

Biodiversity and nature's healing gifts

As aromatherapy practitioners we benefit highly from the world's biodiversity of plant species, says Viv Anthony. Here she explains how biodiversity is under threat and why conservation is important to aromatherapy



Aromatherapy relies on nature's diverse gifts for healing and uses both traditional knowledge and insights from modern science. As practitioners, we are nature's custodians and awareness about plant biodiversity and conservation may help us to keep aromatherapy flourishing. But what is biodiversity and why does it matter?

The English poet William Cowper (1731–1800) perhaps captured its importance in his famous phrase “variety is the very spice of life”. Biodiversity is defined by the UK government Department of Environment, Food and Rural Affairs (DEFRA) as the variety of life on earth, including all species of plants and animals, and the natural ecosystems that support them. It is the tangible outcome of evolution, where species survive through adaptation to their individual environmental circumstances and inherit these beneficial features through their genetic code.

Year of biodiversity

The United Nations declared 2010 the International Year of Biodiversity. The UK is one of over 190 countries that are parties to the Convention on Biological Diversity (www.cbd.int/). This international treaty aims to halt the loss of species on the earth, and raise awareness of biodiversity's importance for health and the discovery of medicines, dietary nutrition, energy production and the environment. Biodiversity also has intrinsic aesthetic and spiritual benefits that contribute to our relaxation and well-being, and inspires creativity for painting, music, writing and sculpture.

The rate of species loss is greater now than at any time in human history, primarily due to man's footprint and the destruction of plant and animal habitats. Since the industrial revolution the global population has grown

from one billion to 6.7 billion. In September, The Royal Botanical Gardens at Kew, together with the Natural History Museum and the International Union for Conservation of Nature (IUCN), published the first comprehensive global study which revealed that over 20 per cent of the world's plant species are under threat of extinction. Cropwatch (2010) has published specific information on the threatened species that we use in the aroma and cosmetics industries (www.cropwatch.org).

It has been estimated that around 500 animals and plants have become extinct (Natural England, 2010) in England over the past 200 years. Natural England is an independent public body that works to protect and improve our natural environment and encourage us to enjoy and get involved in our surroundings. Each week its website (www.naturalengland.org.uk) provides information on activities and features a British species that needs support. In March, it focused on the pasqueflower (*Pulsatilla vulgaris*), a truly beautiful, native, rare medicinal plant on the UK threatened list. It is used by western herbalists (Barker, 2001) and homeopaths as an analgesic and for menstrual problems, and in traditional Chinese medicine as an anti-inflammatory. It grows in calcareous grassland and flowers in March–May in central and eastern England – I'm lucky enough to be able to see this plant growing wild on several sites close to my home near Basel, in Switzerland.

If you're wondering what we can do individually to make a difference remember that you are already participating by reading this article. Raising awareness about the importance of biodiversity amongst your family and friends, and making individual personal and community choices that affect our environment and flora will help. You could also support the conservation work of the Kew millennium seed bank or adopt an endangered plant species (www.kew.org/support-kew/adopt-a-seed/index.htm).



The Easter-blooming pasqueflower (*Pulsatilla vulgaris*) is common in garden centres but rare in the wild in England

Biodiversity in aromatherapy

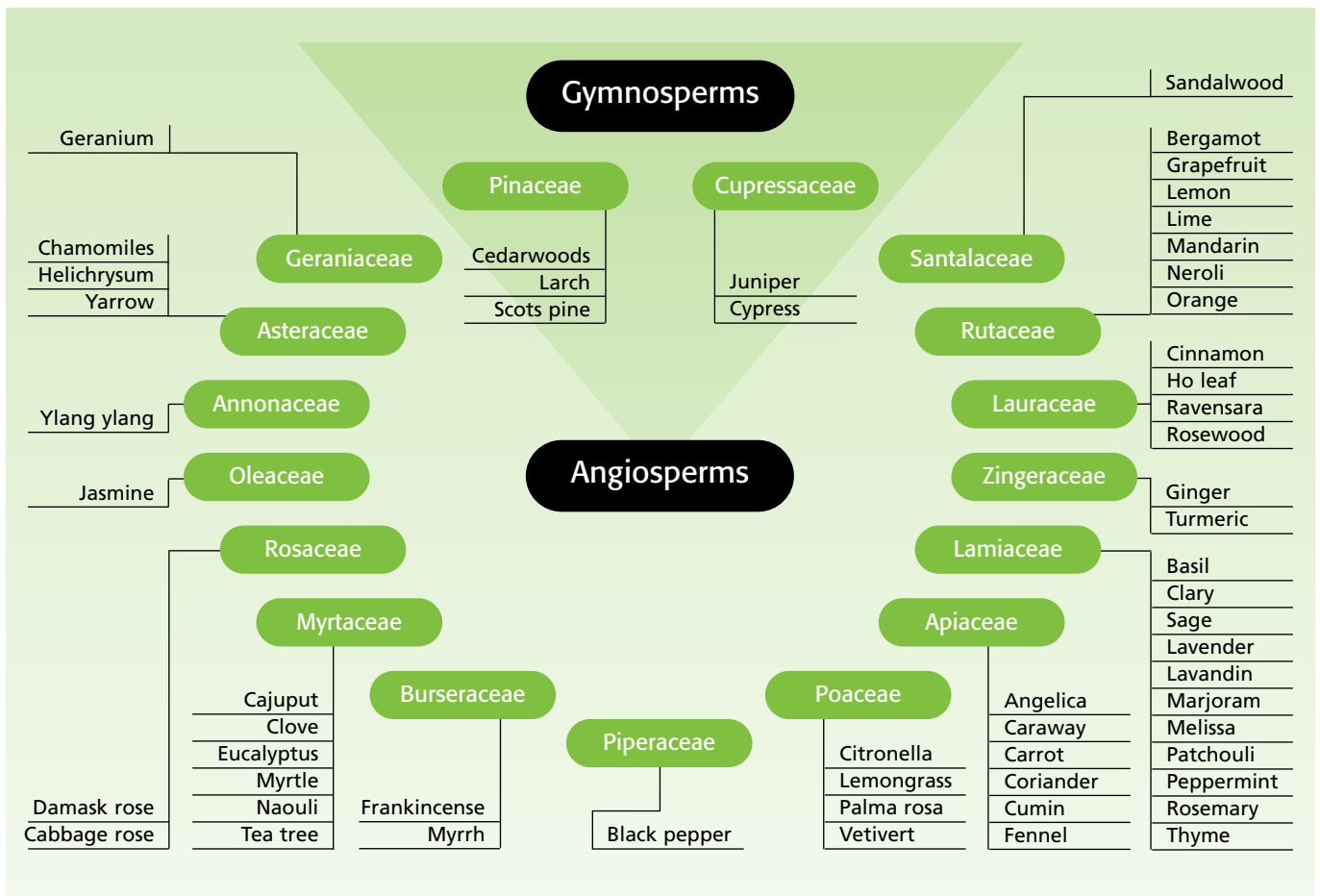
In our work we benefit from the world's huge biodiversity of plant species. Some oils come from plants that are gymnosperms with naked seeds – very old in evolutionary terms (around 300 million years). This group, which includes cedars, firs, larches, pines, juniper and ginkgo, has 700–900 species in around 15 families. This diversity, however, is dwarfed by comparison with that of the flowering angiosperms. Angiosperms have flowers with petals and ovules enclosed in fruits. There are estimated to be at least 250,000 species in 450 families. Angiosperms went through a period of huge diversification around 100–150 million years ago and became the dominant type of terrestrial plant, replacing conifers only around 60–100 million years ago. (See chart on page 16.)

Common oil families

Only about 15 per cent of the world's plant species have been investigated phytochemically so there is still much to learn about them. Three thousand plant species have been reported to produce essential oils (Bowles, 2003).

The table opposite classifies around 200 oils that are readily available commercially and shows the families containing the greatest number. They occur in over 130 genera and 50 families, but most families are represented by only one or two species (Mojay, 2009). ►

Family	Number of essential oils (list of 200)	Number of species per family
Lamiaceae	22	7000
Asteraceae	17	24000
Apiaceae	16	3000
Myrtaceae	15	4000
Rutaceae	14	1600
Pinaceae	11	240
Lauraceae	7	3000
Fabiaceae	6	19000
Poaceae	6	10000
Zingiberaceae	6	1300
Burseraceae	6	540
Oleaceae	4	600
Cupressaceae	4	140
Orchidaceae	1	22000



Role of essential oils in plants

Essential oils are found throughout the higher plant kingdom. As secondary metabolites they are not essential for life processes such as respiration or photosynthesis, but they confer advantages for reproduction, competition and survival (Price, 2007).



Bumblebee orchid (*Orchis holoserica*)

These advantages include:

- acting as chemical attractants for cross-pollination**
Lavandula angustifolia always attracts bees and butterflies with its heady oils produced under sunny conditions. The English naturalist Charles Darwin (1809–1892), who developed theories on evolution, worked for many years on the unique relationship between insects and bee orchids and the involvement of scent, mimicry and nectar. The photograph below shows a bumblebee orchid that grows wild in profusion near my home. It uses volatile compounds and mimicry (looks like a female bumblebee) to ensure cross-pollination.
- preventing attack by insects or herbivores**
 Man has capitalised on this property and now citronellol is regularly chosen as a natural insect repellent. In Switzerland, essential oils are used in many traditional ways. For example, the reason pelargoniums are grown in the window boxes of mountain farms is that the monoterpene alcohols produced by the highly-scented leaves keep flies out of the homestead. Likewise, it's not uncommon to see snack kiosk staff deterring insects on warm days with oranges studded with clove buds emitting volatile eugenol (Trongtokit *et al*, 2005).
- preventing infection by fungi, bacteria and viruses**
 Virtually all plants are attacked by micro-organisms and have evolved to produce natural pesticides with a broad spectrum of action. Although most plant pathogens are not pathogenic to man, the breadth of action of oils like thyme, tea tree and melissa enables them to provide us with effective antiseptic action.

- **allelopathic action**
Oils such as 1,8 cineole and camphor prevent other plants from growing and competing in nearby soil
- **other survival mechanisms**
Some oils are also implicated in healing plant wounds, can act as an energy reserve and help to prevent dehydration in arid conditions (Davis *et al*, 2007)

Conifers and aromatherapeutic uses

Amongst the gymnosperms, the pinaceae or conifer family contains the largest number of species (around 220–250) and offers aromatherapists the greatest range of oils. I find that these oils can provide tremendous benefits for relaxation and release when combined with visualisation techniques about the trees themselves and their location. As a practitioner in Switzerland, I draw attention to native conifers that clients can see when they are out walking. Each oil has its own identity and particular mix of monoterpenes resulting from its individual genetic heritage, habitat and the proportion of needles and twigs/branches used during steam distillation.

Typically, due to the composition of the evergreen needles, conifer oils have a stimulating, refreshing, antiseptic profile that helps cleanse negative thoughts, raise spirits and ease muscle tension and respiratory congestion. Silver fir grows at lower altitudes (600–1700m), with larch (800–2400m), arolla pine (1600–2400m) and Scots pine often growing together (to 2000m). At higher altitudes, towards the treeline, grow dwarf mountain pines.

The Royal Botanical Gardens at Kew offer a tremendous opportunity to see many of these healing and majestic trees (Robinson *et al*, 2008). A highlight is to compare the form and scent of the three key cedars: Himalayan (*Cedrus deodora*), Atlas (*C. atlantica*), and their ancestor the highly protected cedar of Lebanon (*C. libani*). Unlike the pines and firs, it is cedar’s heartwood and sawdust that is steam-distilled to produce the deep, musty familiar smell of the warming oil that gives strength, stability, comfort, and antiseptic benefits. Given the very slow growth careful long-term management for sustainability of the trees is essential.



Scots pine produces pollen masses that can fill the air

Species diversity in angiosperms

There are over 450 families of angiosperms and the two largest – the Asteraceae and the Orchidaceae – each contain more than 20,000 species. Whereas we use a range of essential oils from the Asteraceae, only one oil is commercially available from an orchid. This is the sweet-smelling vanilla from *Vanilla planifolia* – a warming, calming, sensual oil that eases tension and is better known as a food flavouring. A native of Mexico, vanilla is now mainly produced in Madagascar.

Many orchids are tropical and found deep in the rain forest with often only the indigenous peoples really understanding their individual beneficial characteristics. It’s a similar situation with eucalyptus: the Australian aborigines used its properties for thousands of years, but fewer than 20 of the 700 species have been commercially developed (Battaglia, 2003). The Lamiaceae family is highly aromatic and contains the greatest number of therapeutic essential oils in our aromatherapy toolkits.

Rosa displays a broad biodiversity with over 250 actual species and well over 10,000 varieties. The genus is endemic to temperate regions of the northern hemisphere, including North America, Europe, Asia and

Conifer oils used in aromatherapy

Group	Latin name	Common name	Plant part
Cedar	<i>Cedrus atlantica</i>	Atlas cedarwood	Wood
Cedar	<i>Cedrus deodora</i>	Himalayan cedarwood	Wood
Fir	<i>Abies alba</i>	Silver fir	Twigs and needles
Douglas fir	<i>Pseudotsuga menziesii</i>	Douglas fir	Twigs and needles
European larch	<i>Larix decidua</i>	Larch	Branches
Pine	<i>Pinus cembra</i>	Arolla pine	Branches
Pine	<i>Pinus mugo</i>	Dwarf mountain pine	Twigs and needles
Pine	<i>Pinus sylvestris</i>	Scots pine	Twigs and needles
Spruce	<i>Picea mariana</i>	Black spruce	Twigs and needles

Therapeutic profile of rose

Emotional characteristics

- Brings feelings of well-being and vitality
- Gentle but potent anti-depressant
- Helps confidence and self-esteem
- Heals emotional wounds, sorrow and disappointment and opens the heart to new possibilities

Physiological properties

- Helps to regulate female menstrual cycle: reduces pre-menstrual tension and menopausal symptoms
- Soothing anti-inflammatory properties and excellent for dry and irritable skin
- Toning effect on vascular system such as broken capillaries

the Middle East, with the greatest diversity of species found in western China (Phillips *et al*, 1988). Pollen records show that *Rosa* species date back 35 million years and evidence suggests that ancient civilizations in China and western Asia were cultivating them 5000 years ago (Gudin, 2000). Pliny (AD 23–79) confirms that the Romans were growing roses in heated greenhouses in winter, making numerous remedies from the flowers and rosehips, and using rose scent.

Biodiversity is manifested by the numbers of different types of plant species but can also be defined by their range of chemical composition. There are over 4,000 essential oils characterised in “the complete database of essential oils” (www.leffingwell.com) and the genus *Rosa* exemplifies this chemical variation well. Over 300 compounds contribute to the rose’s heady scent (Battaglia, 2003). It is this unique cocktail, with many components at trace levels that cannot be reproduced synthetically, that gives rose special therapeutic properties to comfort and support the mind, spirit and body.

Essential oils are commercially produced from the damask rose (*Rosa damascena*) and the cabbage rose (*Rosa centifolia*) (Mojay 2005), and their spectrum of composition is greatly affected by genetic, environmental and production factors (Baydar *et al*, 2005).



Rosehip pulp is rich in vitamins and minerals

The damask rose is a naturally-occurring hybrid between *Rosa gallica* and *Rosa moschata*. DNA analysis has also implicated *Rosa fedtschenkoana* in its ancestry (Quest-Ritson, 2003). Rose absolute and rose otto, both produced from *R. damascena* petals, have very different scents due to their different extraction methods. Rose otto has a deep, warm, spicy floral fragrance that can be very intense in warm rooms: Rose absolute tends to have a lighter fragrance, more like a garden rose. My clients often have strong preferences for one or the other and it’s worth considering offering both options.

Cabbage rose looks and smells somewhat similar to damask rose and has multiple whorls of pink petals. It contains genes from *R. gallica*, *R. moschata*, *R. damascena*, but also dog rose (*Rosa canina*), a native plant in the UK.

Dog rose, and its relatives the musk rose (*R. moschata*) and sweet briar (*R. rubiginosa*), provide other gifts for aromatherapists. The seeds of these species contain a very rich balance of essential fatty acids (linoleic acid and linolenic acid) and retinoic acid. Rosehip oil is excellent for nourishing mature and dry skin on the face and hands, and is beneficial for reducing scar formation (Kusmirek, 2002). Rosehip pulp is also highly nutritious, being full of anti-oxidants, vitamins B, C and E, polyphenols, carotenoids and minerals K and P. Rosehips have very high vitamin C levels, with between 300–4000mg per 100g fresh weight – 10–80 times higher than oranges. *Rosa* species contain a wonderfully broad range of diversity, spectrum of chemicals and beneficial properties for our health, nutrition and well-being.

Chemical diversity for inspiration

Many of us found studying the chemical structures of essential oils hard going during our aromatherapy training. But recently, I have found that thinking about the main chemical constituents of oils can bring new ideas. For example, two dominant ingredients of quality rose otto are the monoterpene alcohols citronellol and geraniol. Both citronella and geranium oils also have high contents of these monoterpenes.

Whereas geranium is a regular choice for clients, especially for women seeking balance and relaxation, citronella is not. Citronella tends to come to mind as a major ingredient of natural mosquito repellents since I have frequently used it on holidays. Its tangy, lemony smell and the literature suggest that it should be stimulating. However, I have found it to be very effective at helping stressed clients to relax, especially for clients who do not favour floral-type fragrances. Monoterpene alcohols are generally considered to have a stimulating effect but studies on linalool have shown they can also be sedative (Bowles, 2003).

So much to be discovered

Biodiversity is the unique biological and chemical variation that creates the individual signatures and healing properties of the essential oils we use. Oils occur in some of the oldest vascular plant species and confer many competitive advantages for their reproduction and



The simple beauty of the wild dog rose (Rosa canina) with its single whorl of petals

survival. Only a small proportion of plant species has been investigated and we should expect many more oils to be discovered.

The principles of recognising and remembering scents and their impact on health and well-being are also still at an early stage. It was only in 2004 that Axel and Buck won the Nobel Prize for Physiology and Medicine, and the revelation that three per cent of our genes are involved with smell and recognition. Given that so much remains unknown we need to value, protect and support initiatives for the conservation of plant species, both at home and internationally. I hope to have stimulated your curiosity to investigate some of the more unusual oils and to purchase from organisations that actively support ecological sustainability and the conservation of aromatherapy plants.

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