Types of roots:
A pictorial guide for lexicographers

by
David Mead

2019

Sulang Language Data and Working Papers:
Topics in Lexicography, no. 33

Sulawesi Language Alliance
http://sulang.org/

SulangLexTopics033-v1

LANGUAGES

Language of materials : English

DESCRIPTION/ABSTRACT

This paper is a pictorial guide, along with brief discussions, of different kinds of roots, including underground roots, underground stems, and aerial roots. Separate sections are devoted to the pneumatophores of mangroves and the aerial roots of strangler figs.

TABLE OF CONTENTS

VERSION HISTORY

Version 1 [01 May 2019] Drafted November 2014, revised April 2017, further revised and prepared for publication April 2019.

Types of roots: A pictorial guide for lexicographers

by
David Mead

Doubtless your vernacular language dictionary already has the word for 'root.' In fact it's one of the items elicited on even our most basic word lists. What more really needs to be said?

However once you start digging into the topic, roots can be quite interesting. Roots are used to anchor a plant, to absorb and transport water and nutrients, and to store food. Not only are there different kinds of underground roots, but a number of plants produce above-ground roots as well.

Here then is a listing—with pictures, brief discussions, and how they are named in English and Indonesian—of different kinds of roots. This guide covers underground roots, underground stems, runners, and aerial roots. The pneumatophores of mangroves and the aerial roots of strangler figs present special cases and are treated separately.

1 Below-ground roots

Root systems can be divided into two major types: fibrous root systems, and tap root systems. Fibrous root systems are associated with monocots (monocotyledons), a group of plants that includes grasses, rushes, lilies, irises, orchids, aroids, cattails, pandanuses, and palms. Conifers and most other flowering plants have a tap root system.

1.1 Fibrous roots

In plants with a fibrous root system, there is no single large tap root. Rather the roots grow as a mass of slender, branching roots (Indonesian *akar serabut*) that are roughly the same size and length.

Excavated root system of an eastern gamagrass plant. Photo by Keith Weller, Ag Research Magazine. Public Domain (USDA).

Fibrous roots of green onions. Public Domain (Pixabay)

The fibrous root system of a coconut palm exposed by beach erosion. © 2015 by David Mead. Released to the Public Domain (CC0).

Not all fibrous roots are slender. Some fibrous roots form tubers, or can be beset with nodules along their length.

1.2 Tap root and lateral roots

When a seed germinates, it sends out an embryonic root. The primary root that develops from it and becomes dominant is called the tap root (Indonesian *akar tunggang, akar susu, akar utama*). In general plants with a tap root system will be rooted deeper than those with a fibrous root system.

tap root of oak tree (acorn still attached), with lateral roots branching off

Some tap roots are modified for food storage (*akar penyimpan*). Carrots, radishes, and turnips are three well-known examples. The root of a carrot is said to have a conical shape (*berbentuk konus*)—wide at the top and tapering toward the bottom end. The root of a radish is said to have a fusiform shape (*berbentuk pena*)—wide in the middle and tapering toward both ends. The root of a turnip is said to have a napiform shape (*berbentuk gasing*)—broad at the top and suddenly tapering at the bottom.

As opposed to carrots, radishes and turnips, the typical taproot system of most woody plants and shrubs can be described simply as ‘branching’ (technically ramose, Indonesian *bercabang*). Lateral roots, also called secondary roots, form from the tap root, and these in turn are further branched resulting in successive orders of roots. In fact many trees don’t have a tap root past the seedling stage as lateral roots (*akar cabang, akar samping, akar sekunder*) take over in importance.

1.3 From anchor roots to feeder roots

Another way to think of roots is by their size. In this view the largest roots are anchor roots or structural roots (*akar jangkar*). Their primary function is to hold the tree, shrub or plant in place in the soil. Next down in size are transport roots, and finally small roots.

At the finest end of the scale are what are called feeder roots, root hairs, or absorbent hairs (*rambut akar*, *bulu akar*, *akar penyerap*). Root hairs are visible to the naked eye, but each root hair consists of a single elongated epidermal cell. While some anchor roots may grow several feet deep, most of a plant's feeder roots are located in the top twelve or so inches of soil, since this is where oxygen, water, and nutrients are readily available.

Root hairs growing near the root tip.

1.4 Root flare and buttress roots

The root flare, also called the trunk flare, root collar, root crown, or root neck (Indonesian *leher akar*), is the region at the base of a tree where it transitions from trunk to root system—where surface roots flare out from the base of the tree. The older a tree grows, the more prominent the root flare may become owing to the continued thickening of lateral roots.


Public Domain (Pixabay).

Usually the root flare is located within a few inches of the surface level of the soil. However, when a tree has buttress roots (*akar banir*, *akar papan*), these plate-like roots can sometimes extend multiple feet up the side of the trunk and multiple feet out. Trees with buttress roots are more typical of the shallow, nutrient-poor soils of tropical rainforests.


Public Domain (Pixabay).


Ribbon-like buttress roots of *Ficus macrophylla* (Moreton Bay fig), Adelaide, South Australia. © 2016 by John Jennings. CC BY 2.0 Generic.

Indigenous languages of Indonesia commonly have a distinct word for buttress roots, and you should further elicit the term for the space between buttress roots, in Indonesian *celah banir*. Uma *wimi* refers to the buttress roots, while *pelengka'* refers to the nook between two buttress roots (Michael Martens 2019:pers.comm.). In Mori Bawah buttress roots are

called *dali*, while the recess between roots is a *kara dali* (compare *mengkara* ‘sit with the thighs spread apart’).

1.5 Exposed roots

The term ‘surface root’ can be understood in two ways. First, a tree has surface roots (*akar di permukaan tanah*) at its base. These are its major lateral (anchor) roots that are visible above ground flaring out from the base of the tree. A tree often declines in health if these surface roots get covered over (e.g. through improper landscaping, or sediment deposits from flooding).

Second, ‘surface roots’ can be understood as underground roots that nonetheless grow close to the surface—perhaps even comprising the majority of a tree’s root system, since this is where water, oxygen and nutrients are most readily available. Erosion can cause these normally underground roots to become exposed.

Public Domain (Pixabay)

Public Domain (Pixabay)

Exposed tree roots can also be a sign that the soil is imporous or poorly drained—roots have to grow close to the surface in order to better receive water and oxygen.

1.6 Stump root ball

A stump root ball is the portion of a stump that includes its root collar and major anchor roots extending a foot or so (or more) outward, usually once it has been removed from the ground. In English it can also be referred to as a stump with root buttresses; the Indonesian name is *akar gembol* or *akar bonggol*.

Public Domain (Pixabay)

In Indonesia this part of the tree is popular for making pieces of artistically shaped furniture known as a *meja akar gembol*, or what in English are sometimes called root ball tree tables, root tables, or simply stump tables.

meja akar gembol a.k.a. root ball tree table, root table, stump table

The root plate (Indonesian unknown) on the other hand is the part of a tree's root system that comprises its major roots. Usually we don't think about the root plate—or that it has a plate-like structure—until we see it exposed on an upturned tree.

Uprooted trees exposing the root plate, Prince Rupert Rainforest, British Columbia, Canada. Image courtesy of http://www.inkmedia.eu/.

2 Modified stems

Not only do roots grow underground, but sometimes stems do too. Four types of underground stems—classified according to their structure—are bulbs, corms, rhizomes, and tubers. A fifth type of modified stem is the stolon or runner, but these are usually located above ground. Each type of modified stem is discussed in turn.

2.1 Bulbs

If you have seen an onion, then you are familiar with bulbs (Indonesian *umbi lapis*, *bulbus*). A bulb has a basal plate (*subang*, *cakram*), from which grows a shoot (*tunas*) surrounded by modified fleshy leaves (technically, scale leaves, Indonesian *sisik-sisik*) that store food during dormancy. Fibrous roots grow from the bottom of the basal plate.

Public Domain (Pixabay).

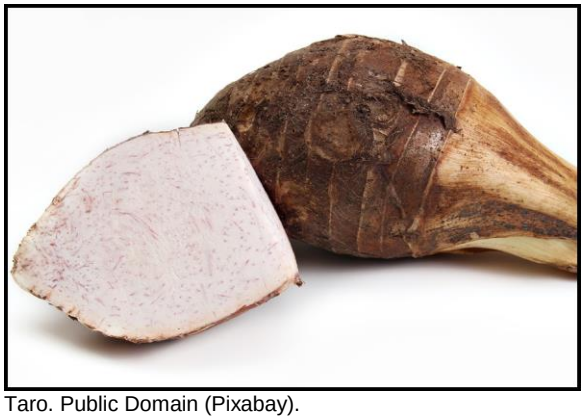
In many cases old, outer leaves form a papery covering around the bulb, called the tunic or tunica (Indonesian *sisik daun kering*, *tunika*, sometimes also *tunica*). However some bulbs lack this covering, so even the outermost leaves are fleshy.

New bulbs (offsets, Indonesian *siung*, *kuncup samping*, *anak umbi lapis*) also form from the basal plate. For example, did you know that each clove of garlic is an offset?

2.2 Corms

A corm (*kormus*, *umbi*) is an underground swollen stem where the plant stores food. Corms are similar to bulbs in that they have a vertical orientation with a basal plate at the bottom and one or more growing points (*mata tunas*) at the top. However if you slice a corm open it is uniform inside, not layered or ringed like a bulb. Taro is a good example of a corm.

Taro. Public Domain (Pixabay).



Taro. Public Domain (Pixabay).

Like bulbs, corms are also covered in modified leaves called scale leaves (here also called the tunic). The scales leaves may be fibrous (also called netted or reticulate), or the tunic may be smoother with distinct rings (called annulate). New corms, called cormels (*kormel*, *anak kormus*), grow from the basal plate.

Gladiolus ‘bulbs’ are actually corms. Public Domain (Pixabay).

2.3 Rhizomes

Rhizomes, also called creeping rootstocks or rootstalks (Indonesian *rimpang*), are underground stems, covered in scale leaves, that regularly put out shoots and roots at intervals. Unlike bulbs and corms, which have a vertical orientation, rhizomes have a horizontal orientation. Rhizomes are involved in plant propagation; however many rhizomes are also modified to store food during dormancy.

Ginger, turmeric, and related spices such as zedoary and galangal are well-known examples of rhizomes. Bamboos and some grasses spread by underground rhizomes. In running types of bamboo the rhizome is relatively straight, whereas in clumping bamboos the rhizome is U-shaped. Day lilies and irises also have rhizomes, although in some species of irises the rhizomes are partially above-ground. Banana trees grow from rhizomes. Ferns also spread by rhizomes.

Turmeric rhizomes for sale at the Ereke market, Buton Island, Indonesia.

Bamboo rhizome. © 2011 by Armin Kübelbeck. CC BY-SA 3.0 Unported.

Iris rhizomes in in Tourcoing (Nord), France. © 2015 by Jamain via Wikimedia Commons. CC BY-SA 3.0 Unported.

2.4 Tubers

Tubers (*umbi*) are modified storage organs that store food for a new growing season. They are sometimes also involved in plant propagation. Botanically speaking tubers lack the organization of bulbs and corms, having neither tunics nor basal plates. However they will have one or more growing points, also called growth nodes or ‘eyes’ (Indonesian *mata tunas*). In some tubers sprouts grow from one end of the tuber and roots from the other end; but other tubers aren’t even that well organized. Some tubers are ‘used up’ in the new growing season, while other tubers simply grow larger every year.

Although it may not be significant for your lexicographical research, botanists make a distinction between true tubers, that is to say, stem tubers (*umbi batang*) on the one hand, and tuberous roots (*umbi akar*) on the other hand. Stem tubers grow from stem material and include yams and Irish potatoes. Tuberous roots grow from root material, and include the sweet potato and cassava. Tuberous roots typically have a scar where they were detached from the mother stem.

Tuberous roots of dahlia, still attached to the mother stem. © 2014 by D. F. Richards. CC BY-SA 2.0 Generic.

While most tubers grow underground, the so-called aerial yam *Dioscorea bulbifera* produces above-ground tubers, colloquially known as ‘air potatoes’ (Indonesian *ubi atas*).

Tubers of the aerial yam *Dioscorea bulbifera* L. © 2010 by Eric Toensmeier. CC BY 2.0 Generic.

2.5 Stolons

Some plants propagate themselves by means of stolons, also called runners (Indonesian *geragih*). A stolon arises from the base of a plant and forms new shoots at the node. If encountering favorable conditions, the new shoot will root and will eventually become a new plant that is genetically identical to the mother plant.

Common cinquefoil (*Potentilla simplex*) spreads by runners, Waxhaw, North Carolina, USA. © 2019 by David Mead. Released to the Public Domain (CC0).

Above-ground stems (runners?) of an unidentified grass species, northern Buton Island, Indonesia © 2017 David Mead. Released to the Public Domain (CC0).

Runners of an unidentified plant, northern Buton Island, Indonesia © 2016 David Mead. Released to the Public Domain (CC0).

Section of the above plant, showing shoots and roots at the nodes

Confusingly to the novice, some plants spread by *underground* stolons. For example mint plants spread this way, as do potatoes (which form tubers at the nodes). Conversely some rhizomes spread above ground. A major difference is that a rhizome is the main stem of a plant and usually adds to its length year after year, whereas stolons usually die away (within a year or two) after the new plant is established.

Pingao (*Ficinia spiralis*) spreads by forming stolons in the sand, northern island of New Zealand.

3 Aerial roots

Aerial roots (Indonesian *akar udara*) are simply roots that grow above ground. However this broad term covers a wide range of root types, from the soft, spongy roots of orchids to the stout, pillar-like prop roots of strangler figs. For the lexicographer it will be useful to further distinguish several subtypes of aerial roots.

At the outset it should be noted that aerial roots serve different functions. These uses include:

(a) to receive water and nutrient intake directly from the air (e.g. orchids, epiphytes);

(b) to trap falling debris, the decomposition of which feeds the plant (e.g. gram orchids);

(c) to cling to crevices in host plants, rocks or buildings (e.g. ivy);

(d) to reach sources of water and nutrients (e.g. some philodendrons);

(e) for structure (e.g. the prop roots of maize);

(f) for aeration, that is to absorb oxygen (e.g. mangroves).

For the most part the discussions which follow run along these lines, with separate sections devote to the aerial roots of mangroves (§ 4) and strangler figs (§ 5).

Second, most aerial roots are also adventitious roots (*akar adventif*, *akar adventisius*, *akar tambahan*). An adventitious root is simply a root that arises from an unusual place such as from the trunk, stem, branch, or even leaf of a plant. Here are pictures of adventitious roots (which are also aerial roots) growing from the trunk of a coconut palm and from the stem of a tomato plant.

Adventitious (aerial) roots from the trunk of an old coconut palm.

Adventitious (aerial) roots on the stem of a tomato plant.

For that matter, underground roots can also be adventitious. For example the roots that grow from a rhizome are adventitious roots. If you take a cutting from the stem of a plant and root it in water, those roots will also be adventitious. For technical reasons botanists classify even the fibrous roots of grasses and other monocots (§ 1.1) as adventitious roots.

3.1 Aerial roots of epiphytes

Epiphytes (Indonesian *epifit*)—orchids and bromeliads are good examples—are plants that grow on other plants or structures but are not parasitic on them. Since these plants are not rooted in the ground, their aerial roots are responsible for absorbing and holding water and nutrients. These roots are covered in a thick layer of dead cells called velamen, which give the roots a spongy appearance. In Indonesian these roots can be called *akar epifit* (also specifically: *akar anggrek*). When they help an epiphyte hold itself in place, they can also be called clinging roots (*akar cengkam*).

3.2 Climbing roots

Vines and climbing plants have four ways of supporting themselves: they can twine around a trunk, pole or branch, wrapping clockwise or counterclockwise as they grow (*batang berlilit*); they can attach with tendrils (*carang*, *sulur paut*); they can hook themselves onto supports with recurved thorns (*duri*); or they can use roots that lodge into crevices and fissures. Roots that perform this function are called climbing roots or holdfast roots (*akar panjat*, *akar belit*, *akar pembelit*). Next time you observe a vine, see if you can figure out how it's attached.

In the Indonesian context climbing roots are characteristic of vanilla, pepper, and betel plants, and of course a number of other tropical vines. Some plants develop climbing roots only at their nodes; others develop climbing roots anywhere along the stem.

Aerial roots of betel, growing from the nodes, Rombo village, northern Buton Island, Indonesia. © 2016 by David Mead. Released to the Public Domain (CC0).

Climbing roots of English ivy, Waxhaw, North Carolina, USA. © 2016 David Mead. Released to the Public Domain (CC0).

Climbing roots of an unidentified aroid, Ereke, Buton Island, Indonesia.

Some climbing roots exude a sticky substance at their tips which assists them in their function, for which the Indonesian term *akar pelekat* may be more appropriate. A famous example is the climbing fig (*Ficus pumila*), introduced around the tropics and subtropics as a landscape plant. An adhesive latex produced by its climbing roots allow it to adhere to almost any surface, creviced or not.

Ficus pumila (creeping fig) on wall, Kihei, Maui, Hawaii.

Ficus pumila (creeping fig) on wall, Kihei, Maui, Hawaii.

3.3 Hanging roots

Some tropical climbers in the aroid (Araceae) family have two types of aerial roots: climbing roots as described above, which hold the plant to its support (*akar panjat*), and longer aerial roots that hang like ropes or strings toward the ground (*akar gantung*). When the tip reaches the soil it sends out lateral roots by which the plant takes up water and nutrients.

Foliage and hanging roots of *Monstera deliciosa*, Réunion Island.

Hanging roots are also characteristic of strangler figs, see § 5.2.

3.4 Prop roots

Defined narrowly, prop roots are a type of aerial root that grow from the nodes of certain plants such as maize, sugarcane and some bamboos. As the name suggests, the roots provide structural support for the plant (although they also assist in nutrient absorption). In Indonesian they are called *akar penyangga* or *akar kait*.

Prop roots of maize plant, Waxhaw, North Carolina

The term ‘prop root’ is sometimes applied more broadly to the roots that grow near the base of certain mangroves, even though these roots do not grow from nodes. The stilt roots described in § 4.1 are sometimes also called prop roots.

Prop roots of spurred mangrove (*Ceriops tagal*), Buton Island, Southeast Sulawesi, Indonesia.

4 Mangroves

Mangrove trees have specialized root systems that allow them to colonize areas with waterlogged soil, low oxygen, high salinity, and regular tidal inundation. One of their peculiar adaptations are their ‘breathing roots’ or pneumatophores (Indonesian *akar nafas*), a specialized kind of aerial root that allows the tree to absorb oxygen from the air. Some pneumatophores grow downward from trunks and branches, while others grow upward from roots until they project several centimeters above the low tide mark. The three ‘typical’ types of mangrove roots are stilt roots, spike roots, and knee roots. However mangrove roots can also take other forms including drop roots, loop roots, and ribbon roots.

4.1 Stilt roots

Stilt roots (Indonesian *akar tunjang*, *akar jangkang*) are a type of adventitious root. From a technical perspective, prop roots (described above) develop only from the nodes of a stem, whereas stilt roots develop from nodes or anywhere else along the stem or trunk. That much said, stilt roots are often colloquially called prop roots. Stilt roots are characteristic of pandanuses and some species of mangroves.

Stilt roots of pandanus, Singapore Botanic Gardens.

Stilt roots of mangrove (*Rhizophora* sp.), Buton Island, Southeast Sulawesi, Indonesia.

When stilt roots develop from the underside of lower branches, they are sometimes called ‘drop roots’ (Indonesian unknown) instead.

Stilt roots (‘drop roots’) of red mangrove (*Rhizophora mangle*) in Hawaii. © 2005 by Forest & Kim Starr. CC BY 4.0 International.

The stilt roots of *Rhizophora* mangroves develop extensions in the form of looping arches that have been called ‘loop roots’ (Indonesian unknown).

Loop roots of *Rhizophora mucronata*, Buton Island, Southeast Sulawesi, Indonesia. © 2016 by David Mead. Released to the Public Domain (CC0).

NPS (National Park Service) Photo. Credit: David Grimes.

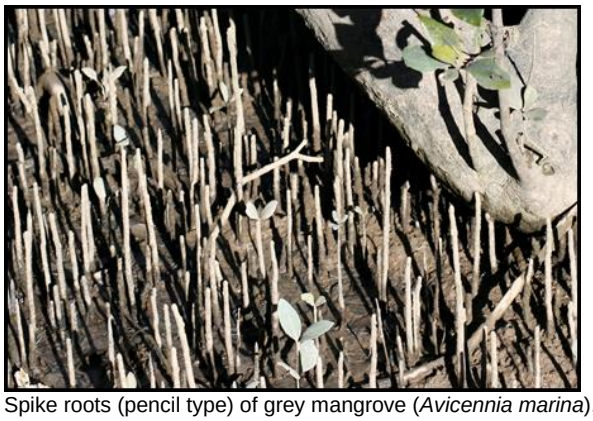
4.2 Spike roots

Other mangroves are characterized by extensions from underground roots that grow upward at regular intervals. The underground roots are termed the plant’s cable roots (*akar kawat*), while the visible upward extensions (pneumatophores) are called spike

roots (*akar paku*, *akar pasak*). Spike roots can be further distinguished into cone roots and pencil roots, for which occasionally one encounters the calqued terms *akar kerucut* and *akar pensil*.

Spike roots (cone type) of apple mangrove (*Sonneratia* sp.)

Spike roots (cone type) of apple mangrove (*Sonneratia* sp.)



Spike roots (pencil type) of grey mangrove (*Avicennia marina*), Paihia, Bay of Islands, New Zealand.

4.3 Knee roots

Knee roots (*akar lutut*) are pneumatophores that grow above the soil surface, turn, and penetrate the soil again. Knee roots are characteristic of *Bruguiera* species.

Bruguiera gymnorhiza roots at Iriomote Island, Okinawa, Japan.

Knee roots of the large-leafed orange mangrove (*Bruguiera gymnorhiza*), Buton Island, Southeast Sulawesi, Indonesia.

4.4 Spreading roots

Although uncommon, a few mangrove species have roots that run along or above the soil surface in a pattern that has been described as 'ribbon-like' or 'like snakes.' Mangrove species known to me with a system of above-ground spreading roots (*akar menjalar*) include the cannonball mangrove *Xylocarpus granatum*, the blind-your-eye mangrove *Excoecaria agallocha*, and the river mangrove *Aegiceras corniculatum*.

Ribbon roots of the cannonball mangrove *Xylocarpus granatum*.

Xylocarpus roots, Kosrae, Federated States of Micronesia.

All three species have been described as favoring the landward margins of mangrove forests, and in favorable conditions the roots may grow more underground than above ground.

5 Strangler figs (banyans)

Strangler figs, also called banyans (Indonesian *pohon beringin*), have an unusual growth cycle that involve roots not commonly seen in other trees.

5.1 Strangling roots

The seed of a strangler fig germinates in the crack or crevice of another tree and sends out roots. Initially these aerial roots (not pictured) supply the young plant with needed nutrients and water. At this stage the stranger fig lives as an epiphyte.[1]

[1] A seed can also germinate in soil, bypassing the epiphyte and strangling stages.

Once the aerial roots reach the ground, the strangler fig develops its own underground root system and begins to grow more vigorously. Roots surrounding the trunk grow thicker and meld, forming a latticework of strangling roots that will eventually kill the host tree. In Indonesian these roots can be called *akar sulur* (emphasizing their wrapping nature) or *akar cekik* (emphasizing their strangling nature).

Ficus watkinsiana on Syzigium. © 1995 by Peter Woodard. Released to the Public Domain (CC0).

Ficus aurea (Florida strangler fig) in Florida, USA. © 2012 by James St. John. CC BY 2.0 Generic.

5.2 Aerial roots

As noted above, aerial roots are characteristic of a number of different kinds of plants. However the hanging aerial roots (*akar gantung*) of banyans seem particularly noticeable, perhaps because of how they can grow in thick draping masses, perhaps because there are few other large trees that produce such roots. In Pamona banyan aerial roots are figuratively called *soe angga* ‘ghost swings’ (Adriani 1928:867).

Banyan aerial roots, Ereke, Buton Island, Southeast Sulawesi, Indonesia.

Ficus benghalensis (Indian banyan tree), Lahaina, Maui, Hawaii.

Banyan tree roots, Lili'uokalani Park and Gardens, Hilo, Hawai'i.

5.3 Secondary trunks

When one of these hanging roots reaches the ground, it will grow in the soil and thicken. These roots can be called 'prop roots' or 'aerial prop roots'; however they sometimes grow and thicken into the size of trunks, for which Indonesian has a particular term, *akar batang* (sometimes also *akar tiang*). Some sources describe these pillar-like prop roots as

secondary trunks. In this way a single strangler fig can expand to become a virtual grove with many interconnected trunks all from the same tree.

Aerial prop roots of Indian rubber tree (*Ficus elastica*), Singapore Botanic Gardens. © 2015 David Mead. Released to the Public Domain (CC0).

© 2015 David Mead. Released to the Public Domain (CC0).

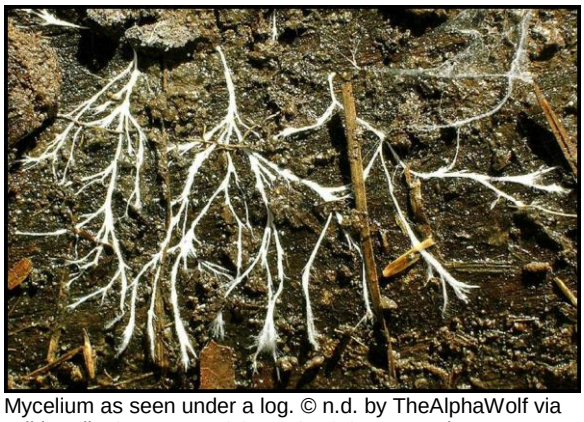
Banyan tree at Managaha Island, Northern Mariana Islands
© 2006 Hajime Nakano. CC BY 2.0 Generic.

6 Miscellaneous

6.1 Mycelium

The term mycelium (Indonesian *miselium, jaringan akar jamur*) refers to the mass of thread-like filaments (the individual hyphae, *hifa*) that form the vegetative mass of a fungus and allow it to absorb nutrients from its surroundings.

The mycelium of some fungi may be too small to be seen. Most mycelia probably go unnoticed except for their fruiting structures, mushrooms. However there may be occasions where the mycelium of a fungus is observed, for example in compost or when a rotting log is turned over or broken apart.



Mycelium as seen under a log. © n.d. by TheAlphaWolf via Wikimedia Commons. CC BY-SA 3.0 Unported.

Oyster mushroom mycelium growing on coffee grounds in a Petri dish. © 2012 by Tobi Kellner. CC BY-SA 3.0 Unported.

6.2 Haustorial roots

Haustoria or haustorial roots (Indonesian *akar pengisap*) are the roots that parasitic plants such as mistletoe (*benalu*) and dodder (*tali putri*) sink into their host plants in order to extract nutrients and water.

Dodder in Hawaii. © 2017 by Scot Nelson. Released to the Public Domain (CC0).

The haustorial roots are also used to anchor these plants. However the roots are rarely seen and can probably be ignored in terms of our lexicographical research.

Fungi that feed off of living matter also produce haustoria, but these structures are even smaller than the individual hyphae mentioned in the preceding section, and are not visible to the naked eye.

6.3 Holdfasts

Seaweeds are a kind of multicellular algae. A few types of seaweed are free-floating. However most seaweeds grow anchored to a particular spot by a structure called the holdfast (Indonesian *ruas pemegang*). The shape of the holdfast varies depending on species and the type of substrate to which it is attached, and can be root-like, flattened or even bulbous. Unlike true roots, holdfasts are not used for nutrient transport. Holdfasts are also characteristic of sea fans, sea anemones, and even some types of lichens (if attached with a stalk/umbilicus).

Holdfast of kelp, California Channel Islands. © 2010 by Claire Fackler, CINMS, NOAA. CC BY 2.0 Generic.

Umbilicate lichen on oak tree, Waxhaw, North Carolina, USA.

Be careful not to confuse seaweeds with sea grasses. Although both are known in Indonesian as *rumput laut*, sea grasses are flowering plants adapted to growing underwater in marine habitats. Sea grasses of Indonesia typically have an underground stem (rhizome) and ribbon-like or spoon-shaped leaves.

References

Adriani, N. 1928. *Bare'e-Nederlandsch woordenboek met Nederlandsch-Bare'e register*. Leiden: E. J. Brill.