

Basils (*Ocimum* spp.) in Indonesia

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ABSTRACT

Only four or five species of basil (genus *Ocimum*) are found in Indonesia. This paper is a layman's guide on how to recognize a basil plant in Indonesia and identify it at the species level.

TABLE OF CONTENTS

How to recognize a basil plant; Chemotype; Indonesian common names; Basil species in Indonesia; *Ocimum gratissimum*; *Ocimum tenuiflorum*; *Ocimum basilicum*; *Ocimum americanum*; *Ocimum* × *africanum*; Comparison table; References.

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by David Mead

My first encounter with basil in Indonesia was in 1996. However, because it didn't look or smell like the sweet basil I was used to from my American background, at first I didn't even recognize it as such. I thought it was a type of mint.

Across Indonesia there are only four or five species of basil (genus *Ocimum*). This paper is a layman's guide on how to recognize a basil plant in Indonesia and identify it at the species level.

How to recognize a basil plant

Basil plants are herbs or small, usually low-growing shrubs. They are known—and often cultivated—for their fragrant leaves. More is said about fragrance below. A plant can be confirmed as a kind of basil by examining its flowers.

Basil flowers occur in long shoots at the ends of stems. One stem may end in a single shoot of flowers, or it may be branched into several shoots (technically the entire inflorescence can be called a thyrses, and an individual branch a raceme). There are flowers up and down each raceme, but they have an orderly arrangement. In most basils, flowers occur in paired triplets, that is, on one side is a set of three flowers, and directly opposite it on the other side of the stem, another set of three flowers. A set of flowers is called a cyme, and together two cymes that are opposite one another are called a verticil. Of course along the axis of a single raceme several verticils will be arranged one above the other, although not compactly—the verticils will be somewhat separated from each other. If you look closely, you will see that each individual flower has a small stalk. Technically this stalk is called a pedicel (in the same way, for example, that the stalk of a leaf is technically called its petiole).

The calyx is tubular, and at its open end it has five lobes, which are arranged into a broad, single-lobed upper lip, and a four-lobed or four-pronged lower lip. This two-lipped (bilabiate) arrangement of the calyx is distinctive of basils and its close relations, and is a clear way to distinguish basils from mints (*Mentha* spp.).



basil inflorescence
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The corolla, which is also tubular, protrudes only slightly from the calyx. The corolla is also five lobed. In this case, however, it is the *upper* lip of the corolla that has four lobes, while the *lower* lip has one lobe. There are four stamens, two upper and two lower. After the corolla shrivels and falls off, the calyx persists and grows larger, containing four nutlets.

Chemotype

Rub a basil leaf between your fingers, and you will find that it is more or less aromatic. A plant's aroma is determined by the particular mix of essential oils found in it. To botanists this is known as a plant's chemotype. However, chemotype is not fixed for a particular species. For example, worldwide at least six major chemotypes of 'sweet basil' (*Ocimum basilicum*) have been recognized, including types that have been compared to cinnamon, clove and licorice. 'Mrs Burns' is a variety of sweet basil that was selectively bred for its citrus scent.

I remember smelling the leaf of a plant I was trying to identify on Buton Island in Indonesia (the plant turned out to be a basil). The smell was definitely *not* mint or basil or lemon, but I couldn't place it. For want of a better description, in my notes I simply wrote 'fragrant with deep undertones, pungent.' I could have done better.

Here is a list of some compounds which—present in greater or lesser measure—will give a particular basil plant or cultivar its distinct aroma.¹ Or said another way, when you go nosing around, here are some scents or undertones you might be on the lookout for.

methyl chavicol (estragol) – sweet basil / tarragon aroma
 linalool – spicy floral aroma
 linalyl acetate – bergamot / lavender aroma (think Earl Grey tea)
 myrcene – bay leaves / parsley aroma
 thymol – thyme aroma
 geraniol – rose aroma
 citral – lemon aroma
 limonene – lemon peel aroma
 eugenol – clove aroma
 anethol – anise-licorice aroma
 methyl cinnamate – cinnamon aroma
 pinene – pine aroma
 camphor, camphene – camphor aroma (think vapor rubs)
 eucalyptol (1,8-cineol) – camphor-like aroma with spicy, cooling taste
 (cough drop and mouthwash ingredient and cigarette additive)

¹ This list was compiled from Simon et al. (1999), Hiltunen and Holm (1999) and from Wikipedia, s.v. "Basil," <http://en.wikipedia.org/wiki/Basil> (accessed March 6, 2014). The reader should consult these sources for additional compounds not mentioned here.

Methyl chavicol and linalool are the primary compounds in the typical ‘sweet basil’ aroma that Americans and Europeans are familiar with (Hiltunen and Holm 1999:91).

An interesting feature of basils (as well as other plants of the Lamiaceae family) is that many species are associated with more than one chemotype. Therefore you can’t base an identification on chemotype—you still need to look at morphological features. Besides, I have yet to come across a study which investigates the chemotypes of basils in Indonesia. Nonetheless, when mentioning basils it would not be out of place to add a note about aroma in our dictionary entries.

Indonesian common names

As mentioned above, four or five species of basil grow in Indonesia. In *Kamus Besar Bahasa Indonesia* I found four names for basil: *selasih*, *ruku* (also *reruku*, *ruku-ruku*), *kemangi*, and *lampes* (the last is apparently from Javanese *kelampes*). In addition I have consulted other sources, including de Clercq (1909:291–292), Keng (1978:376–379), Aguilar et al. (1999), Jansen (1999), Sulistiarini (1999), Stevens and Schmidgall-Tellings (2004), Porcher (2009) and the Indonesian-language version of Wikipedia.² Overall these sources present a confused picture of how the primary names—not to mention various binomial expressions such as *ruku hitam* (black *ruku*), *selasih jantan* (male *selasih*) and *kemangi hutan* (wild *kemangi*)—map onto the four or five species of basil found in Indonesia.

My own conclusion is that there is likely significant regional variation in how these names are applied. This makes it all the more imperative that we bring our own scholarship to bear when identifying basils and recording the names by which they are known locally. Below I give basil species by scientific and English common name, but I omit the Indonesian common name since this could not be determined.

Basil species in Indonesia

Seven species of basil grow in mainland Southeast Asia (Suddee, Paton and Parnell 2005), and of these at least four (Keng 1978:376–379), and probably five, are also found in Indonesia. Unsurprisingly, these five are also among the most common basil species cultivated worldwide (Carović-Stanko et al. 2009:13).

Two of the five species are distinct, and should be relatively easy to identify when you come across them. The other two (or three) species are more similar in appearance, so care must be taken when making an identification at the species level.

² Wikipedia Ensiklopedia Bebas, <http://id.wikipedia.org/wiki/> (accessed March 6, 2014).

***O. gratissimum* L. = bush basil, shrubby basil**

As the English common name implies, this basil has a bushy appearance. It is a perennial, and the lower stems are woody. It can grow to a height of two or even three meters, whereas it would be rare for any of the other basil species of Indonesia to exceed a meter in height.

Another positive identifying characteristic of this plant is that after the blossoms have fallen and the fruits mature, the two middle lobes of the lower lip of the calyx curve up and back, covering the throat of the calyx. This is the only basil species world-wide with this characteristic.

Shrubby basil does not have a culinary use. Flowers are greenish white.

O. gratissimum, by R. A. Howard © Smithsonian Institute. Courtesy of Smithsonian Institute and USDA-NRCS PLANTS Database



***O. tenuiflorum* L. = holy basil**

In the literature this species is often encountered under the synonym *Ocimum sanctum* L. The name ‘holy basil’ comes from its use and importance in Hinduism. The Sanskrit name is *tulasī* (Monier-Williams 1899:451).

Holy basil has been described as a short-lived perennial, and a dwarf shrub (or subshrub). It is much branched, but only grows to a height of 30–60 cm (or rarely up to a meter).



Holy basil © 2011 Rubel Roy www.flickr.com/rubelroy. Used by permission.

Like *O. gratissimum* it may go through a dormant phase after which it puts out new shoots from the same root or stem.

This plant can be firmly identified by the pedicels (individual flower stems) which are as long as the calyx and branch

off from the main axis of the inflorescence at a nearly 90-degree angle, giving the raceme a somewhat ‘open’ rather than ‘tight’ appearance. (Compare the specific descriptor *tenuiflorum* from *tenuis* ‘fine, thin, slender’ + *flos* ‘flower’). In other basil species the pedicels bend upwards, and may even grow pressed against the stem.

There are two varieties of holy basil, one in which the plant is greenish, and one in which the plant is purple tinged. In the green variety flowers may be white or lavender, but in the purple variety flowers are also lavender-purple.

Holy basil usually does not have a culinary use, but there is one variety, Thai holy basil, which is used in Thai cooking. This same variety is also reported from Sumatra where it is also used in cooking.³ Simon (1995) suggests that a variety being grown by gardeners in the U.S. under the name ‘spice basil’ could in actuality be holy basil.

***O. basilicum* L. = sweet basil**

O. basilicum can be identified because it has the largest flowers of any basil found in Indonesia; corollas are 6–9 mm long (or longer), whereas they are only half that length (3.5–4 mm) in bush basil and holy basil. Stems and leaves are glabrous (smooth, without hairs) or only minutely hairy.

Most varieties of *O. basilicum* are annuals, that is the plant has a tap root (rather than a rhizomous ‘creeping’ root), and after it flowers and the seeds have matured it dies. However a few tropical varieties are short-lived perennials, with woody stems.

It seems impractical for me to discuss the many varieties of *O. basilicum* that are cultivated worldwide,⁴ particularly as I have not found a resource that definitively states which cultivars are found in Indonesia. However, the leaves may be smaller and narrower than the usual ‘sweet basils’ that North Americans are used to.

Thai basil (*O. basilicum* var. *thyrsiflora*), a cultivar known for its purple stems and licorice scent © 2005 Sakura. Distributed under the Creative Commons [Attribution 2.0 Generic](https://creativecommons.org/licenses/by/2.0/) license.



³ “Masyarakat Minangkabau menggunakan tumbuhan sejenis kemangi yang dinamakan dengan ruku-ruku yang di dalam Bahasa Thailand disebut sebagai *bai kra pao*. Ruku-ruku biasanya digunakan untuk memasak gulai ikan dan asam padeh (asam pedas).” Wikipedia Ensiklopedia Bebas, s.v. “Kemangi,” <http://id.wikipedia.org/wiki/Kemangi> (accessed March 10, 2014).

⁴ Simon et al. (1999) list some twenty cultivars of *O. basilicum* that are commercially available in North America. See also Wikipedia, s.v. “List of Basil Cultivars,” http://en.wikipedia.org/wiki/List_of_basil_cultivars (accessed March 15, 2014).

***O. americanum* L. = hoary basil**

First of all, the descriptor *americanum* is a misnomer; this plant is native to Africa and Asia. Second, while some have dismissed *O. americanum* as a small-flowered variety of *O. basilicum* (e.g. Aguilar et al. 1999), its classification as a separate species has been maintained in all the recent literature. Despite their similarity, *O. americanum* can be distinguished from *O. basilicum* based on indumentum (hair distribution), corolla size, and calyx size and shape.

- As the common name ‘hoary basil’ suggests, this basil tends to be hairy, including stems and leaves.⁵ So do a touch test. Hoary basil leaves may be either smooth or downy above, but they will always be downy on the underside, with longer hairs on the leaf veins (Suddee, Paton and Parnell 2005:28).
- In hoary basil corollas are 4–5 mm long, versus the 6–12 mm (usually 7–8 mm) long corollas of *O. basilicum* (Paton and Putievsky 1996:510–511; Suddee, Paton and Parnell 2005:24).
- In hoary basil the fruiting calyx is less than 5 mm long, in *O. basilicum* the fruiting calyx is 6–8 mm long (Paton and Putievsky 1996:510–511).
- As noted above, the lower lip of a basil calyx has four lobes. In *O. basilicum*, the two outer lobes are pointy and always symmetrical, whereas in *O. americanum* the two outer lobes are pointy but asymmetrical (Paton, Harley and Harley 1999:8, 36). However the entire calyx is 2 mm long when flowers appear, and only grows slightly as the nutlets inside mature, therefore any asymmetries in calyx lobes will be on a very small scale.

***O. × africanum* Lour. = lemon basil**

The English common name for this plant, ‘lemon basil,’ is problematic. It is the kind of name which botanists would rather avoid, since it conflates the notions of chemotype and genotype—especially given that this species has at least both lemon and anise chemotypes (Paton and Putievsky 1996:511). However, when the USDA brought lemon basil to America from Thailand in 1940, it was this species which they introduced (De Baggio and Belsinger 1996, reported in Vieira, Goldsbrough and Simon 2003:97). Therefore *in America* it may be largely correct to say that lemon basil is *O. × africanum*. However in Indonesia it could be a different story.

To be sure, a lemon-scented basil is present in Indonesia. However I have not come across any report that definitively states that *O. × africanum* is. One reliable authority gives its distribution simply as “Tropical Africa, America and Asia, widely cultivated” (Suddee, Paton, and Parnell 2005:29). Can we assume Indonesia is included in the mix?

⁵ In fact two varieties have been described, a more hairy *pilosum* variety (found only in Africa) and a less hairy *americanum* variety found in Africa and elsewhere (Paton, Harley and Harley 1999:24).

O. × africanum has for many years been recognized as a cross between *O. basilicum* and *O. americanum* (Pushpangadan and Sobti 1982 *inter alia*), which is why botanists put a multiply sign (×) in front of the specific descriptor. In the literature it is also identified by its synonym *O. × citriodorum* Vis.⁶

Although sweet basil, hoary basil and lemon basil are similar in many ways, you can use the following characteristics to differentiate them (Paton, Harley and Harley 1999:20–21):

- *O. basilicum* differs from both *O. × africanum* and *O. americanum* in having stems which are smooth or “minutely puberulent on two opposing faces” (Paton, Harley and Harley 1999:20) versus the downy stems of the latter two species, which have hairs on all four surfaces of the stem.
- In turn, a consistent difference between *O. americanum* and *O. × africanum* is to be found in the length of the fruiting calyx.⁷ Compare especially the highlighted boxes in the lower right corner of the following table (this table is compiled from measurements given in Suddee, Paton and Parnell 2005:24, 28–30).⁸

	corolla length	calyx length at flowering stage	calyx length at fruiting stage
<i>O. basilicum</i>	7–8 mm	4–5 mm	6–8 mm
<i>O. × africanum</i>	4–5.5 mm	1.5–2.5 mm	4–5.5 mm
<i>O. americanum</i>	4–5 mm	1.5–2 mm	2–3 mm

⁶ The name *O. × citriodorum* was replaced by *O. × africanum* circa 2005. The terminological waters are further muddied in India, where scholars have referred to the *hybrid* species as *O. americanum* (Paton and Putievsky 1996:510–511).

Western tradition		Indian tradition
<i>O. americanum</i> (syn. <i>O. canum</i>)	=	<i>O. canum</i>
<i>O. × africanum</i> (syn. <i>O. × citriodorum</i>)	=	<i>O. americanum</i>

Anyone who would jump into the literature should be alert to this. I have even come across one book, *Basil: The species Ocimum* (Hiltunen and Holm 1999) in which the chapters alternate between these two terminological traditions.

⁷ There are also consistent but miniscule differences—on the order of 0.1 mm—in anther diameter (Paton, Harley and Harley 1999:21).

⁸ These figures are apparently specific to these species as collected in mainland Southeast Asia. By contrast, Paton, Harley and Harley (1999:21) state that the mature (fruiting) calyx is 4–5 mm long in *O. americanum* versus 5–6 mm long in *O. × citriodorum* (= *O. × africanum*).

Comparison table

The following table compares five species of basil. The primary source for measurements is Suddee, Paton and Parnell (2005:24-31). Where Keng (1978) gives different calyx and corolla lengths this has been noted in the table.

	habit	leaf	raceme	calyx	corolla	nutlets	aroma
<i>O. gratissimum</i>	perennial herb, 1–2 (or 3) m tall, woody at the base	leaves 2.5–10 long by 1.2–6 cm wide, stem (petiole) 1–5 cm long	10–15 cm long; verticils up to 1.0 cm apart; pedicels 2–3 mm long, recurved	calyx 2–3 mm long, in fruit 3–4 mm; two lower calyx teeth upcurved and closing the mouth of the fruiting calyx	corolla greenish white, 3–4 mm long	nutlets produce mucilage in water	leaves when bruised strongly smelling of clove or thyme
<i>O. tenuiflorum</i>	short-lived perennial, erect, much branched, 30–60(–100) cm, stems woody at the base	leaves 0.5–4.5 cm long by 0.5–2.0 cm wide; petiole 0.4–1.5 cm; leaf base may have rounded teeth, leaf margin entire (or remotely serrate) elsewhere	racemes or panicles 8–10 cm long; verticils 0.5–1.0 cm apart; pedicels 2.5–4 mm long, nearly as long as the calyx, branching off from rachis at a 90 degree angle	calyx 1–1.5 mm long, in fruit 3–4 mm; middle teeth of the lower lip longer than the two outer teeth	corolla lavender or white, 2–3 mm	nutlets unchanged when wet	often clove, but variable
<i>O. basilicum</i>	annual or short-lived perennial, 30–100 cm tall	leaves 1.5–5.0 cm long by 0.5–2.5 cm wide	10–15 (or more) cm long, verticils up to 1.2 cm apart; pedicels 1–2 mm long	calyx 4–5 mm long, in fruit 6–8 mm [Keng 2–3, 5–9]	corolla white, pinkish or purple, 7–8 mm long [Keng 7–9]	nutlets produce mucilage in water	variable depending on cultivar
<i>O. americanum</i>	annual or short-lived perennial, 10–40(–100) cm tall	leaves 0.5–2.5 cm long, 0.5–1.5 cm wide, petiole 0.2–1.5 cm, margin entire or sparsely serrate	7–15 cm long, verticils up to 1.0 cm apart; pedicels 1–2 mm long, recurved	calyx 1.5–2 mm long, in fruit 2–3 mm [Keng 3–4.5 in fruit]	corolla white or light purple, 4–5 mm long [Keng 4–6]	nutlets produce mucilage in water	often strongly smelling of camphor; citrus, cinnamon and clove types also reported
<i>O. x africanum</i>	annual or short-lived perennial, 10 to 50 cm tall	leaves 0.5–3.5 cm long by 0.5–2.0 cm wide, margin entire or sparsely serrate	verticils up to 1.0 cm apart; pedicels 1–2.5 mm long, recurved	calyx 1.5–2.5 mm long, in fruit 4–5.5 mm long	corolla white or light purple, 4–5.5 mm long	nutlets producing mucilage in water	lemon or anise scented

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