma longa, tumeric (India)

C. amada, mango ginger (India)

Elettaria cardamomum, cardamom (Indonesia)

Alpinia galanga, galanga root, SE Asia

Aframomum melegueta, melegueta pepper

Musaceae

Musa spp., bananas and plantains, *M. acuminata*
(sweet, SE Asia), *M. balbisiana* (Sri
Lanka, S. India), and hybrid *M. x paradisiaca*
(domesticated, including some sweet v
arieties)

Musa ensente, ensente (Ethiopia)

families Cannaceae and Marantaceae both include edible tubers (arrowroots)

subclass Liliidae, 2 orders, 19 families (including Lilies, aloes, and orchids), also

Liliales

Liliaceae (lily family)

Allium spp, garlic and onions

Diocoreaceae

Dioscorea spp. true yams, native and cultivated species in SE Asia, W. Africa and S.
America

