REVISED AND UPDATED EDITION

WILD COLOR

The Complete Guide to Making and Using Natural Dyes

JENNY DEAN

Karen Diadick Casselman, consultant

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Watson-Guptill Publications
New York

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Published in the United States by Watson-Guptill Publications, an imprint of the Crown Publishing Group, a division of Random House, Inc., New York.
www.crownpublishing.com
www.watsonguptill.com

Originally published in slightly different form in the United Kingdom by Mitchell Beazley, an imprint of Octopus Publishing Group Ltd, London, and subsequently published in the United States by Watson-Guptill Publications, New York, in 1999. This revised and updated edition was originally published in the United Kingdom by Mitchell Beazley, an imprint of Octopus Publishing Group Ltd, London.

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Produced for Mitchell Beazley by Walton and Pringle

Library of Congress Control Number: 2010924465
ISBN: 978-0-8230-5879-2

Typeset in Gill

Printed and bound in China

1 2 3 4 5 6 7 8 9/07 06 05 04 03 02 01 00 99

First Revised U.S. Edition

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Preface

This revised edition of Wild Color *brings the craft of natural dyeing into the 21st century and is the result of over three decades of experience with natural dyes, during which time I have conducted numerous experiments to find the most reliable methods to produce the widest possible range of shades in safe, environmentally friendly ways.*

Today, when concern for the environment and conservation of the resources of the natural world are of paramount importance, it is vital that we look towards the future and consider the environmental and human impact of our activities.

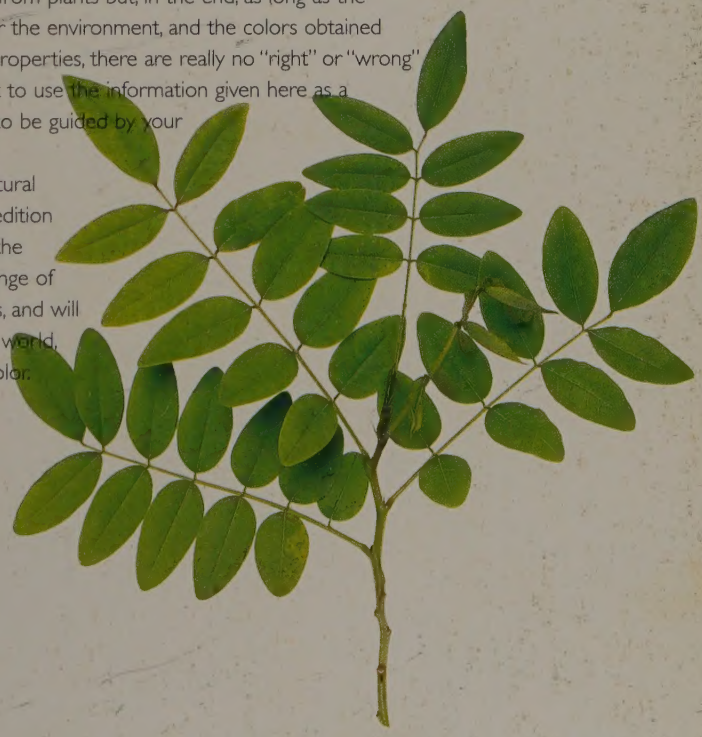
My aim as a natural dyer has been to use only dyes from renewable sources and to reduce as far as possible the quantities of chemicals used, without compromising the quality of the results. The dyes and methods described in this book are those which, in my experience, will give reliable colors with degrees of fastness suitable for most purposes.

The increased interest in self-sufficiency and in growing one's own produce has led to a desire among craftspeople to grow plants for use in dyeing. In this book, dyers will find details for growing numerous sources of color, including most of my personal favorites, and these plants will usually also beautify the garden as well as providing color in the dye pot. Some resourceful dyers may also wish to make their own mordant solutions from common household or garden materials, and instructions for these are also given in this book.

Natural dyes give textile artists great opportunities for individuality of design and color, especially as there are so many variables in plant dyeing. Much of the dyer's art relies on intuition and experience and each dyer will develop favorite methods, based on experimentation and trial and error, and will no doubt also gradually develop a personal range of unique shades.

There are many ways of producing colors from plants but, in the end, as long as the techniques used are not harmful to humans or the environment, and the colors obtained are pleasing and have the necessary fastness properties, there are really no "right" or "wrong" ways to produce each color. So it is important to use the information given here as a starting point for your own experiments and to be guided by your own experiences.

The wealth of colors available from the natural world is truly remarkable. I hope this revised edition of *Wild Color* will enable dyers to experience the excitement and pleasure of creating a wide range of beautiful, reliable shades from natural materials, and will bring an enhanced appreciation of the natural world, which provides us with such rich sources of color.



Introduction

Natural plant color

Within many plants lie hidden treasures – remarkable tinctorial properties that bring a myriad of hues to the dye pot for those with the knowledge to unlock their secrets.

Dye colors extracted from plants can be vivid and intense or subtle and delicate, but whatever the color result, each has its own unique charm and beauty. This book is a celebration of these rich sources of color.

Supplies of dye color are not difficult to find in nature. Many familiar garden and wild plants, including some regarded as weeds, are rich in dye potential, and waste materials, such as onion skins or prunings from trees and shrubs, can be gathered for the dye pot by the enthusiastic dyer. Some of the classic, ancient dye plants, including madder, weld, and woad, can be grown from plants or seed in most temperate regions, while heartwood from trees, such as logwood and brazilwood, is available by mail order as wood chips or shavings from specialist dyestuff suppliers. Full details of how to cultivate the dye plants, how to harvest the plant parts for the dye pot, and the most appropriate dyeing procedures are described in The Dye Plants (see pp.66–139).

Throughout the gardening year, the different plant parts – such as flowers, leaves, bark, or seeds – will yield their tinctorial properties. One of the thrills of natural dyeing is that each season brings a wealth of new shades to the dye pot. Those who enjoy gardening will gain great pleasure and satisfaction from growing plants that are both beautiful and useful.

above *Garden and kitchen waste can find a place in the dye pot. Onion skins reliably produce rich shades of orange, rust, and brown on fibers.*

The dyeing tradition

Until the mid-19th century, when synthetic dyes came into use, all colors came from natural sources. However, natural substances were used as body paints, cosmetics, and colorants for pottery and baskets long before they were applied to textile fibers. Over 15,000 years ago our ancestors were using natural pigments to decorate the walls of caves, as the cave paintings of Altamira in northern Spain and Lascaux in the south of France show.

Many of these colors were of mineral rather than plant origin. They derived from deposits of iron, colored clays, malachite, and lapis lazuli, for example, and were often ground into pigments for surface decoration. A pigment is easier to apply than a dye, because the finely-ground color particles, which are held in suspension in a liquid, often with a thickener, are applied to the surface only. However, for a dye to be effective, the color particles must dissolve in solution and must then be absorbed by the fiber molecules. The process is complicated by the fact that many dyes do not remain permanently fixed to the fibers without the use of some other substance to act as a bond between the two. This substance is known as a mordant, from the Latin word *mordere*, meaning to "bite" or "fasten." The most

left *An early hunting scene of bulls and other wild animals painted on the wall of the Hall of the Bulls in the Lascaux caves in Dordogne, France (c.15,000–13,000 BCE). Natural pigments, such as iron oxides, ocher, and probably charcoal, were applied to the surface of the wall.*

common mordants are metallic compounds of aluminum, iron, or copper.

In all probability, the earliest dyes were not fixed permanently to the fibers using a chemical mordant, and dyeing simply meant that the fibers were soaked or simmered in solutions from plants or other materials and became stained as a result.

We do not know at exactly what point prehistoric peoples learned how to apply dyes to textile fibers, because yarns and fabrics decay relatively quickly in most environments, leaving little evidence for following generations to study. However, it is more than likely that the craft of dyeing developed simultaneously in various parts of the world.

below *Ocher and black pigments were used to paint bison on the cave wall at Altamira near Santander, Spain (c.14,000– 12,000 BCE).*

The origins of dyeing techniques

Some of the processes and rituals involved in such daily activities as food and drink preparation may have been the starting points for experiments using plant materials for color.

Preparing a dye bath is very similar to cooking food, and foodstuff would no doubt have imparted color to the water in which it was boiled. The fermentation that turned fruit and grain into wine and beer may have led to techniques for fermenting plant materials to extract color. The use of tannin-rich barks in the processing of hides for leather might well have led to the discovery of the value of tannin as a natural mordant for the fixing of dye colors to textile fibers.

Many of the plants used in dyeing also had medicinal properties and it is possible that their tinctorial qualities were discovered as a result of their medicinal use. For example, the leaves of two of the most important dye plants – indigo and woad – were considered to aid the healing of minor wounds and skin ailments and would probably have been applied as poultices. Heat from skin, together with salt from sweat, could well have provided the conditions necessary to extract the blue color from indigo and woad leaves, especially if urine, which was regarded as an antiseptic, was also present.

The evolution of natural dyeing

Although the precise origins of dyeing textile fibers with natural substances is still largely unknown, archaeological finds indicate that dyes from natural sources have been used to color textiles for at least 6,000 years.

Between about 4,000–3,000 BCE dyeing had become an established craft in India, China, and parts of South America. Archaeological excavations at the site of Thebes in ancient Egypt revealed an indigo-dyed garment dating from around 2,500 BCE, and a belt dyed red with madder root was also found at Thebes in the grave of Tutankhamen, who died c.1,352 BCE. Outstandingly beautiful textiles in vivid colors, dating back to the first millennium BCE were also found in the Paracas peninsula in Peru.

Dyed textiles from the tombs of the Pazyryk valley in the Altai region of Siberia date back to the 5th century BCE. These textiles from the Pazyryk valley were remarkably preserved in burial chambers in solid ice. The decorative deer and horsemen design on the Pazyryk carpet is still rich in color and remains true despite its age. It is a particularly important find because it shows that the history of rug and carpet weaving is much older than was previously thought.

By about 1,000 BCE the Phoenicians were the most famous dyers in the Mediterranean, and soon after the Greek and early Roman civilizations mastered the skills for applying dyes, such as purples from shellfish and reds

below *This richly-colored Pazyryk carpet, discovered preserved in ice, dates to the 5th century BCE. It predates the other oldest-known pile rugs by about 1,700 years.*

above *This is the border of a textile sample (c.600–200 BCE) decorated with bright yellow and purple hummingbirds. It was found in the Paracas peninsula on the southern coast of Peru.*

from madder. Dyeing fibers, fabrics, and yarns became one of the luxury trades of the Roman Empire, and as the Empire expanded, the knowledge of the craft spread.

Early Egyptian, Indian, and Chinese dyers had already discovered the use of mordants to fix dye colors and learned that color variations could be achieved by using different mordants. Pliny the Elder, a Roman scholar who wrote in the middle of the 1st century AD, described the accomplishments of early Egyptian dyers. He explained how the materials were first treated with chemical substances that later absorbed the colors in the dye bath, noting that, although the dye in the pot was of one color only, the materials, when removed from it, were of various colors, depending on the chemicals that had been applied to each.

Pliny's comments on dyeing verify that the more complex processes of applying dye colors permanently to textile fibers had been mastered by the Egyptians, and that it was not uncommon to use more than one mordant in order to produce several colors from each dye used.

Just how early civilizations discovered the chemistry of dyeing fibers is a matter for wonder and conjecture. Natural curiosity, trial and error, and experimentation no doubt all played important roles in the process, and techniques used for other practices, such as preparing food, cleaning fibers, and tanning hides, were probably applied experimentally to the craft of dyeing. For example, the Egyptians used natural sodium salts for laundering clothes, and this may have led to their use of other minerals as mordants. Both the Egyptians and the early Swiss Lake Dwellers (4,000–2,000 BCE) used iron solutions as a dye, and this practice may have prompted them to use iron as a mordant.

In central and northern Europe, textiles from the Bronze Age and the Iron Age show evidence that dyeing was one of the skills

below *Overland trade routes between the Far East and the West brought textiles, such as this panel of silk embroidery (c.9–10th century AD) to a new audience, and influenced textile design and techniques.*

right *The first dyers' guilds were formed in Germany in the 12th century.*

known to these early peoples. Blues (from woad) and reds (probably from plants in the madder family) were valuable colors, together with purples (from lichens) and yellows (from weld and birch leaves).

Following the withdrawal of the Romans from western Europe after 400 AD, dyeing continued to develop throughout Europe, especially in the Germanic Kingdoms and under the Vikings, and there is evidence that both local and imported dyestuff was used.

Guilds of master dyers

In Medieval times, dyeing flourished in Europe, and the first dyers' guilds were formed in Germany in the 12th century. Apprentices trained under master dyers, and guilds in different areas often specialized in particular dyes or techniques. A master dyer's recipe book was closely guarded, and there were frequent attempts to steal trade secrets.

Development of trade routes

Trade in textiles has a long history. Evidence from archaeological finds indicates that textiles were traded in the Middle East from 2,000 BCE, leading in time to trade across the whole region from Egypt and Turkey to Persia. Overland routes between the Far East and the West began to open up from c.100 BCE. The Silk Road, which was actually a number of trading routes from China across Asia to the Middle East, became the most important land passage for trade between East and West Asia and ultimately Europe. This trade inevitably influenced textile design and led to exchanges of ideas between countries and cultures.

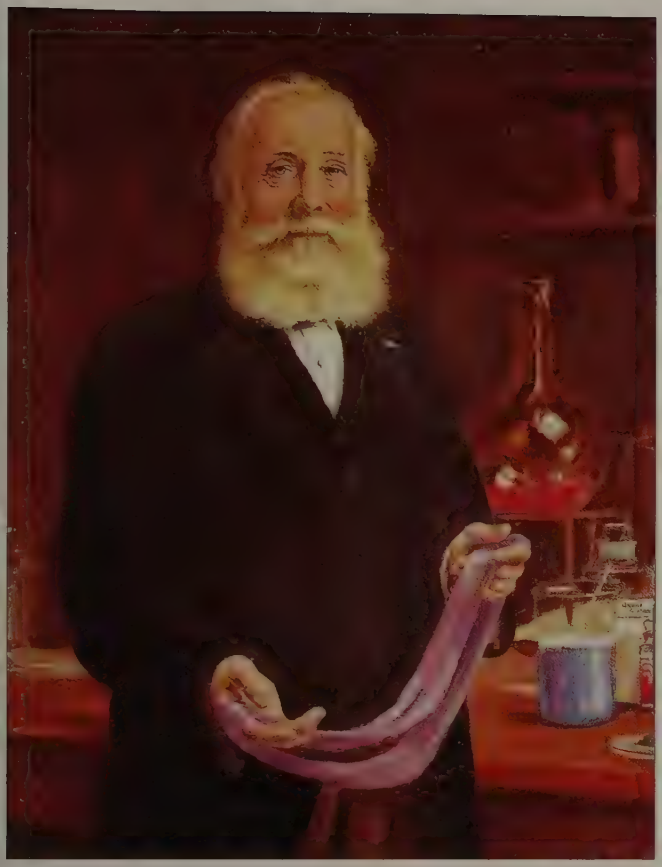
When the sea routes from the Americas were discovered at the end of the 15th century, trade began in valuable dyestuff that had not previously been available in Europe. This included cochineal insects for reds and logwood for purples and blacks.

The discovery of the sea route to India and the East Indies from Europe by Vasco da Gama in 1498 increased the range and quality of dye colors available in the West. Indigo became a trade commodity, as up until this time woad had been the source of blue dye.

At the beginning of the 17th century, the East India Trading Company was formed. As trade flourished, Europeans were able to see textiles from the Indian subcontinent, which had long been the home of sophisticated dyeing skills and techniques. When Indian printed fabrics reached Europe in the 17th century, people were amazed by the beauty of the colors and the intricacy of their designs. This was mordant and block printing of a high art, unsurpassed even by the textiles of today.

With a wide spectrum of colors now at their disposal, an increased knowledge of how dyes could be applied to yarns and fabrics of all fiber types, and an increased demand for

below *Once Vasco da Gama had discovered the sea route to India and the East Indies in 1498, quality dyes, such as indigo, were brought to the West.*



above *In the 1850s, William Perkin was the first person to make a synthetic purple dye. His experiments led the way for the manufacture of many synthetic dye colors.*

more decorative textiles, master dyers throughout Europe were able to put their skills to good use.

Synthetic dyes

The desire to manufacture synthetic dye colors was driven by economics and the needs of the textile industry, which required large amounts of reasonably priced dye for production. The problem with natural dyes was that large quantities of natural materials had to be harvested to make small amounts of dye, and many of the most prized reds and blues, such as brazilwood and indigo, had to be imported, which kept prices high.

The first successful synthetic dye was discovered by chance in 1856 by the English chemist William Perkin. Perkin had been using the hydrocarbons in coal tar for his experiments in synthesizing quinine when he found he had developed a deep purple color. Within a year he was manufacturing the first aniline dye, which he called mauve or mauveine, after the French name for the mallow plant that has a purple flower.

Coal tar, from which this mauve dye had been made, was to form the basis of many synthetic dyes. Alizarin, the red dye pigment in madder plants, was synthesized in 1869 by both Perkin and the German chemists Graebe and Liebermann. Further important work by German chemists led by Adolf von Baeyer culminated in the marketing of synthetic indigo in 1904 by Badische-Anilin-und-Soda-Fabrik. It is a tribute to the remarkable tinctorial qualities of indigo plants that the synthetic product was simply a chemical copy of the original; it could not be improved upon.

With these discoveries, the application of synthetic dyes grew rapidly and the use of natural dyes began to decline. Today, natural dyes are rarely used on a large commercial scale, although their use continues in some areas of the world and among specialist dyers. It is important that the skills and knowledge are kept alive, not only because they are a valuable part of our heritage, but also because it is possible that in the future we may need to rely on them again.

above *The German chemist Adolf von Baeyer led research into the development and marketing of synthetic indigo.*

Categories of dyes

The history of some of the more significant dyestuff is interwoven with the development of dyeing techniques. Natural dyes fall into three categories. The easiest dyes to apply are the substantive dyes – so called because they can be fixed within the fibers without the assistance of any other substances. Substantive dyes are often those that are rich in tannins, including barks and the leaves and fruits of trees, such as walnut and staghorn sumac.

Substantive dyes were probably the first type of dyes to be used, partly because some of the trees and plants from which they derive were already familiar to early peoples and were used in other areas of daily life, such as for tanning hides and in food preparation.

Dyes in the second category are known as vat dyes, probably because wine casks or vats were originally used to ferment grain and fruit for beer and wine, and fermentation is one of the processes involved in the making of "vat dyes." Vat dyes are also substantive dyes and require no mordant. They include indigo and woad and Tyrian or Imperial purple. The methods for using vat dyes are quite different from those used to apply other natural dyes. The coloring matter of dyes in this category is not directly soluble in water, so the dyestuff cannot just be simmered to extract dye color.

Vat dyes need other treatments to render the coloring matter soluble. They do not react

chemically with the fibers, but are deposited mainly on the external surface of the fibers. When they initially emerge from the vat, the fibers appear almost colorless. The color develops on exposure either to oxygen in the air, as is the case with indigo and woad, or to light, as with the shellfish dyes. Like other substantive dyes, vat dyes were probably among the earliest to be applied to fibers.

Dyes in the third category are known as adjective dyes, because they need a mordant in order for the colors to develop fully and fix permanently to the textile fibers. Many natural dyes fall into this group, including traditional dye plants such as weld and logwood.

Clearly, the application of adjective dyes required knowledge of the techniques for using metallic compounds as mordants to fix the dye colors to the fibers, so their use probably went hand-in-hand with other cultural and technological developments.

Other sources of natural color

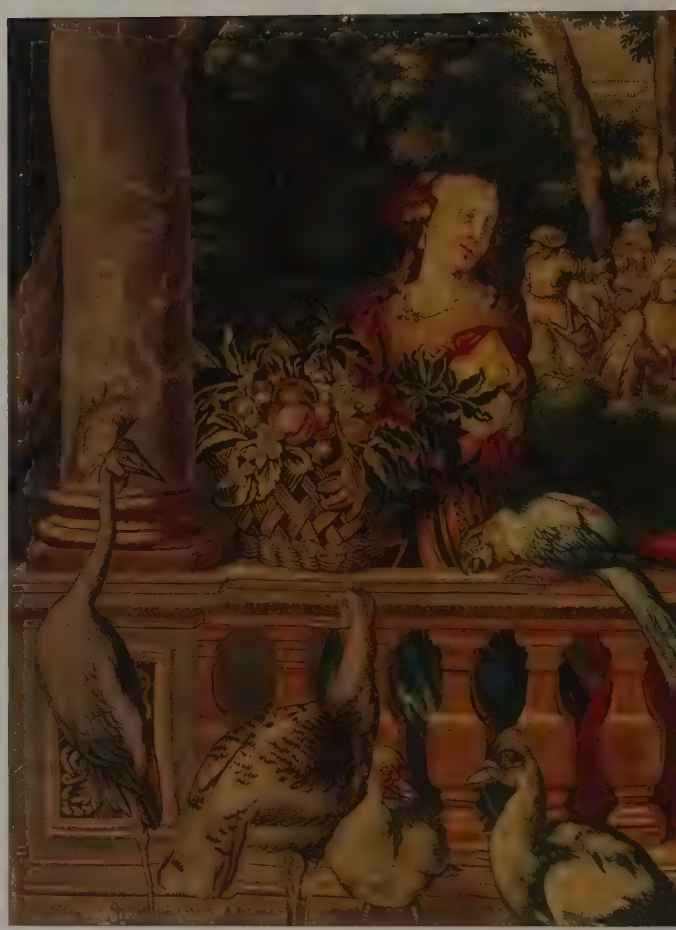
Although most natural dyes come from plant sources, some of the historically important dyes were derived not from plants, but from shellfish and insects.

A purple dye from shellfish of the *Murex* and *Purpura* genera produced a color known as Tyrian or Imperial purple. This dye color was highly valued by the inhabitants of the Greco-Roman world, and during the Roman Empire the color purple was regarded as a symbol of luxurious living. Although the shellfish inhabited the Mediterranean, the Indian Ocean, and the Pacific coast in South America, the Phoenicians are generally credited with having discovered this source of purple dye, probably before 1,000 BCE, and they founded dye works and trading stations around the Mediterranean. However, some evidence indicates that the use of shellfish purple was probably known as early as 2,000 BCE in Crete. Recent research also suggests localized use of mollusk purple from the Bronze Age onward in northern Europe.

Pliny the Elder wrote that the use of shellfish purple in Rome dated from "earliest times" and gave details for its use. One method of extracting the purple dye color, as described by Pliny, included removing the dye-bearing gland from the shellfish and then soaking it for several days in a strong salt solution. Unmordanted yarn or cloth was then dipped and soaked repeatedly in this dye solution for several hours at a time, and the purple color developed on exposure to light.

Even in Roman times this purple dye was very expensive, as vast quantities of the

below *The purple-producing mollusks are gathered from rocks. The clear dye liquid is squeezed from the living organisms onto fibers, which turn purple in the light.*



above *In many old tapestries, grass often appears blue because the yellow dye color, which was used with blue to make green, has faded.*

shellfish were required to produce relatively small amounts of dye matter. Not surprisingly, the number of shellfish dwindled and today all that remains of this once-thriving industry, which brought great fame and wealth to these Phoenician cities, are layers of crushed murex shells on long stretches of beach around the ancient cities of Tyre and Sidon in Phoenicia, now modern day Syria and Lebanon.

Purple shellfish dyeing continued on a somewhat smaller scale in the Byzantine world, but after the fall of Constantinople in 1453, the entire production of this Tyrian purple shellfish dye industry was lost, together with much of the accumulated knowledge of dyeing fibers with this natural ingredient.

Contemporary use of shellfish purple

Today, the use of shellfish purple as a dyestuff still survives in a few coastal areas in Oaxaca, Mexico. At certain times of the year, the rocks are covered with mollusks, which are removed one-by-one and gently squeezed until they eject the thick dye liquid directly onto the materials to be colored. This liquid is initially colorless, but the purple develops on the fibers upon exposure to light. The mollusks are then returned to the rocks until required once again to give up their precious fluid. Needless to say, liquid from many thousands of shellfish is needed to dye even one skein of yarn, so this purple shade is highly valued.

Natural dyes from insects

During the Middle Ages, the scarlet color known as kermes and obtained from scale insects was as important as Tyrian or Imperial purple had been in the ancient world. Large numbers of the insects were laboriously collected from the leaves of oak trees, on which they feed, from around the Mediterranean and were then dried for use as a dyestuff.

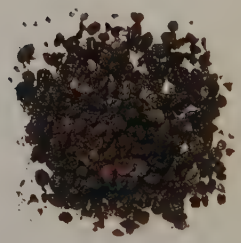
These insects feed specifically on the leaves of the kermes oak (*Quercus coccifera*) and the holm oak (*Quercus ilex*) and the red dye is contained in the female's egg sac. Today, kermes red is rare. It is sometimes used locally for dyeing in Mediterranean areas where it is found, but it is rarely available commercially on a large scale to the craft dyer.

In southern and Southeast Asia, red lac dye was also obtained from scale insects, which feed mainly on fig and acacia trees. It was used in India for centuries but was not exported to Europe until 1796. The insects secrete a sticky resin and it is this resin, known as lac, that contains the red dye. The resin is also used to make shellac for varnish. The dye is sometimes known as sticklac, because it often contains small pieces of twig from the host tree as well as the dye resin.

The most important insect dye is cochineal, a substance that comes from the bodies of female insects of the *Dactylopius* species, which live on prickly pear cactus.

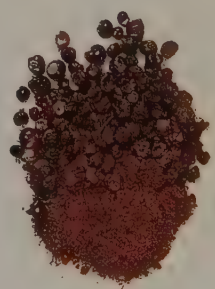
From around 1,000 BCE, cochineal was used in South and Central America. Once the sea routes to the Americas were discovered, cochineal became available in Europe in the 16th century. It quickly replaced kermes red, because of its much stronger coloring power. It was used to dye certain military uniforms scarlet, and has more recently been used to color food and also cosmetics.

Cochineal is still available from specialist suppliers and comes both from South America and from the Canary Islands, off the northwest coast of Africa, where it was introduced as a commercial crop in the 19th



above *The strong tinctorial properties of cochineal red, made from the dried bodies of female insects, made it more successful as a dye than kermes red.*

above *The red dye produced from the lac resin secreted by scale insects was well known in India for centuries but was not introduced to Europe until 1796.*



above *The egg cases of the female insects of the genus* Kermes *offered a rich source of red dye until it was replaced by the superior cochineal red.*

above *Turkey red was the most famous shade produced from madder plants. It was used extensively to dye cotton, as this discharge print c.1860 shows.*

century. As with other insect dyes, cochineal is a very expensive commodity, since many thousands of insects are required to make a relatively small amount of dye.

Dyes from plants

The plant world is rich in sources of color, which may be extracted from flowers, leaves, barks, roots, heartwoods, fruits, and seeds. Sometimes the whole plant top may be used in the dye pot, or only one part of the plant may possess coloring properties.

The most common colors from plants are yellows and tans, and sources of these shades have always been abundant. In fact, the problem sometimes can be how to avoid them. Although yellow is the easiest color to obtain, it is also the one that tends to fade most quickly. Indeed, on some old tapestries the grass often appears as blue as the sky because the yellow, which was used to create a green when overdyed with blue from indigo or woad, has disappeared entirely and only the blue remains.

Interestingly, although green is the most common color in the natural world, a true grass green is almost impossible to achieve from a single plant dye. This is why such greens were, and still are, made by overdyeing yellow with blue or blue with yellow.

Valuable plant dyes

Due to the scarcity of plants producing red and blue dyes, any plants capable of producing shades of red or blue were of great value to dyers. For this reason (and also because of their good fastness to light and washing) madder, indigo, and woad became some of the most important dyestuffs.

Indigo and woad contain the same blue coloring matter, but indigo eventually superseded woad because the dye is available in much higher concentration in indigo leaves. Both indigo and woad are relatively easy to grow, and indigo-bearing plants occur in various forms around the world.

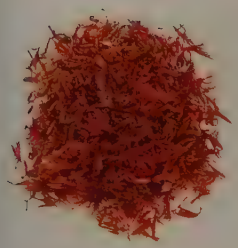
Sources of red plant dyes

Plants in the madder family, or related species, provided sources of red dye in many parts of the world, and madder is one of the simplest dye plants to cultivate. One of the techniques surrounded by mystery was the dyeing of Turkey red, which was the most famous shade produced from madder. Turkey red was a color of great brilliance, with excellent fastness qualities, and was used extensively to dye cotton. It is the most complex dye known, and the chemistry behind the processes involved has never been fully fathomed. The technique is called Turkey red because it was developed in India, and in the 18th century was brought to Europe, by way of Turkey.

Turkey red required as many as 20 different processes over a period of several months, and included not only madder but ingredients such as animal dung, rancid oils, soda ash, tannin, alum, and ox blood.

Another red dye, known as brazilwood and originally mainly from India and the East

opposite *This simple design on black is a Bokolanfini mud cloth from Mali. A mud-based solution, rich in iron, is painted on with a stick to the cloth dyed in leaves and bark with a high tannin content. On contact, the iron fixes to produce black.*



above *Safflower petals were used by early Egyptian dyers to produce red and yellow colors.*

Indies, comes from trees of the species *Caesalpinia*. Its importance is illustrated by the fact that it gave its name to the country Brazil. Brazilwood is still available commercially.

Safflower, used by the early Egyptian dyers, is remarkable in that both a yellow and a red color can be obtained from its tiny petals. It was used until the 20th century to dye the tapes that were used to secure British government and legal documents – hence the term "red tape."

Purple plant dyes

Purple is not a color found in many plants, although it is possible to obtain shades close to purple from the roots of madder and dyer's alkanet. Purples were usually made by overdyeing pinks and reds in blue obtained from indigo or woad. However, a purple dye known as logwood can be obtained from the tree *Haematoxylon campechianum*, which grows in parts of South America and the West Indies. Logwood was one of the most important dyes introduced into Europe following the discovery of the sea route to the Americas. However, early problems in finding ways of applying it to produce lightfast colors led to its prohibition in England from 1581–1662. When combined with iron, logwood was useful in dyeing black. It was used commercially for this purpose until the mid-20th century. Today, logwood heartwood can be bought from specialist dye suppliers.

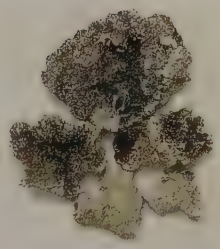
Lichen dyes

For at least 2,000 years, lichens have been a source of both purple and red dyes. These organisms are composed of fungal and algal partners that have a symbiotic relationship.

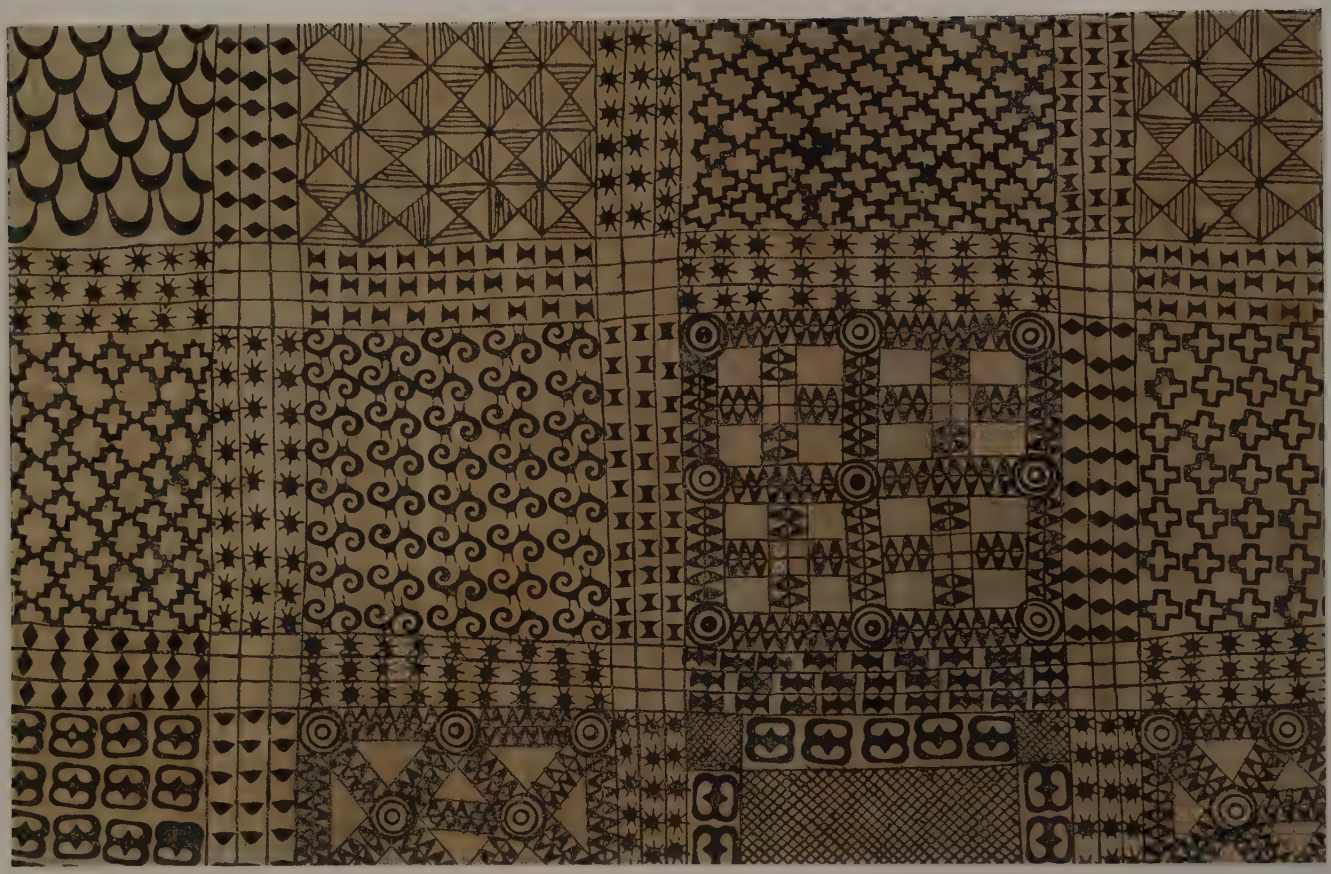
The purple dye compound found in lichens, known variously as orchil, cudbear, or orsallia, depending on its source, can be applied without a mordant. It is produced by steeping certain lichens (notably species of *Roccella*, *Ochrolechia*, *Umbilicaria*, and *Lasallia*) in a solution of ammonia. In the past, urine was traditionally used instead of ammonia.

Application of natural dyes

In some parts of the world, natural dyes are still used to color traditional textiles. Tannin from plant sources is commonly mixed



above *This shows the lichen* Ochrolechia tartarea *in its unprocessed state, before the purple dye has been extracted.*



above *An example of traditional Adinkra block printing from Ghana.*

together with iron to make black. Some interesting examples of this technique can be found throughout Africa.

Along the Ivory Coast, for example, Korhogo cloths, which have traditional designs in black, were used in religious ceremonies. These designs were painted on the fabric with a knife, stick, or quill, using a black dye made from a combination of iron-rich mud and tannin from plants. The designs were originally painted on the outside walls of religious houses, but because weathering often caused them to wear away, they were applied instead to cloths, which could be brought out and hung up for religious ceremonies.

In Ghana, the black dye used in traditional Adinkra block printing was made from a combination of iron slag and tannin from leaves, which were boiled together until a thick consistency was obtained.

below *A Bai woman washing excess indigo dye from a batik near Er Hai Lake, Dali, Yunnan province, China.*

Discharge dyeing

The well-known Bokolanfini mud cloth of Mali is particularly fascinating because it involves discharge dyeing, a process that involves removing some of the color as well as using tannin and iron. The cloth is first dyed yellow in a solution made from the tannin-rich leaves and branches of niginam trees. The yellow color is an unwanted result of this process, and is later discharged.

An iron solution is prepared from water that is mixed with iron-rich mud from dried-up ponds. This solution is then applied with a stick to outline the designs. The iron combines with the tannin on the cloth to make a black color. The areas around these designs are then

filled in with the iron solution, resulting in yellow designs on a black background.

To restore the yellow designs to their original white color, a discharge solution, known as "*Savon de Sodani,*" is applied. This is made from ground peanuts, caustic soda, millet bran, and water. The cloth is left in the sun for several days to dry, and then the discharge solution is washed off, leaving white designs on a black background.

Block-printed textiles

Among the fabrics from the Indian subcontinent, which were greeted with such wonder and admiration in 17th century Europe, were painted and block-printed textiles. The design outlines of these fabrics were first made using tannin plus iron. More complex patterning processes followed. These included the use of intricately carved wooden blocks to apply thickened mordant solutions to various areas before the fabric was immersed in the madder dye bath. If indigo was to be used, all the areas to remain undyed by indigo had first to be covered with a resist of paste or wax.

Other design elements were sometimes painted on by hand. The Ajarakh fabrics from North India and Pakistan are remarkable in that the designs are applied with equal skill to both sides of the cloth.

Ikat dyeing techniques

Ikat is another of the dyeing techniques used in the Indian subcontinent. It is also used in other parts of the world, including Southeast

above *Wood blocks were carved with intricate patterns and used in printing to apply thickened mordant solutions to fabrics.*

below *A fine example of an Indian Mughal carpet dating from the 17th century.*

above *An 18th century Indian chintz has an exquisite floral pattern on a spot background.*

opposite *These silk and cotton fibers were resist dyed before being woven to create stunning effects on these ikats from Central Asia (1850–1880).*

Asia, Japan, South America, Central Asia, and Africa. The term comes from the Malay word "mengikat," meaning to bind or tie, and describes the technique whereby pre-determined patterns are produced from warp and/or weft threads, which have been resist-dyed before the weaving is begun.

The process is long and laborious, and requires great precision, patience, and skill, but the effects can be quite stunning.

Other resist techniques for producing patterns have been in use all over the world for thousands of years, and are more ancient in origin and more widespread geographically than surface printing on textiles. Many of the earliest textile finds show evidence of tie-dye and clay-, wax-, or paste-resist. Examples of batik and tie-dyeing from Peru have been found, some dating from c.900 BCE. Textiles from Egyptian burials of the 5th and 6th centuries AD show evidence of wax- or clay-resist patterns, and resist-dyed silks, possibly from China and dating from the 6th century AD have been found at various excavations in Asia. For these techniques to be successful, the areas of fabric to remain undyed may be covered with a resist of clay, paste or – in the case of batik – wax. Designs may also be made by tying or stitching parts of the cloth with thread before dyeing. Sometimes small stones, shells, or seeds are tied in to make shapes. These methods of patterning are often used in indigo dyeing.

The Yoruba women of Nigeria are famed for their indigo-dyed adire cloths, which have patterns that are made either by stitched resists or by applying flour paste resist, to make pale designs on a dark background.

Blue prints

In many areas of Europe, "blue prints" were part of the textile tradition. The term is misleading, since it was the resist paste, not the dye, that was printed on with blocks before the fabric was placed in the indigo vat. Sadly, blue printing on a large scale has almost died out.

The experience of using ancient dyes and techniques forges a link with the traditions of the past. However, the greatest pleasures lie in gaining in-depth knowledge of the rich and diverse colors that nature has to offer. This book is simply the beginning of a rich and colorful journey toward discovering the potential of plants as sources of beautiful dyes.

HOW THE COLOR SWATCHES WORK

The Dye Plant pages guide the reader to the plants they may wish to use as dyes. Information is given on how to cultivate and harvest the plants, how to extract the dye color, and how to apply the color to fibers. A standard set of color swatches for each plant entry is based on the results the dyer is likely to achieve on fibers when using: the dye color alone; alum as a mordant before dyeing; iron as a modifier after dyeing; and an alum mordant and an iron modifier. Using other mordants and modifiers will extend the range further.

Dye symbols
These show if the dye, mordant, modifier, or all three are used.

Dyeing Techniques

Experimenting with color

Using natural dyes from plants is a miraculous way of bringing the colors of nature into everyday life. The seasonal colors can be replicated on yarns and fabrics, and demonstrate the rich variety of wild color that nature has to offer.

Sources of wild color are not difficult to find, even if you do not have a garden or regular access to the countryside. Local parks and municipal gardens can provide the dyer with useful materials, and most park keepers, if asked, will be willing to let you collect the prunings from shrubs, the faded blooms that have been removed, and the plants that have been uprooted to make way for the next season's floral display. Fallen leaves and acorns and walnuts, which often litter the ground beneath trees, can all be gathered for the dye pot. Waste materials – such as onion skins or the green leafy tops of carrots – give beautiful colors, and the daffodils and dahlias bought as cut flowers can be put to good use when they fade.

All these provide a starting point for dyeing experiments, but eventually most dyers will want to discover the more extensive colors that traditional dyes have to offer. Indigo for blues, madder and brazilwood for reds, and logwood for purples, can all be purchased from specialist suppliers and will bring a wider color spectrum to your dye pot. For keen gardeners, madder for reds and some sources of blue, such as woad, are not difficult to grow. Dyeing one color on top of another creates even more shades and the possibilities become endless.

There are many ways of approaching the craft of natural dyeing and only a few hard and fast rules. Each approach has its advantages and disadvantages, and no one method is better than another. The "right" method is the one that works best for each individual and his or her situation. The elements of personal choice and preference are part of the charm and fascination of dyeing with plants and each dyer has favorite dyes and methods.

Most dyers revel in the diversity and occasional unpredictability of the results, and await the outcome of each dyeing session with eager anticipation. However, there may be times when surprises, no matter how pleasant, are not welcome and the color result needs to be more reliable and consistent.

Predicting colors and even repeating or matching them is possible, if less fun. Dyers who need to be precise in their approach will develop their own tried and tested methods and recipes, and tend to stick to a limited number of dyes that they know really well. Some of the traditional dyes – such as madder, logwood, brazilwood, and indigo – can usually be relied on to produce consistent colors, if the same recipes are followed each time. This is how the master dyers of the past would have approached their craft, because they needed to be able to guarantee that they could produce consistent results; each dyer often specialized in the use of one dyestuff.

For many, the magic of dyeing with plants lies in the infinite variety of the results: the leaves gathered from apple trees in spring may produce bright yellows one year and mustard tones the next. It is this unpredictability that delights so many craft dyers.

Color results

Dyers in different regions may get different shades from the same plants, because the mineral content of tap water varies from area

left *The conditions under which the plants are grown and when they are harvested often influence the color result. Leaves from fruit trees are particularly sensitive. Here, skeins dyed with fruit tree leaves picked in spring, summer, fall, and late fall yield a range of honey tones.*

to area. Indeed, dyers have been known to import water from another area in order to achieve a particular color.

There are many other variables, including the conditions under which the plant was grown, when it was harvested, whether it was used fresh or dried, and how long it was simmered to extract the dye color. Some dyes can be applied successfully without heat, while others require prolonged simmering in the dye pot before a strong color is achieved. Some plant materials may benefit from being soaked in water for several weeks before use; others may release enough color for the dye bath by simply having boiling water poured over them. All these factors can influence the colors each plant material produces.

Dyeing methods

Some people choose not to use chemicals – such as alum, copper sulfate, and iron mordants – to fix dye color to the fibers, and may use dye pots made of aluminum, copper, or iron instead. Some people add mordants to the fibers before the dyeing process while others prefer to add the mordant (to fix the color to the fibers) to the dye bath. There are those who decide to use only natural plant materials – such as rhubarb leaves or tannin from oak galls – as color fixatives, and create color variations by adding homemade mineral solutions to the dye bath. All these are valid methods if they provide the dyer with the desired color result.

Each method of applying the dye color will result in a variation of shade, and the freedom to experiment with different methods enhances the pleasures of the dye pot. The available literature on dyeing with plant materials offers a wealth of varying advice and instructions, but the important thing is to be guided by your own dye experiments.

Experimenting with color

Do not be afraid to experiment, and do not be deterred by fear of failure. Dyeing is very much like cooking, and the addition or omission of one ingredient or process can often produce a satisfying result.

Whatever experiments are undertaken, it is vital to keep a record of the quantities of dyestuff used and the method, so the experiment can be repeated if the color result is satisfactory.

The best approach to natural dyeing can be summarized as follows:

First, any plant that produces the desired color result, and that has the necessary degree of light- and washfastness is a good dye plant. And second, any dye method that produces good results without endangering people or the environment is worthwhile.

Using chemicals

Although there are many aspects of natural dyeing where personal choice plays an important part, safety is not one of them. There are several hard and fast rules that must be followed when dyeing fibers and fabrics to prevent accidents. Most of these rules are just common sense.

In our daily lives, we have become accustomed to dealing with substances for household cleaning that are potentially harmful. These must be kept well away from children and pets, and treated with caution as a matter of routine. Most of the plant materials and additional chemicals used in dyeing are no more harmful than household bleach, disinfectant, or cleaning materials, and many of them are less so.

By knowing and understanding the implications of the ingredients in the dye pot, and avoiding anything you are unsure about, dyeing fibers with natural plant colors can be an enjoyable activity rather than one fraught with anxieties.

The safety guidelines outlined below will help the new or experienced craft dyer to take the appropriate measures when dyeing skeins of animal and vegetable fibers, lengths of fabric, and other natural objects such as shells, pebbles, handmade paper, reeds for basketry, and pieces of wood at home.

SAFETY GUIDELINES

- Store all dyes, mordants, assistants, and modifiers in clearly labeled glass or plastic containers, and keep them well away from children, pets, and food storage areas.
- Handle all substances with care, as some mordants and dyestuff are poisonous or irritative. Make sure that you know which these are.
- Do not eat, drink, or smoke when carrying out any of the processes involved in mordanting and dyeing.
- Reserve pots, containers, strainers, and all other equipment especially for mordanting and dyeing, and make sure they are labeled. Never use the same pots and equipment for food preparation or storage.
- Put a lid on the pots when in use to avoid inhaling any steam or fumes, and do not exceed simmering point 190°F (88°C) when mordanting fibers or fabrics.
- Rubber gloves, an apron, a mask, and protective eyewear are all recommended.
- Use pot holders when handling hot pots.
- Always work in a well-ventilated area. Outdoors, under a covered porch, or in a shed or garage is better than the kitchen.
- If you have to work in the kitchen, never prepare or handle food at the same time. Clear all work surfaces and cover them with sheets of plastic or thick absorbent paper. Make sure all spills are mopped up immediately, and wash work surfaces thoroughly after use. Avoid using any poisonous substances.
- All fine powders, whether toxic or nontoxic, are potentially harmful if inhaled, so remember to wear a dust mask when using powdered substances.
- Seek medical advice if any substances come into contact with your eyes.

Take particular care with the following:

Alum (Aluminum sulfate, aluminum ammonium sulfate, aluminum potassium sulfate, aluminum acetate). These are irritants and are harmful if ingested.

Iron (Ferrous sulfate, "iron liquor"), used as a mordant or modifier, is harmful if ingested.

Copper (Copper sulfate, "copper liquor"), used as a mordant or modifier, is toxic, so handle with extreme caution.

Color run remover, sodium hydrosulfite, and thiourea dioxide, used in indigo dyeing, are harmful if ingested. Follow the instructions and do not allow them to become wet, as they generate heat when damp and could catch fire.

- Remember, even some natural materials, such as rhubarb leaves, are poisonous.

Equipment for dyeing

Much of the equipment needed for natural dyeing can be purchased quite inexpensively at hardware stores or bought secondhand. Remember to label each item as a dyeing utensil and store it well away from cooking equipment.

Before you begin dyeing fibers and fabrics with natural plant dyes, you will need some basic gardening equipment to gather the plant materials. These include a trowel (A) and fork (B) for digging up roots, a pair of pruning shears (E) to cut leafy shoots and flowers from trees and shrubs, a collecting basket (F), and gloves (G) to protect your hands from thorns and nettles.

Drying and storing plant materials

Many plant materials can be dried as well as used fresh, and are best stored in paper sacks (D) or cardboard cartons, out of daylight; plastic bags should be avoided, as the air cannot circulate inside the bag and so the plant materials are more likely to rot. Garden string (C), old net curtains, or a hanging rack are also useful for hanging up the harvested plants so that they dry out thoroughly.

Basic equipment

The following equipment is recommended for the natural plant dyer, but beginners only really need a source of water and heat, a dye pot, the dyestuff, and the natural fibers, skeins of yarn, or fabrics to be dyed.

A camping stove, portable electric ring, or a hotplate (1) are the best sources of heat for developing colors in the dye bath, but make sure the stove is stable enough to support the weight of a full dye pot. Avoid using the cooking stove, so that areas where food is prepared do not become contaminated. A source of water is also essential, as fibers and fabrics need plenty of wetting and rinsing during the dyeing process. Fresh running tap water is best but rainwater can also be used. Buy pH papers (see p.28) to check the acidity or alkalinity of the water, as this can influence the color results.

For mordanting and dyeing fibers, you will need large, heatproof pots with lids (2). These should be able to hold about 3–4 gallons (14–18 liters) of liquid and should preferably be made of stainless steel. Three or four smaller heatproof stainless-steel pots (3) are also useful for using color modifiers. The pans sold as pet-food bowls are ideal. For soaking plant materials to extract the dye color, and for rinsing fibers, you will need several medium-sized bowls or buckets (4). Large, lidded plastic buckets are useful for indigo and woad dyeing (see pp.54–57), while plastic food containers or glass jars (5) are suitable for storing leftover liquids. Stainless-steel tongs (6) and long-handled spoons (7) are ideal for stirring dye baths and adding or removing fibers or fabrics from the dye pot. A heatproof glass measuring jug (8) is ideal for dissolving mordants and color modifiers in boiling water. Kitchen scales are needed for weighing dyestuff and fibers so you can calculate the amount of dye to use.

A wire-mesh strainer (9) or colander (10) will help you strain off the dye liquid once the dye color has been extracted from the plant material. Plant materials left in the dye bath may get stuck to the fibers or fabric and cause patchy color results.

When dyeing fibers, wearing rubber gloves, protective eyewear, and an apron is highly recommended. Pot holders are also useful for handling hot dye baths, and a mask prevents inhalation of chemicals.

Lastly, have a supply of plastic tie-on labels and a waterproof marker (11) to identify fibers that have been prepared for dyeing using different mordants and dyeing processes.

left *When gathering and storing plant material, you will need pruning shears (E), gardening gloves (G), a basket (F), and paper sacks (D).*

right *Stainless-steel pots and bowls (2–4), a glass measuring jug (8), a set of measuring spoons (12), long-handled tongs (6), a pestle and mortar (13), and a thermometer (14) are just a few of the items used by dyers.*


5
2
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Testing the pH value of water

The acidity or alkalinity of the water used for dyeing will influence color results. Many people use tap water without realizing that a small adjustment in its pH value will bring a further range of shades to the dye pot.

To achieve subtle color results when dyeing with plants, and to discover the "true colors" of traditional dye plants, it is important to know how to change the acidity or alkalinity of your local tap water. Several natural dyes require particular degrees of acidity or alkalinity to develop fully. For example, with madder dye plants (see pp.124–125) you will never discover the beauty of rich madder reds if the water in the dye bath is too acidic. Acid water will only yield coral or orange shades.

The pH scale is a logarithmic scale used to measure acidity or alkalinity. To check the pH value of your water, purchase a booklet of pH test paper (litmus paper), either from a pharmacist or from a specialist dyestuff supplier. Dip a small piece of paper in water, and wait for the paper to change color. Compare the paper color with the color range on the chart that is supplied with the booklet. This color range is also shown below. pH7 is neutral, while any color reading below seven becomes increasingly acidic, and anything above seven is alkaline.

Although neutral water (pH7) is usually considered best for dyeing natural fibers, water with a slightly higher or lower pH reading of between 5.5 and 8.5 will not affect the resulting dye colors too much.

Changing the pH value of water

Adjusting the pH value of your water or dye bath is easy. To make the dye bath water more alkaline, add a small amount of an alkali, such as washing soda, household ammonia, ground chalk, or wood ash water, and then retest the pH value of the water. Repeat this until the required pH reading is achieved.

To make the dye bath water more acidic, add a few drops of clear vinegar or lemon juice, or a few crystals of citric acid. Then retest the water and, if necessary, add more to achieve the desired reading. As discussed in the section on modifiers (see pp.58–63), adjusting the pH value of the water in the dye bath is one way of extending the range of colors produced by each dyestuff.

Water impurities

Impurities in the dye bath water may also affect the resulting dye colors. Water that runs over mineral beds contains traces of these minerals. Limestone rock makes water more alkaline, and calcium, magnesium, and iron, often present in "hard" water, can cause spotting or unevenness on the dyed fibers.

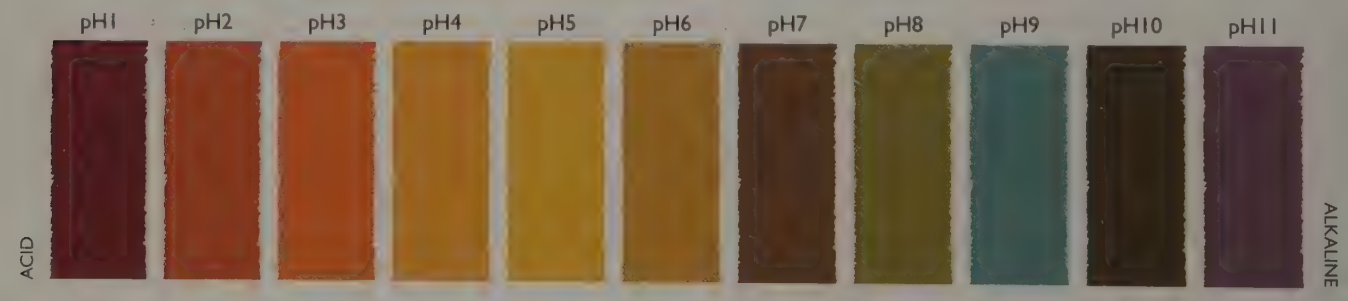
Some dyers prefer to use fresh rainwater as their water source, although nowadays there is no guarantee that this will necessarily be purer than tap water. For bright, clear colors, rainwater is best collected in a plastic container, as the tannin in some of the woods used for wooden barrels may leach into the water and result in darker dye colors. However, as tannin also acts as a dye fixative, its presence could be beneficial.

Rinsing fibers in neutral solutions

It is also important to make sure that the dyed fibers are rinsed and washed in neutral solutions or in solutions that have a similar pH value to the dye bath water, otherwise the colors may change again.

Dishwashing liquid is perhaps the best medium for washing dyed fibers. Many of the dishwashing liquid products on the market are neutral when in solution. Some actually state that they are "pH neutral" on the container, and it may be worth looking out for these.

Some dyers, however, use soap flakes for washing dyed fibers. Soap flakes are usually alkaline, unless the label indicates otherwise, and while they are suitable for washing fibers dyed in an alkaline dye bath, they may alter colors that have been dyed in an acidic bath.



pH1–4 *A result in this color range on the test paper indicates that the water is acidic. To make the water neutral or alkaline add one of the following alkaline ingredients in small amounts and then retest the pH value of the water:*

- *Washing soda*
- *Household ammonia*
- *Ground chalk*
- *Wood ash water*

pH5–7 *Neutral water (pH7) is the most suitable water for dyeing with plant materials. However, a pH reading between 5.5 and 8.5 is considered "safe" and will not significantly affect the resulting dye colors. Neutral water should also be used for rinsing and washing dyed fibers, before and after dyeing, otherwise unwanted color changes may result at this stage.*

pH8–11 *A result in this color range on the test paper indicates that the water for the dye bath is alkaline. To make the water neutral or acidic, add one of the following acidic ingredients in small amounts and then retest the water until the desired pH value is achieved:*

- *Clear vinegar*
- *Lemon juice*
- *Citric acid crystals*

Choosing items to dye

Many people use plant dyes to color textile fibers. These can be added to the dye bath as unspun fibers, as skeins of yarn, or as lengths of fabric. Other natural materials that can be dyed include wood, pebbles, and shells.

The main factors that determine what can be dyed with natural plant dyes are the amount of liquid the dye pot will hold and the fact that nothing larger than a 3–4 gallon (14–18 liter) pot will fit on a portable stove. For this reason, long lengths of fabric may be difficult to dye at home, and the color result may be uneven or patchy if the fabric is squashed into too small a dye bath. Intentionally folding and crumpling fabrics into the dye pot, however, can create some wonderful effects.

Dyes from plants can be successfully applied to most natural materials, including reeds and stems for basketry, paper, leather, wood, shells, bones, and stones. It is always worth adding experimental items to sample dye baths and testing new dyestuff on a range of different materials. For example, an old clear glass bottle placed in a red madder dye bath produces a dark red glass because the mineral deposits on the surface of the glass absorb the dye color.

Although some books do not recommend using natural plant dyes on synthetic fibers because they do not take up the color well, this is not always the case. Lengths cut from old nylon stockings or tights and used as ties to hold skeins of fibers together in the dye pot can sometimes absorb the dye color better than the fibers themselves. Similarly, the plastic buttons on garments dyed in an indigo vat occasionally dye a much deeper blue than the garments. To find out how well any object, natural or synthetic, will take up natural dye color, simply add it to the dye bath and see.

below *Mother-of-pearl buttons, pieces of driftwood, reeds for basketry, handmade paper, and skeins of natural fibers are just some of the items that take up dye color successfully.*

Animal and vegetable fibers

Natural textile fibers are classed as animal or vegetable in origin, and fibers from each group are prepared for dyeing in slightly different ways. Most fibers can be dyed in their raw state (shown here), but skeins of yarn are easier to manage.

Most craft dyers use plant dyes on natural, rather than synthetic fibers. Natural fibers fall into two groups -- animal fibers, which are based on protein, and vegetable fibers, which are based on cellulose.

Animal fibers

The animal fibers most commonly used by dyers are wool and silk. Other animal fibers include mohair, alpaca, and camel hair. Wool is probably the fiber most frequently used by beginners because it is readily available, easy to prepare, and can be relied upon to absorb most dyes well. It can be dyed in any form. Unspun fleece is often dyed for use by feltmakers or handspinners, and skeins of wool are dyed by weavers, knitters, and embroiderers. Woolen fabrics can also be dyed successfully. Natural dyes are very effective on silk, which is also easy to dye and reacts well to natural dyes, as long as the processing temperatures are not too high. Mohair, alpaca, and camel hair are less frequently used but also absorb dye without problems, although mohair has a tendency to become matted unless it is handled gently.

Vegetable fibers

Cotton and linen (from flax) are the vegetable fibers most commonly used by dyers. Other vegetable fibers include ramie, hemp, raffia, sisal, and jute. All of these fibers absorb dye well, although the preparation processes may take a little longer than with animal fibers. Cotton is occasionally dyed in its unspun state by handspinners but, in general, vegetable fibers are usually dyed in the form of skeins of yarn or lengths of fabric. Cotton or linen are available in natural cream or beige, or in bleached white. Both types can be dyed successfully, but unbleached materials often produce deeper, richer shades.

right *Animal and vegetable fibers in their raw state must be washed thoroughly in cleanser and rinsed well to remove natural grease and dirt before they are dyed with plant materials.*


RAMIE
CAMEL HAIR
SILK
WOOL
ALPACA

Absorption of dye colors

The way in which different fibers take up dye color depends not only on the group of fibers to which they belong, but also on the form, density, and general structure of the individual materials being processed.

Protein-based and cellulose-based fibers have different molecular structures and are not prepared for dyeing in the same way. As a result, they absorb the dye colors differently and often produce different shades from the same dye bath. Silk does not always dye the same shade as wool, although both are animal fibers, and even fibers of the same group and type often take up dye color in varying ways.

A piece of thick woolen felt may appear a deeper color than unspun woolen fleece or a skein of wool, although both were treated in exactly the same way and dyed in the same dye bath. This is because the structure of the felt is denser and more compact than spun or unspun wool, and there are more individual fibers for the dye to adhere to. Similarly, a length of tightly woven cotton may appear a darker shade than a loosely woven piece of cotton muslin. A gossamer silk fabric will dye a paler shade than a skein of thick, tightly spun silk yarn, and materials made from lustrous white silk yarns will appear brighter and clearer than those made from natural raw silk.

Unbleached linen, which is often lustrous, frequently dyes a much deeper, richer shade than white, bleached linen, which is often more matte in appearance.

Test samples

When using dyes for the first time, it is a good idea to test them on a range of samples from each fiber group. For these tests you can put all the samples in the same dye bath.

However, if you want to dye larger quantities of fibers for a particular project, it is better not to mix animal and vegetable materials together in the same dye bath. Animal fibers tend to absorb the dye color at a faster rate than vegetable fibers. If materials from both groups are dyed together, the animal fibers may take up most of the dye

right *Swatches of dense and fine-weave silk, cotton, linen, and wool fabric together with their skeins were dyed with annatto seeds. The denser materials produce deeper colors.*

LINEN

WOOL

color before the vegetable fibers have had a chance to absorb their share. Also, vegetable fibers can be dyed successfully – and often better – at lower temperatures than animal fibers. Therefore, if you want to dye large quantities of both animal and vegetable fibers, prepare the dye bath in the usual way, and then divide the liquid between two dye pots – one for each fiber group.

These varying natural tendencies can be exploited to create special effects by using yarns or fabrics that are composed of a mixture of different fibers. These may include mixtures of silk and cotton, silk and linen, or wool and silk. Wool and mohair mixes also often produce attractive effects, as mohair does not always react to the dye in the same way as wool. Mixtures of natural and synthetic fibers may often produce interesting results, because the synthetic component of the materials usually dyes a paler shade than the natural fibers, and will sometimes not absorb any dye at all.

The success of the effects of dyeing fiber mixes depends to some extent on the way the fibers have been blended together. Some of the most exciting yarns are produced by handspinners, who can mix the fibers in any way they choose, either when they prepare them for spinning or as they spin them. Handspinners can also spin two yarns, each of a different fiber, and ply the two together to make a yarn composed of the two fiber elements. Weavers, too, can create their own fiber mixes as they weave, and feltmakers often add fibers of other types, such as raw or unspun silk or cotton, to their fleece during the feltmaking process.

The orange samples of wool, silk, cotton, and linen shown on these pages were all dyed in the same dye bath, made from annatto seeds (*Bixa orellana*, see p.77). The materials were thoroughly cleaned and wetted before being added to the same cool dye bath, and left to soak in the dye liquid overnight, without any application of heat. The samples of fabric were then removed from the dye bath, rinsed well, and washed briefly before drying. The results show that the thicker, denser materials appear slightly darker orange in color. This clearly demonstrates that different types of fibers absorb the annatto dye color from the dye pot in varying ways.

Preparing fibers for the dye bath

Before being mordanted or dyed, all textile fibers must be thoroughly cleaned and rinsed, otherwise the dye color may be applied unevenly. Yarns also need to be wound into skeins before any further processing can take place.

Before mordanting or dyeing, ensure that all fibers and fabrics are absolutely clean and free from dirt, grease, natural oils, and any chemical residues from industrial processing. This treatment is sometimes called "scouring." It is crucial to successful mordanting and dyeing, because grease or dirt particles will prevent the full and even penetration of whatever is applied to the fibers. If there is any grease left on the fibers when they are mordanted, the mordant will not be able to penetrate through to the fibers and the mordant will come unstuck when the fibers are rinsed. This will result in uneven coloration when the fibers are dyed. Similarly, if any grease remains on the fibers when they are dyed, the dye color will stick to the grease and then either be washed off, or rub off on your hands. Most of the uneveness problems in dyeing can be traced back to inadequate scouring of fibers.

It is crucial to wet fibers thoroughly before mordanting or dyeing, otherwise patchiness may result because different sections of the fibers will absorb the mordant or dye liquid at different rates. It is a good idea to soak all fibers overnight in clear water. This will also give you a better idea of how much liquid the fibers soak up and therefore will indicate how much liquid the fibers need to move freely in the pot. Whatever process you are carrying out, the fibers should always be submerged in the liquid and be able to move freely. Too little water in a large dye pot or too many fibers in a small pot can only lead to uneven dyeing.

Washing temperatures

Animal fibers cannot tolerate sudden changes in temperature, and may be damaged if plunged straight from hot into cold liquids and vice versa. Never pour very hot water straight from the tap or kettle onto animal fibers. If the dye bath needs to be simmered to obtain the full color potential from the plant material, first put the fibers in tepid water and then heat them slowly. After the dyeing process, animal fibers should be allowed to cool in the dye pot before they are rinsed in tepid water. Silk, for example, is best processed at slightly lower temperatures than wool and should never be boiled, as excess heat may destroy its luster. Vegetable fibers are more resilient and can tolerate rapid temperature changes, although it is best not to "shock" the vegetable fibers too much.

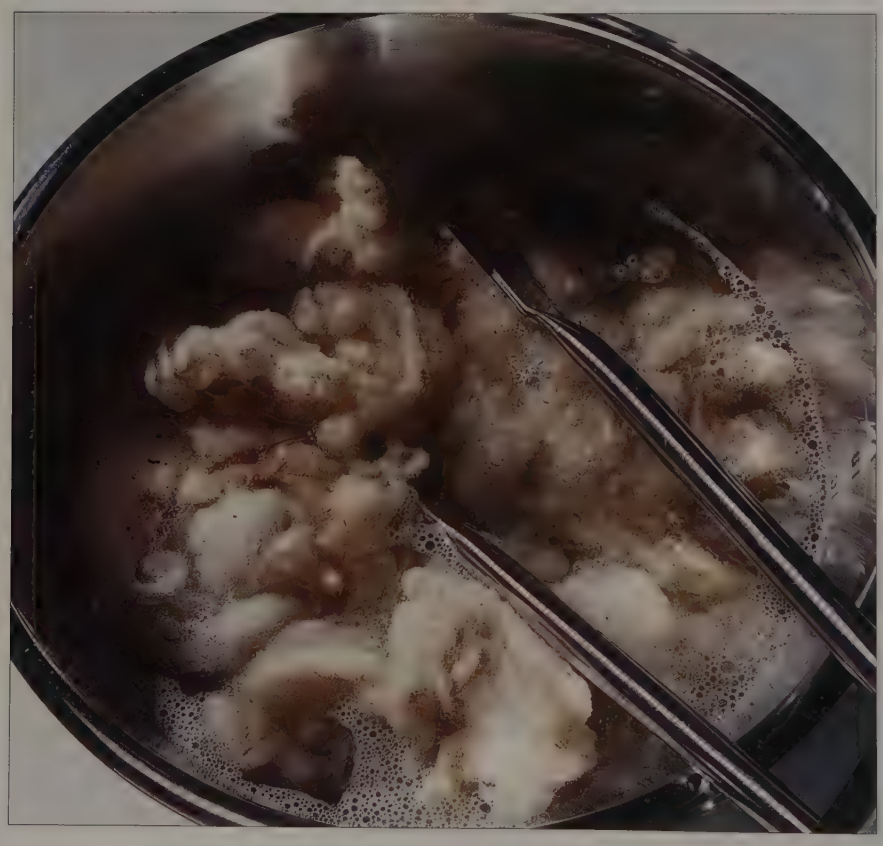
Washing fibers

When washing fibers, just squeeze them gently. Do not handle them roughly or rub them vigorously against one other, as this can cause some animal fibers to become matted. When dealing with unspun fibers of any type, it is better not to handle them at all once they are in the washing solution, because they can easily become tangled into a solid mass. When you rinse the fibers, press them against the sides of the bowl until the water runs clear.

Some materials are sold as "ready for dyeing," but it is always best to wash these anyway, just in case. All commercially-produced cotton yarns must be washed well, as the industrial processing rarely removes all the natural wax and pectic substances. In general, it is wise to routinely wash all materials before processing them further, as it can do no harm and may prevent disappointing results.

If you are dyeing old, used fibers, bear in mind that the dye color is unlikely to make any stained sections less obvious. Indeed, it often simply serves to accentuate them. So if fabrics are badly stained, it may be wise not to use them for dyeing.

In the following instructions for cleaning fibers, approximate quantities of cleanser are given according to the amount of water required. It is wasteful and unnecessary to use too much cleaning agent. If the fibers still seem greasy or oily, repeat the cleaning process, using fresh water and cleanser.



left *Soak dirty, unspun raw fleece in a solution of warm water and pH-neutral dishwashing liquid for six to 12 hours, or overnight. Remove the fibers, rinse, and wash and rinse them again.*

Washing ingredients

To clean the fibers, buy either dishwashing liquid or a scouring agent, which can be bought from specialist suppliers. Scouring agent is pH neutral and is used in the textile industry as a cleanser. It is very concentrated, so only use about half the quantity given for dishwashing liquid. As a general rule, two teaspoons of dishwashing liquid or just one teaspoon of scouring agent should be sufficient for 3 gallons (13 liters) of water.

Cleaning animal fibers

For raw, unspun fleece or yarns spun from unwashed fleece, first soak the fibers in a solution of warm water and cleanser for six to 12 hours, or overnight. If the materials are very dirty and greasy, change the water and add more cleanser after about three or four hours. Remove the fibers and rinse them, then wash them again and rinse very thoroughly several times. Do not stir the fibers or treat them roughly during the cleaning process, as they can become matted.

If you are using raw silk that has not had the "gum" removed, gradually heat the fibers in the cleaning solution. Heat them to just below a simmer and keep the solution at this temperature for 30 minutes to one hour, without allowing it to boil. If the silk still appears sticky, repeat the process, before rinsing thoroughly several times.

Wool and silk skeins or fabrics, which do not require the rigorous treatment described above, and all other animal fibers, should be washed well in warm water and dishwashing liquid or scouring agent. They should then be rinsed thoroughly several times.

Cleaning vegetable fibers

Vegetable fibers, such as cotton and linen, should be simmered for at least two hours in a solution of cleanser and washing soda. Use one or two teaspoons of washing soda for every 1 gallon (4. 5 liters) of water.

Cotton contains wax, oil, and pectic substances, and the water will become brown and smelly as these are washed out. It is usually a good idea to wash cotton twice, rinsing well between washes and making a fresh cleaning solution for the second wash. Then rinse thoroughly several times.

If you are washing unspun fibers, try to remember not to stir or agitate them when they are being processed.

Linen does not contain as much oil as cotton does, so it will normally only require one wash.

Winding skeins

When preparing fibers in the form of yarns, first wind the fibers into skeins about 1yd (1m) in circumference. Skeins for test samples, however, can be smaller. Even if all the skeins are to be dyed the same color, it is better to make each one no more than 8oz (250g), as heavy skeins are difficult to work with.

Small skeins for test samples can easily be made by winding the yarn around a hard-backed book. For those without a skein-winding device such as a niddy-noddy, large skeins can be made by winding the yarn around the posts of two straight-backed wooden chairs, placed back-to-back. Tie the end of the yarn to one of the chair posts, then wind it around the chair posts until the skein is the required size. Leave the chairs in place until you have secured the two ends of the skein to each other, and put the ties in place.

Securing the skeins

Once you have wound the skeins, tie the two loose ends of each skein together in a knot, leaving approximately 6in (15cm) to spare at each end. Then pass these ends loosely around the skein and knot them together again. This tie will hold the skein together while the other ties are put in place and will help you to locate the ends of the skein when you want to wind the skein into a ball.

above *Skeins can be made by winding the yarn around a niddy-noddy. Tie one end of the yarn to one of the cross-pieces, then wind it around the niddy-noddy as shown above. Fasten the two loose ends together and finish off with four ties to prevent the skein from becoming tangled.*

To prevent the skein from getting tangled up, tie three or four pieces of white cotton or linen yarn loosely around it. Try not to make these ties too loose or it will defeat the purpose, but do not make them too tight either or the mordant or plant dye color will not be able to penetrate through the ties in the dye bath and the skein will end up with an unwanted tie-dyed effect. Also, bear in mind that many fibers expand when wet.

Wool ties can be used on skeins of animal fibers, but not on skeins of vegetable fibers, as they will not withstand treatment in hot solutions containing washing soda. Cotton and linen ties are much tougher and can be used on all fibers. Use a simple knot rather than a figure-of-eight, as the latter may pull tight and produce an unwanted tie-dyed effect.

Fixing the dye color to fibers

A mordant is a substance that has an affinity with both the materials to be dyed and the natural plant dyestuff. Acting as a bond between the two, a mordant helps the dye to become permanently fixed to the fibers.

The most common chemical mordants used by dyers are compounds of aluminum, copper, and iron. Sometimes chrome or tin mordants are suggested, but they are not included here because they are less safe to handle and more difficult to dispose of safely.

Some natural plant substances – such as the tannin contained in the galls of oak trees (*Quercus* species, see pp.117–118) or in staghorn sumac leaves (*Rhus typhina*, see p.123) and oxalic acid from rhubarb leaves (*Rheum* species, see pp.121–122) – can be used as alternatives to chemical mordants. However, some natural plant substances can be just as harmful as chemical mordants. For example, oxalic acid is dangerous if ingested, so rhubarb leaves should be treated with care.

Some natural plant dyes – for example, those rich in tannin, such as many tree barks, or vat dyes, including indigo (*Indigofera* species, see pp.98–99) and woad (*Isatis tinctoria*, see pp.100–101) – will fix to animal and vegetable fibers without the use of a mordant.

Why mordant fibers?

Even though many plant dyes may color fibers when used without a mordant, the addition of a mordant will often produce much stronger colors on fibers. The fibers will also have the added benefits of increased light- and washfastness. Mordants also have an effect on the colors achieved in the dyeing process, so that the same fibers mordanted in different ways will each produce a different color from the same dye bath: if one skein is mordanted in an aluminum solution, a second in a copper solution, and a third in an iron solution, and then all three skeins are placed in the same dye bath, three differently-colored skeins will result (see pp.62–63).

Mordanting methods

To be most effective, the mordanting process should be carried out before dyeing. This is known as premordanting. If mordanting is done before dyeing, almost all the dye will fix to the fibers, and give better colorfastness.

Storing mordanted fibers

Mordanted fibers can be dried, labeled, and stored indefinitely before use. Furthermore, fibers do not need to be remordanted if a second dye color is applied to fibers that have already been mordanted and dyed. Remember, too, that when dyeing one color on top of another a mordant is required, even if only one of the dyes requires it.

It is a good idea to mordant plenty of fibers in advance, so that you have a supply of mordanted fibers ready for dyeing. Set aside a few days for mordanting, and prepare several batches of fibers with alum, iron, and copper mordants. These mordanted fibers can then be stored until required for dyeing.

Aluminum mordants

Aluminum is the most useful mordant. It can be used on all fibers, and helps plant dyes produce bright clear colors on animal and vegetable fibers. Aluminum mordant is not a poison, but it is an irritant and should be handled with care and not ingested.

The term "alum" is used to describe the following four types of aluminum compounds:

- Aluminum sulfate – this is sometimes sold in garden stores as a soil acidifier. In this form, it may contain iron contamination. If it contains any brown particles, and is not white in color, it should not be used as a mordant.

CHEMICAL AND NATURAL MORDANTS

Chemical mordants are metallic salts of aluminum, copper, or iron, and they can be bought as powder or crystals. They are dissolved in boiling water in a heatproof jug before being added to the mordant pot.

Natural mordants include the leaves of staghorn sumac and rhubarb, and galls from oak trees. Oak galls and staghorn sumac leaves are rich in tannin, needed for mordanting vegetable fibers. Rhubarb leaves contain oxalic acid, and are good for animal fibers. To extract the tannin or acid, simmer the plant materials in water, and strain off the liquid. Oxalic acid is toxic; please see p.44 for safety information.

right *Wool yarns dyed in logwood without a mordant turn beige, while those premordanted with alum are purple. Similarly, unmordanted fibers dyed with madder produce orange and those mordanted with alum turn deep red.*

- Aluminum potassium sulfate or potash alum – this is the form of alum most commonly used as a mordant.
- Aluminum ammonium sulfate – this is sometimes sold as "alum" in pharmacies.
- Aluminum acetate – this is the form of alum used to mordant vegetable fibers and silk.

Copper mordants

Copper can be used on all fibers, and usually improves the fastness of plant dyes. It can be bought as copper sulfate, sometimes known as "blue vitriol." In the past, copper sulfate was also known as "blue copperas." Copper sulfate is a poison and should be handled with great care.

It is also possible to make your own "copper liquor" by soaking several lengths of copper piping in a mixture of water and clear vinegar (see p.42).

Iron mordant

Iron is more commonly used as a modifier than as a mordant. Used on all fibers, it makes colors darker and more somber in tone, and increases their light- and washfastness. It is always used in small quantities, because it can weaken fibers and cause them to deteriorate over a period of time. Iron can be purchased in the form of ferrous sulfate, also known as "copperas" or "green vitriol." Iron in this form is harmful if ingested. It should be handled with care.

To make your own "iron liquor," soak rusty nails or pieces of iron in a mixture of water and clear vinegar (see p.42).

Calculating quantities of mordant

To calculate how much mordant to use, first weigh the textile fibers to be mordanted and make a note of the weight. Wet the weighed fibers by soaking them in water for one or two hours, or overnight. Squeeze out the excess water before putting the fibers in the mordant bath.

The quantities of mordants recommended here may be smaller than those given in other natural dyeing reference manuals. Small quantities give good results if used according to the recipes, and they ensure that virtually all the mordant is absorbed by the fibers.

Quantities are given as a percentage of the dry weight of the fibers to be processed (imperial equivalents are given in teaspoons or ounces). The percentage metric system is more accurate and is recommended for use with chemical mordants.

This percentage metric system is not difficult to use. For example, 8% means use 8g mordant crystals for every 100g fibers. So, if the dry materials weigh 200g, use 16g of mordant, for 250g fibers use 20g of mordant, and for 500g of fibers use 40g, and so on. Sometimes dry fibers may have an awkward weight, such as 480g. In this case, round up the weight of the fibers to the nearest 50g, which would be 500g.

For those without metric scales capable of measuring small quantities, dissolve mordant crystals in solution as described in the tinted panel on the right. Make a separate solution for each mordant or assistant used.

MAKING MORDANT SOLUTIONS

Mordant solutions can be stored indefinitely in clearly labeled glass or plastic bottles. Making mordant solutions can save a lot of time, as mordant crystals do not have to be dissolved and weighed every time a mordanting session is planned.

- To make a mordant solution, dissolve the mordant crystals in boiling water, using 2tsp (10ml) of water for each 0.04oz (1g) of crystals. This means that 4oz (100g) of crystals will make 2 pints (1000ml) of solution. Make sure you stir the solution well to ensure all the crystals have dissolved.
- To use, measure off 2tsp (10ml) of liquid for every 0.04oz (1g) required. This means that 16tsp (80ml) of solution is equal to 0.32oz (8g) of mordant, and so on.

Mordanting animal fibers

Animal fibers readily absorb alum, copper, and iron mordants, which improve the light- and washfastness of most dye colors. Some mordants are used with assistants to increase the amount of mordant taken up by the fibers.

Animal fibers absorb mordants readily and alum, copper, and iron can be applied in relatively straightforward processes. Most craft dyers tend to choose alum or copper as their chemical mordants for animal fibers and use iron as a color modifier after dyeing.

When used as a mordant for animal fibers, alum is often used in conjunction with cream of tartar. The cream of tartar assists the absorption of the alum by the textile fibers, and helps to ensure that little or no aluminum remains in the used mordant bath. Alum can also be used without cream of tartar and applied without heat. See the green box on p.39 for details of this cool mordanting method.

COPPER SULFATE MORDANT

When used as a mordant, copper sulfate is mixed with clear vinegar or dilute acetic acid. The acid enables the copper to be more easily absorbed by the fibers, and ensures that few residues remain in the used dye bath.

INGREDIENTS

2% copper sulfate or ½tsp per 4oz (100g) fibers
8tsp (40ml) clear vinegar or 5% dilute acetic acid per 4oz (100g)of fibers

① See step 1, Mordanting with alum.
② Fill a large pot with cool water, allowing at least 4 gallons (18 liters) per 1lb (500g) of fibers. Dissolve the copper sulfate crystals in boiling water and add to the pot. Then add the clear vinegar and stir well. Add the wet fibers, heat slowly to simmering point, and simmer for one hour.
③ When the fibers are pale green, and the solution in the mordant pot is virtually clear, allow the fibers to cool. Remove the fibers and rinse well.

Note For dyers who are unfamiliar with the percentage metric system (see p.37), all the recipes also give approximate equivalents in teaspoons. If you prefer this method, which avoids the need to use a conversion table, you must make sure to use a 5ml teaspoon for measuring out the ingredients.

Mordanting with alum

Alum is the mordant most frequently used by dyers for animal fibers. It improves light- and washfastness and produces bright, clear colors. It is safe to handle but should not be ingested.

INGREDIENTS

8% alum or 1¾tsp per 4oz (100g) of fibers
7% cream of tartar or 1½tsp per 4oz (100g) of fibers

① Weigh the fibers to be mordanted and make a note of the weight. Wet the weighed fibers by soaking them in water for one or two hours, or overnight. Squeeze out the excess water before putting the fibers in the mordant bath. To calculate how much mordant to use, see details on p.37.
② Fill a large stainless-steel pot with cool water, allowing at least 4 gallons (18 liters) per 1lb (500g) of fibers. Dissolve the cream of tartar in boiling water in a measuring jug, stir well, and then add the dissolved cream of tartar to the cool water in the mordant pot.
③ Dissolve the alum crystals in a measuring jug of boiling water and add this to the mordant pot. Stir very well with a long-handled spoon.
④ Add the wet fibers and heat slowly to simmering point. Simmer for one hour. While the fibers are in the pot, move them around very gently from time to time to ensure even absorption of the mordant, and make sure that the fibers remain below the liquid surface. When mordanting fabrics, rather than skeins of yarn, be vigilant as the fabrics tend to pop up above the surface, especially if any air becomes trapped between the layers of cloth. If this becomes a problem, put an old china or ceramic plate on top of the liquid in the pot to make sure that the fabric stays submerged in the alum mordant solution.

⑤ Switch off the heat and leave the fibers to cool in the liquid overnight, or for at least two hours, moving the fibers around gently in the pot from time to time. Then remove the fibers from the mordant solution and rinse them thoroughly in cool water.

Note This alum mordant can also be applied without the hour-long simmering process described in step 4. This is particularly useful if you are mordanting silk, as excess heat can destroy its luster. Just remember to slowly heat the solution until simmering point is reached, then remove the pot from the heat and allow the fibers to soak in the mordant

solution for at least 12 hours. Make sure all the fibers remain below the surface of the alum mordant solution all the time.

Mordanting with iron

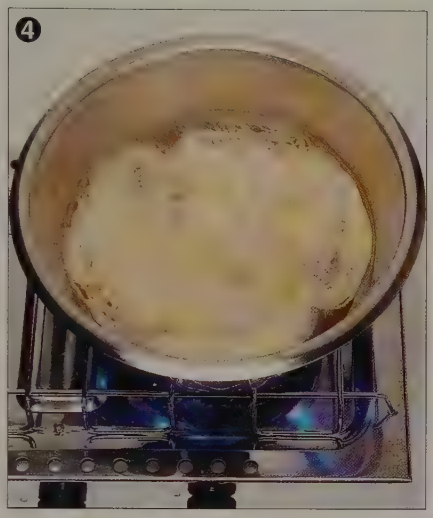
Iron is less frequently used as a premordant for animal fibers because an excess of iron can cause fibers, such as wool and silk, to weaken and deteriorate over a period of time. It is more commonly used as a modifier or "after-mordant." However, iron as a premordant improves the light- and washfastness of most dyes.

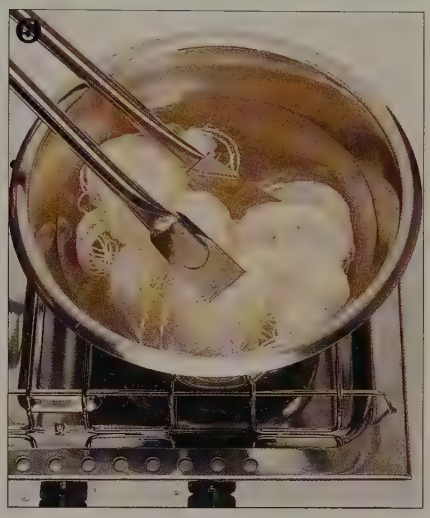
INGREDIENTS

2% ferrous sulfate crystals or ½tsp per 4oz (100g) of fibers

COOL ALUM MORDANTING METHOD

Alum mordant can also be applied without heat. Use 10% alum or 2tsp per 4oz (100g) of fibers. Follow steps 1–3 on p.38, omitting the cream of tartar, then add the wet fibers, submerge, and steep for at least 12 hours. Remove and rinse well. **Note** If time is short, this mordant can also be applied with heat, following steps 3–5 on p.38.





① See step 1, Mordanting with alum.
② Fill a large pot with cool water, allowing at least 4 gallons (18 liters) per 1lb (500g) of fibers. Dissolve the ferrous sulfate in boiling water and add it to the mordant pot. Stir very well. Add the wet fibers. Heat slowly to simmering point, and simmer the fibers for about 10 to 15 minutes.
③ Gently move the fibers around in the mordant pot during the process to avoid uneven results. Remove the pot from the heat and allow the fibers to cool down before rinsing them very thoroughly. This rinsing is important. It will wash away any unattached iron and prevent any loose particles from coming off when the fibers are placed in the dye bath. Loose iron particles will contaminate other fibers in the dye pot.

Cleaning pots after iron mordanting

Always thoroughly clean mordant pots that have been used for mordanting fibers with iron before using again, or reserve one mordant pot for use with iron only. Even the slightest trace of iron can dull the colors of anything processed in the pot at a later stage.

RHUBARB LEAF SOLUTION MORDANT

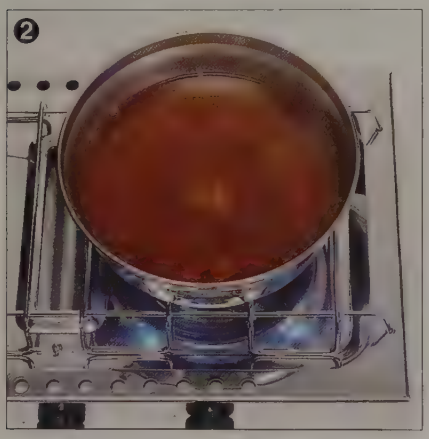
Oxalic acid from rhubarb leaves can be used as a mordant for animal fibers. Oxalic acid is toxic; please see p.44 for safety information.
① Collect about 1lb (500g) of rhubarb leaves, which should be sufficient to treat up to 2lb (1kg) of fibers. Cut up the leaves and simmer them gently in a covered pot for one hour in plenty of water. Let the solution cool, then strain it into a pot. It can be used as a mordant or as a yellow dye for animal fibers. Put the well-wetted fibers in the rhubarb leaf solution, adding more water if necessary, and simmer gently for 30 to 40 minutes. Leave to cool, then rinse.
② Store any remaining solution in a plastic container. Label the container clearly and store it well away from children and pets. If mold appears on the stored solution just skim it off. It will work the same, although the odor can be strong.
Note When the solution has treated 2lb (1kg) of fibers it will be exhausted and should be discarded. This solution can also be used as an acidic modifier, and acts as other acidic modifiers (see pp.58–63).

Mordanting vegetable fibers

Chemical mordants are applied to vegetable fibers using slightly more elaborate processes than for animal fibers. Tannin from plants can also be used as a mordant for vegetable fibers or as an assistant for alum and copper mordants.

Some mordant compounds do not combine as readily with vegetable fibers as they do with animal fibers. However, if tannin is also applied, alum sulfate and copper mordants combine well with the tannin/fiber complex. Tannin can also be used on its own, without alum or copper, as a natural plant mordant. Iron is generally used as a mordant without tannin.

Most dyers use alum as their preferred mordant for vegetable fibers and there are two methods of mordanting vegetable fibers with alum. In the first method alum sulfate, in the form of aluminum sulfate or aluminum potassium sulfate, is applied after first treating



the fibers with tannin. In the second method aluminum acetate is the form of alum used and in this form alum can be applied without first treating the fibers in tannin. (For details of applying alum acetate see green box on p.41.)

Sources of tannin

The bark and sometimes also the leaves of many trees contain tannin, but the highest percentages of tannin are found in oak galls and the leaves of species of *Rhus*, especially *R. typhina* (staghorn sumac). These sources of tannin have the added advantage of only producing a pale beige or tan color on the tannin-mordanted fibers, so the color results from subsequent dye baths are more true.

Barks from trees such as alder, oak, or willow can also be used as sources of tannin, but they are used less often than oak galls and staghorn sumac leaves because they can add too much unwanted color to the mordanted fibers and affect the colors from dye baths.

Using tannin as a premordant

Tannin is used to improve the absorption of alum and copper mordants. It can also be used on its own as a natural plant mordant.

INGREDIENTS

4oz (100g) oak galls or staghorn sumac leaves per 1lb (500g) of fibers

① Weigh the vegetable fibers to be treated in tannin and make a note of the weight. Wet the weighed fibers by soaking them in water for one or two hours or overnight.

② Meanwhile, simmer the appropriate quantity of oak galls or staghorn sumac leaves to the weight of the fibers in about 4 gallons (18 liters) of water for one hour. Leave the solution to cool, then strain off the tannin liquid. Dry the oak galls thoroughly, and then reuse them for another batch of solution.

③ Add more water to the tannin solution if necessary, then soak the weighed and wetted fibers in the tannin solution for eight to 24 hours. Rinse the vegetable fibers well before dyeing or proceeding with the alum or copper mordanting processes.

④ After use, pour the tannin solution into a plastic container to store. Reuse the solution until it is exhausted and no longer produces a beige or pale tan color on the fibers. Mold may form on the top of the stored tannin liquid, but this can be removed and does not affect the viability of the solution.

Note This tannin solution can be used for vegetable fibers, either on its own as a dye fixative, or as one of the stages in the alum or copper mordanting processes. When tannin is used alone on vegetable fibers, it produces muted shades when dye color is applied. Strong tannin solutions, however, produce darker dye colors. Weaker tannin solutions are useful for achieving lighter, brighter dye colors.

Mordanting with alum sulfate

When used as a mordant for vegetable fibers, alum sulfate is used with washing soda. Alum can be applied once or twice after the fibers have been treated with tannin solution. Washing soda is added to make the alum solution less acidic, and to help the fibers absorb the alum. The tannin enables the alum to combine more readily with the fibers, and so makes the application of dye colors more successful.

Many dyers apply the alum mordant once only, as this takes less time and gives perfectly satisfactory color results from the dye bath.

However, for stronger colors, a second mordant bath can be made up and applied to the fibers. Whether one or two applications of alum mordant is used, always treat the fibers in tannin first (see above).

INGREDIENTS

20% alum or 4tsp per 4oz (100g) of fibers
6% washing soda or 1½tsp per 4oz (100g) of fibers

① Weigh, wet, and treat the vegetable fibers in tannin as described in Using tannin as a premordant (see facing page).
② Half-fill a large stainless-steel pot with hot water. Measure out the correct quantity of alum, dissolve it in boiling water, and add it to the pot. Measure out the washing soda and dissolve it in boiling water, and add this to the alum solution in the pot and stir well. Bubbles may appear in the mordant pot – this is just carbon dioxide gas being released.
③ When the bubbles have subsided, fill the pot with more hot water and add the fibers

MORDANTING WITH ALUMINUM ACETATE

Use 5% alum acetate or 2½tsp per 4oz (100g) fibers. Dissolve it in boiling water, stir, then add to a large pot filled with at least 4 gallons (18 liters) water per 1lb (500g) fibers, and stir again. Add the wet fibers, heat to simmering point, and simmer for one hour. Allow the fibers to cool in the solution then remove and rinse well.

to the mordant pot. Make sure that there is enough water to cover the fibers.
④ Heat the alum solution to simmering point, then turn off the heat and leave the fibers to steep for eight to 24 hours. Move the fibers around gently in the alum solution from time to time to ensure even penetration of the mordant. Then remove the fibers, squeeze the excess solution back into the pot, and dry the fibers. Rinse well before dyeing.
⑤ Store any remaining alum solution and use it as the base for your next mordant solution, as it may still contain some alum residues.
Note For really deep, bright colors, apply the alum and washing soda mordant twice. This will ensure that the vegetable fibers absorb as much mordant and then dye color as possible.

If applying an alum mordant twice, when you remove the vegetable fibers from the mordant pot the first time, do not rinse the fibers in water, simply squeeze them out and allow them to dry overnight. Then wet the fibers again in water, add them to the second alum (and washing soda) solution in the pot and leave them to steep for a further eight to 24 hours. Then remove the vegetable fibers and dry them. Rinse the mordanted fibers well to wash off any loose mordant particles just before dyeing them in your chosen color.

Mordanting with copper

Copper sulfate mordant is used together with dilute acetic acid or clear vinegar to ensure it is absorbed. The copper sulfate mordant is toxic; please see p.44 for safety information.
Note This chemical mordant is more effective if the vegetable fibers are first treated with tannin (see facing page).

INGREDIENTS

2% copper sulfate or ½tsp per 4oz (100g) of fibers
8tsp (40ml) clear vinegar or 5% dilute acetic acid per 4oz (100g) of fibers

① Weigh, wet, and treat the vegetable fibers in tannin as described in Using tannin as a premordant (see facing page).
② Fill a large pot with water, allowing at least 4 gallons (18 liters) per 1lb (500g) of fibers. Dissolve the copper sulfate in a jug of boiling water and add it to the pot. Then add the clear vinegar or dilute acetic acid and stir well. Add the wetted vegetable fibers to the pot and slowly bring to simmering point.
③ Simmer for 30 minutes to one hour, then remove from the heat, and let the fibers cool in the solution before rinsing them well.

Mordanting with iron

Iron mordants tend to cause animal fibers to deteriorate over time. However, they have a less harmful effect on vegetable fibers and can be used to produce deep, somber colors.

INGREDIENTS

2% ferrous sulfate or ½tsp per 4oz (100g) of fibers

① Fill a large pot with water, allowing at least 4 gallons (18 liters) per 1lb (500g) of fibers.
② Dissolve the ferrous sulfate in boiling water and add it to the pot. Stir well, then add the wetted fibers and heat slowly to simmering point. Simmer for 30 minutes.
③ Remove the pot from the heat and allow the fibers to cool before rinsing thoroughly.

Making your own mordants

Concocting your own mordant solutions can be very satisfying. The degree of accuracy required when measuring quantities of purchased chemicals becomes more of a creative experiment when using homemade alternatives.

With homemade copper and iron mordants, it is not possible to know the exact amount of copper or iron that has dissolved into the water. This method of working is suitable for those who do not enjoy the discipline of weighing out precise quantities of mordant compounds. Many natural dyers in the past would have worked in this intuitive and experimental way, and it can be satisfying to be able to see a natural plant-dyeing project through from start to finish without having to rely on purchased chemicals.

Homemade mordant solutions can be cooled after simmering with the fibers, and returned to their jars for reuse. Extra ingredients can be added to keep the supply going. When the solutions no longer impart their characteristic pale yellow or green colors to fibers, they are exhausted.

Copper liquor

To make a solution of copper liquor, take a length or several pieces of copper piping and place them in a glass jar with a lid.

Make a solution of one part water to one part clear vinegar, or 5% dilute acetic acid, and then soak the copper piping in the solution for as long as is necessary to obtain a bright blue liquid. This usually takes about seven to 10 days to achieve. When using this solution as a copper mordant or modifier, it is not necessary to add any more clear vinegar or dilute acetic acid.

To use copper liquor as a mordant, strain the liquid into a stainless-steel pot, adding water as necessary. Then add the wetted fibers, and simmer the fibers gently for about 30 minutes. The fibers should turn a pale green color. Let them cool in the solution, then rinse them thoroughly.

When cool, return the remaining copper liquor to the jar containing the copper piping. The jar can then be filled with more water and vinegar or dilute acetic acid, as required. When the copper solution no longer appears blue, or if the fibers no longer become green when the solution is applied, then the supply is exhausted, and you will have to start again.

left *Bright blue copper liquor and rusty-orange iron liquor are stored in glass containers and offer a constant supply of mordant solution if topped up regularly with more ingredients.*

IRON LIQUOR AS A DYE BATH

"Iron liquor," or ferrous sulfate mordant, can also be used as a dye for cotton, linen, and silk fibers, but it is best not used on wool, as it weakens the fibers. Treat the fibers in iron liquor as described below, but do not rinse them. Then soak them for 30 minutes in a hot solution of washing soda. Use two teaspoons of washing soda for every two pints (1 liter) of water. When the fibers are exposed to the air, light- and washfast rusty-orange colors develop.

Note Copper liquor, or copper sulfate mordant, can also be used as a green dye, following the recipes given for mordanting.

Iron liquor

To make iron liquor, place some rusty nails or pieces of scrap iron into a glass jar with a lid. Fill up the jar with two parts water to one part clear vinegar, or 5% dilute acetic acid. Leave the iron to steep in the solution for one or two weeks, or until the solution turns a rusty-orange color.

To use iron liquor as a mordant, strain the solution into a stainless-steel pot, adding water as necessary. Then add the well-wetted fibers and simmer gently for 10 minutes, or until the fibers appear pale orange in color. Let the fibers cool in the solution, then rinse them thoroughly. This rinsing is important because any loose iron particles that become detached in the dye bath will contaminate it and dull the colors of other fibers dyed in the pot.

When cool, the remaining iron liquor can be returned to the jar that contains the pieces of iron. This jar can be filled with more water and clear vinegar or dilute acetic acid, as required. When the iron mordant solution no longer appears rusty-orange, or if the fibers no longer turn pale orange or yellow when the iron solution is applied, then your supply of iron liquor is exhausted, and new supplies of iron, clear vinegar or dilute acetic acid, and water will need to be added to the jar.

Combined mordanting and dyeing

In addition to the method of mordanting animal and vegetable fibers before dyeing, there are two energy- and timesaving ways to apply a mordant or achieve a mordanting effect. These offer a useful shortcut in some situations.

Where water is scarce or energy conservation is an important factor, it is possible to save resources by adding the mordant directly to the dye bath, and carrying out mordanting and dyeing in one process. This "simultaneous" method was often used for large-scale production, and appears frequently in old master dyers' recipe books. The main advantages of this method, apart from saving water and energy, are that fewer dye pots are required and the whole dyeing process is much quicker to complete.

However, this method does not always give such good results as mordanting the fibers separately before dyeing, and can cause some of the dye color to be wasted. This is due to the fact that the dye will often combine with the mordant before the mordant has combined with the fibers, and some of the loose, precipitated dye particles will stick to the pot rather than to the fibers. If mordanting is done before dyeing, almost all of the dye will fix to the fibers, because that is the only source of mordant with which it can combine. Again, the choice of method is a personal one.

Adding mordant directly to the dye bath

To use this method, first extract the dye color from the plant material as generally described in Dyeing Techniques (see pp.46–48), or refer to The Dye Plants (see pp.66–139) for specific methods of color extraction. Strain off the dye liquid into a pot of water. Choose the appropriate mordant for the animal or vegetable fibers (see pp.44–45) and dissolve the mordant in a measuring jug of boiling water. Add the mordant to the dye pot and stir well. Then add the wetted fibers and dye them in the appropriate way (see p.49).

"Pot-as-mordant" method

Carrying out the dyeing process in pots made of different metals can also have a mordanting effect on the fibers being dyed, but this method is less reliable. For example, if an aluminum pot is used instead of an aluminum mordant, it is unlikely that enough aluminum will be dissolved into the dye liquid to have a true mordanting effect, although the resulting dye colors may be brighter. Also, some of the dye color may be wasted, because it tends to become attracted to the aluminum on the pot rather than to the fibers being dyed. This method can often result in a well-dyed pot, which is very difficult to clean, and badly dyed fibers.

However, there is no reason why this "pot-as-mordant" method should be dismissed if you find that it produces the desired light- and washfast color. It was often used in the past, and is still used in areas where chemical mordants are difficult to obtain. It certainly saves time and energy, and avoids the need to deal with purchased chemicals.

For good results with this method, use old-fashioned iron pots without an enamel coating, or copper and brass pots without a tin coating. They can be bought secondhand, but copper and brass can be expensive as they are collectors' items.

above *A brazilwood solution is strained into the pot and then an alum mordant is added, so that the fibers can be mordanted and dyed in one go.*

Choosing a suitable mordant

Although many plant dyes can be applied successfully without a mordant, in some cases a mordant may be necessary to ensure good color fixation. Before selecting which mordant to use, there are several factors to consider.

Before applying any mordant to fibers, it is important to know which mordanting methods and ingredients are most suitable for each fiber type to achieve the best color results when the fibers are dyed. It is also important to understand the implications and potential hazards of any chemicals or substances used in the mordanting process.

The information in the tables on the following pages will provide the craft dyer with all the information needed to make an informed choice about which mordant is most appropriate for the fibers and the purpose for which they will be used. Consult these pages before you decide which dyes and mordants to use to avoid any time-consuming and costly mistakes. One important factor to consider is the degree of light- and washfastness that is likely to be necessary for any items made from naturally dyed materials. For more information on how to test the light- and washfastness of fibers see page 64. Another point to bear in mind is that each mordant will have a different effect on the final color achieved from the dye bath. So your choice of mordant will also be determined by whether you are aiming for bright, clear colors or more subtle, somber tones. There may also sometimes be occasions or situations when using a potentially harmful substance is best avoided. For example, dyers who have small children, or who have to work in the kitchen area, may prefer to limit their experiments to nontoxic substances.

Remember that many natural plant dyes can be used successfully on animal and vegetable fibers without a mordant. Check which dyes these are by referring to The Dye Plants (see pp.66–139). Bear in mind, too, that color variations can be achieved on all dyed materials by using familiar household products, such as clear vinegar or washing soda, as modifiers (see p.58). Using the "pot-as-mordant" method is also a viable option for craft dyers who wish to avoid using chemical substances (see p.43).

Natural dyeing should be a safe and pleasurable occupation, not one beset by anxieties. Increased knowledge and understanding will enable the natural dyer

MORDANT	Fiber suitability	Color effects	Light- and washfastness	Safety	Disposal (see safe disposal of mordants)
No mordant	All fibers	Paler shades may sometimes result	Light- and washfastness may be reduced	No safety problems	No disposal problems	Consult dye plant pages for plants that give good results without a mordant
Alum *Aluminum ammonium sulfate, aluminum potassium sulfate, aluminum sulfate or aluminum acetate*	All fibers	Bright, clear colors with most dyes	Improves light- and washfastness	Nontoxic but should not be ingested. Irritant: wear a dust mask to avoid inhaling fine particles	Consult with local environmental authorities for advice on safe disposal	Aluminum acetate is used only on vegetable fibers and silk. Aluminum sulfate, aluminum potassium sulfate, and aluminum ammonium sulfate are used on all fibers
Copper *Copper sulfate or copper liquor*	All fibers	Tends to make colors greener or browner in tone	Improves light- and washfastness	Toxic: wear rubber gloves and dust mask, especially when using copper sulfate crystals	Consult with local environmental authorities for advice on safe disposal	All fibers: use copper sulfate with dilute acetic acid or clear vinegar to increase absorption. Vegetable fibers: apply tannin first, then copper mordant
Iron *Ferrous sulfate or iron liquor*	Animal fibers: more suitable as modifier Vegetable fibers: suitable as a mordant or modifier	Colors darker and more somber in tone; changes yellows to olive-green Produces gray-black with tannin mordant	Improves light- and washfastness	Harmful if ingested; wear rubber gloves	Consult with local environmental authorities for advice on safe disposal	Weakens fibers, especially animal fibers, and can make fibers feel harsh
Tannin *Oak galls or staghorn sumac leaves*	Vegetable fibers	Muted tones with most dyes	Improves light- and washfastness	Nontoxic	Dilute with water before disposal	Use alone as a mordant or in sequence with alum and copper mordants
Rhubarb leaf solution *Oxalic acid*	Animal fibers	Makes yellows greener and reds more orange in tone	Improves light- and washfastness	Toxic (contains oxalic acid): wear rubber gloves and keep a lid on the pot to avoid vapor inhalation	Consult with local environmental authorities for advice on safe disposal	pH sensitive: use pH-neutral washing medium to avoid color changes

to fully enjoy all the processes involved in dyeing fibers and fabrics with a wide selection of natural plant colors.

Safe disposal of mordants

The basic instructions for safe disposal of mordants and solutions containing chemical residues are outlined in the charts below. US federal law requires that manufacturers of dye substances must provide, on request, a Materials Safety Data Sheet, with information on proper lawful handling and disposal of chemical substances. Your local retailer may also have this information. It is always advisable to talk with your local environmental protection agency about safe disposal requirements for chemical substances.

Dyers with plenty of storage space may opt to keep the remains of mordant baths in clearly labeled, sealed glass or plastic containers, and then use them as the base for the next batch of mordant solutions. This is recommended, because it means that there will be fewer occasions when chemical mordant residues need to be disposed of. However, there should be hardly any chemical residues remaining in the used mordant baths when mordants in crystalline form (see pp.36–41) have been used, because the majority of the mordanting methods and recipes given in this book should enable nearly all the mordant to become absorbed by the fibers. This means that, if the remains of used mordant baths prepared from purchased chemicals are reused, mordant quantities will still need to be calculated in the same way as before, and not reduced. Homemade iron liquor and copper liquor will produce less measurable amounts of dissolved iron or copper, and can be refilled and stored for reuse (see p.42). Eventually, however, disposal of some chemical residues may become necessary, and dye baths containing copper or iron modifiers will also need to be discarded.

State Environmental Departments

If you have questions about the proper disposal of waste materials, contact your state environmental agency listed below and ask them to refer you to programs that accept waste from household artists and hobbyists.

Alabama Department of Environmental Management; Alaska Department of Environmental Conservation; Arizona Department of Environmental Quality; Arkansas Department of Pollution Control and Ecology; California Environmental Protection Agency; Colorado Department of Public Health and Environment; Connecticut Department of Environmental Protection; Delaware Department of Natural Resources and Environmental Control; Florida Department of Environmental Protection; Georgia Department of Natural Resources; Hawaii Department of Land and Natural Resources; Idaho Bureau of Hazardous Materials; Illinois Environmental Protection Agency; Indiana Department of Environmental Management; Iowa Department of Natural Resources; Kansas Department of Health and Environment; Kentucky Department of Environmental Protection; Louisiana Department of Environmental Protection; Maine Department of Environmenta Protection; Maryland Department of the Environment; Massachusetts Department of Environmental Protection; Michigan Department of Environmental Quality; Minnesota Pollution Control Agency; Mississippi Department of Environmental Quality; Missouri Department of Natural Resources; Montana Department of Environmental Quality; Nebraska Department of Environmental Quality; Nevada Department of Conservation and Natural Resources; New Hampshire Department of Environmental Services; New Jersey Department of Environmenta Protection; New Mexico Environment Department; New York State Department of Environmental Conservation; North Carolina Department of Environment, Health and Natural Resources; North Dakota Department of Health; Ohio Environmental Protection Agency; Oklahoma Department of Environmental Quality; Oregon Department of Environmental Quality; Pennsylvania Department of Environmental Protection; Rhode Island Department of Environmental Management; South Carolina Department of Health and Environmental Control; South Dakota Department of Environment and Natural Resources; Tennessee Department of Environment and Conservation; Texas Natural Resources Conservation Commission; Utah Department of Environmental Quality; Vermont Agency of Natural Resources; Virginia Department of Environmental Quality; Washington State Department of Ecology; West Virginia Division of Environmental Protection; Wisconsin Department of Natural Resources; and Wyoming Department of Environmental Quality.

If you have access to the world wide web, you can link to the above state agencies by visiting the environmental protection agency at http://www.epa.gov/regional/federal/envrolst.htm.

WHICH ASSISTANT TO USE?

ASSISTANT	Fiber suitability	When used	Safety	Disposal (see safe disposal of mordants)	Other comments
Cream of tartar *Potassium bitartrate or potassium hydrogen tartrate*	Animal fibers	Used as an assistant to increase absorption of alum mordants	No safety problems	Dilute with water before disposal	The cream of tartar used in cooking is sodium pyrophosfate. This is slightly less effective but is commonly used by craft dyers
5% dilute acetic acid or clear vinegar	All fibers	Used as an assistant to increase absorption of copper mordants	No safety problems, but avoid inhaling vapor	Dilute with water before disposal	Also used as a color modifier for all fibers. Can be applied with or without heat
Color run remover Sodium hydrosulfite Thiourea dioxide (Spectralite™)	All fibers	Used to remove oxygen from indigo and woad vats	Toxic: do not ingest, and wear a dust mask to avoid inhaling any dust and vapors. Keep dry and store in a sealed container	Whisk vigorously to incorporate air, which will use up any remaining de-oxygenating chemicals; consult with local environmental authorities for advice on safe disposal	Handle with care. Generate heat when wet and could catch fire. Always add them to water, never pour water onto them
Washing soda Soda ash ***sodium carbonate***	All fibers	Used as an assistant with some alum mordants to increase alkalinity and to improve absorption of the mordant. It is also used in indigo and woad vats in order to increase alkalinity	Irritant: keep it away from eyes and mouth and do not ingest	Strongly alkaline solutions should be diluted with water before disposal; consult with local environmental authorities for advice on safe disposal	Also used as a color modifier for all fibers. Apply to animal fibers without heat

Preparing plant parts for dyeing

Purchased dyestuff from specialist suppliers is usually sold ready for use, and some of the preparation will have been done. However, it is also satisfying and enjoyable to process your own flowers, berries, leaves, and roots for the dye pot.

When plant materials have been harvested for the dye pot, they can either be used fresh, or dried and stored for later use. Some plant materials, however, only yield good dye colors if used fresh. If this is the case, it is indicated in The Dye Plants (see pp.66–139).

Sometimes it is not possible to gather enough leaves or flower heads for a dye bath in a single picking, so flowers or other plant materials can be dried and stored as they are harvested until there are sufficient materials. At other times, it is simply more convenient to dry and store plant material until time allows for a dyeing session.

Drying plant material

Dry plant materials away from direct sunlight and damp or humid environments, which can cause the plant materials to rot. Air must be able to circulate around the plantstuff, otherwise mold may develop. Bunches of plant tops can be hung with the heads downward in an airy porch. Bathrooms and kitchens should be avoided. Spread out the plant material on several layers of old paper. Whole plant tops containing woody material are often easier to dry because they do not form a solid mass. Flower heads tend to stick together, unless spread out, and spreading them out also prevents mold from developing.

If plant materials have to be placed on top of one another, put a sheet of newspaper between the layers and turn the plant materials over frequently.

Before use, most dye materials should be sliced or chopped up into small pieces, but flower heads and petals do not need to be cut up. If there are large quantities of anything, a garden shredder can be very useful.

When completely dry, dyestuff should be put in paper sacks or bags, not in plastic or polythene, and then labeled. These bags should be sealed and stored in a cool, dry place away from direct sunlight. If stored in a garden shed, they are best raised off the ground, and should be kept away from areas where dogs, cats, or birds can interfere with them. It is a good idea to check the dry materials from time to time to make sure that they have not been contaminated by visitors.

If your plant materials become moldy for any reason, do not throw them away, as they may still be useful in the dye pot. Prepare a dye bath and then test it on a small sample of fibers before dyeing a larger quantity. In general, moldy materials tend to produce more sludgy colors.

Depth of color

Offering specific instructions as to exactly how much of any plant dyestuff to use is not easy, because there are so many variables. Dyers who like strong, saturated colors often use more than the recommended quantity, while those who prefer paler, more subtle shades may use much less.

Many plant dyes cannot be relied on to yield the same depth of color each time, even if used in exactly the same way. Usually, classic dyestuff purchased from specialist suppliers gives more consistent colors because it is grown and harvested under controlled environmental conditions. However, even these plant materials can vary in strength and quality from batch to batch.

With homegrown or gathered dyestuff there are other factors to be considered, such as growing conditions, harvesting times, and whether the plant materials are used fresh or dried. In addition, the methods each dyer uses for color extraction and dye application will also play a part in determining the intensity of shade produced from the dye pot.

Quantities to use

As a general rule, and unless otherwise indicated in The Dye Plants (see pp.66–139), equal weights of fresh or dried dyestuff to fibers to be dyed will usually achieve a good depth of color. This does not mean that 4oz (100g) of dyestuff will only dye 4oz (100g) of fibers and no more. It simply means that, for reasonably strong colors, it is advisable not to add more fibers to the dye bath when you use a dyestuff for the first time. If more fibers are added, paler shades often result because the dye color has to be shared among more fiber; adding too much fiber at one time "dilutes" the dye bath.

above *Flowers are usually used fresh or dried. They do not need to be cut up. Simply place them in a pot, pour boiling water over them, and leave them to steep in the liquid overnight. This method may extract enough color for the first dye bath. Otherwise, simmer the same flowers in the liquid for half an hour to extract more color.*

DYES IN EXTRACT FORM

Many natural dyes are available in the form of extracts. These are concentrated natural dyes in powder, crystal, or liquid form, which dissolve in hot water. They usually require no further processing and, when dissolved, can be added to the water in the dye bath, which is then used as generally instructed for the dye in question. As extracts are very concentrated, only very small quantities are required and 1tsp of extract is often sufficient for 4oz (100g) of fibers.

above *Soak bark in cool water for at least one week, or longer, before processing further. This first soak may produce enough color for an initial dye bath. Apply heat to the bark in solution to extract more dye color. For clear colors, it is best not to boil the bark, but to keep the water temperature in the pot below a simmer.*

above *Crush berries well in a pestle and mortar before processing further to ensure that they release their full color potential. Then place the berries in a pot with some water and simmer for at least one hour. Turn off the heat and then leave the berries to soak overnight in the pot, before straining off the dye liquid.*

Note Bear in mind that it is not the amount of water used in the dye bath that affects the strength of the dye bath. The amount of water does not "dilute" the dye color. The strength of the dye bath is only affected by the amount of fibers added in relation to the amount of dye color present, as it is the color particles in the solution that have to be shared among the fibers being dyed.

Testing the plant dye

When trying a plant dyestuff for the first time, it is advisable to test the color on a small portion of fibers to see whether it is likely to give deep or pale shades. If the test sample suggests that the dye color may turn out deeper than desired, and there is only a limited amount of fiber to dye, remove some of the color potential by pouring off a portion of the dye liquid. The reserved dye liquid can then be used to treat a second batch of fibers or the same fibers a second time, if the color from the first dyeing process proves to be too pale. Alternatively, the dye liquid can be stored for later use. If the dye bath is exhausted and the fibers are still not deep enough in color, prepare a fresh dye bath and redye the fibers, using either the same plant dyestuff or one that produces a similar color.

Sometimes fibers do not absorb all the available dye color in the dye bath, so there is enough left for a second batch of fibers. This second batch usually dyes a paler shade. This second bath is called the "exhaust" dye bath.

For pale dye colors, it is not wise to reduce the period of time that the fibers are in the dye bath. Light- and washfastness can be substantially decreased if the fibers are removed from the dye bath too soon.

Color results on vegetable fibers

Achieving really deep colors on vegetable fibers can sometimes be a problem, as they seem to reach a point in the dyeing process where they will not take up any more dye liquid. Try preparing stronger dye baths for vegetable fibers, and then use the remaining dye liquid on animal fibers.

With some dye colors, the color potential is considerable, and the supply of fiber to be dyed may run out before you have exhausted the color in the dye pot. If this happens, store dye liquids for use at a later date. Pour them into labeled plastic containers, making sure to fill them right up to the top to exclude any air, and keep them in a cool, dry place.

Experimenting with plant dye colors

Once you have started to experiment with different plant dyestuff, it will be easier to judge how much of each dyestuff to use to achieve the desired color. It is difficult to lay down rules on this subject. The simplest guideline to follow is to use as much or as little dyestuff necessary for a good result.

Extracting color from plant materials

Most plant materials need simmering for about one hour or so to extract their color. Other plant materials can be soaked in cold water, but you can pour hot water over them to speed up the process. When the color has been released, strain off the dye liquid and pour it into the dye bath. Fill the dye bath

with water so that the fibers are submerged in solution. It is worth simmering the plant materials again to extract every last bit of color before they are discarded. However, different plant parts may benefit from other color extraction methods described below.

Extracting flower and petal color

Some flowers and petals give clearer, brighter colors if they are not processed for long periods at high temperatures. Others need to be simmered for several hours to extract their color. Pouring boiling water over the flowers, and leaving them to soak, may in some cases produce better colors than simmering. The Dye Plants (see pp.66–139) offers advice on which method best suits each individual flower type.

Extracting bark color

Barks are best soaked for several days or even weeks in cold water before processing. Then simmer them for one hour. Never boil bark, as this will release too much tannin into the dye liquid, and may dull the dye color.

Sometimes soaking the bark in water will provide enough color for the first dye bath, and the bark can then be simmered in more water for a second dye bath. It is always worthwhile to simmer the used bark again to see if any color potential remains.

Extracting color from leaves and berries

Leaves often yield enough color for the first dye bath if they are soaked in cool water for several days. Pour boiling water on them first to speed up this process. The leaves reserved from the first color extraction can then be simmered again, or dried for later use.

Berries should be crushed, then simmered for an hour or so to extract their color.

Combining dyestuff

When several plants yield similar colors, they can be combined in one dye bath. This is useful if there is not enough of any one dyestuff to make a dye bath. Put the plant materials in one pot to extract the dye color, and use the dye liquid in the usual way.

right *Purchased dyestuff, such as heartwood, often has more color potential than other plant parts and can be processed several times. Just pour boiling water over the wood chips and soak overnight before straining off the dye liquid.*

above *Soak leaves in cool water for several days before processing them further. This initial soak may produce enough color for a dye bath. Simmer the same leaves for one hour, and let them soak overnight for a second dye bath.*

above *Powdered dyestuff can be mixed into a smooth paste with a little warm water. Then add more water and stir well to incorporate all the particles. Simmer the solution for half an hour, and then strain the liquid through a coffee filter.*

Selecting the best dyeing method

Applying the dye color to the fibers is probably one of the most straightforward of all of the processes involved in natural dyeing. It is certainly the most satisfying, as at long last the color results can be seen.

Before adding the fibers to the dye pot, leave them to soak in water overnight to make sure they are thoroughly wetted. A brief squirt of pH-neutral dishwashing liquid will help the fibers absorb water more quickly and speed up the wetting process. Meanwhile, strain the extracted dye liquid into the dye pot. If dyeing animal fibers, let the liquid cool before adding the fibers to the dye pot. If necessary, add more water to the dye bath to make sure that the fibers have plenty of room to move freely in the pot for even color distribution. Some natural plant dyes, such as logwood and brazilwood, only yield good colors if heat is applied, while most barks only give clear colors if kept below a simmer. Some other dyes, such as madder, weld, and rhubarb, can also be applied successfully without heat.

The chart below indicates whether hot or cool dyeing temperatures (see pp.50–51) or the all-in-one dyeing method (see p.52), work best for The Dye Plants (see pp.66–139). More details are given on the plant pages.

Latin name Common name	COOL	HOT	ALL-IN-ONE
Acacia catechu Cutch, catechu	●	●	●
Achillea millefolium and Achillea hybrids Common yarrow		●	●
Alcea rosea Hollyhock	●	●	●
Alkanna tinctoria Dyer's alkanet		●	
Allium cepa Onion	●	●	●
Alnus species Alder	●	●	●
Anthemis tinctoria Dyer's chamomile	●	●	●
Berberis thunbergii Barberry	●	●	●
Betula species Birch	●	●	●
Bixa orellana Annatto	●	●	●
Caesalpinia species Brazilwood		●	
Calendula officinalis Pot marigold		●	●
Calluna vulgaris Heather		●	●
Carthamus tinctorius Safflower (see instructions p.53)	●	●	●
Chlorophora tinctoria Fustic, Dyer's mulberry	●	●	
Coreopsis grandiflora, C. verticillata, C. lanceolata Coreopsis, Tickseed	●		●
Coreopsis tinctoria Dyer's coreopsis		●	●
Cosmos sulphureus Yellow cosmos		●	●
Crataegus species Hawthorn		●	●
Curcuma longa Turmeric	●	●	●
Dahlia species Dahlia	●	●	●
Daucus carota Wild/Domestic carrot, Queen Anne's lace		●	●
Eucalyptus species Eucalyptus	●	●	●
Fraxinus species Ash		●	●
Galium verum Lady's bedstraw, Yellow bedstraw	●	●	●
Genista tinctoria Dyer's greenweed, Woadwaxen		●	●
Haematoxylon campechianum Logwood		●	
Hedera helix Ivy		●	●
Hibiscus species Hardy hibiscus, Rose mallow		●	●
Hypericum perforatum Saint-John's-wort		●	●
Indigofera species Indigo (see instructions pp.54–55)	●	●	
Isatis tinctoria Woad, Dyer's woad (see instructions pp.56–57)	●	●	●
Juglans species Walnut	●	●	●
Juniperus communis Juniper		●	●
Lawsonia inermis Henna		●	●
Maclura pomifera Osage orange, Bois d'arc	●	●	
Mahonia species Mahonia		●	●
Malus species Apple	●	●	●
Myrica gale Bog myrtle, Sweet gale		●	●
Narcissus species Daffodil		●	●
Persicaria tinctoria (Polygonum tinctorium) Japanese indigo, Dyer's knotweed	●	●	
Prunus species Cherry, Plum, Peach, Almond, Apricot	●	●	●
Prunus spinosa Blackthorn	●	●	●
Pteridium aquilinum Bracken, Brake		●	●
Pterocarpus santalinus Sanderswood, Saunderswood		●	
Punica granatum Pomegranate	●	●	●
Pyrus communis Pear	●	●	●
Quercus species Oak	●	●	●
Reseda luteola Weld, Dyer's rocket	●	●	●
Rhamnus species Buckthorn	●	●	●
Rheum species Rhubarb	●	●	●
Rhus typhina Staghorn sumac	●	●	●
Rubia tinctorum Madder	●	●	●
Rubus fruticosus Blackberry	●	●	●
Rudbeckia species Rudbeckia, Coneflower, Black-eyed Susan		●	●
Rumex species Dock, Sorrel, Curled dock		●	●
Salix species Willow	●	●	●
Sambucus species Elder, Elderberry		●	●
Solidago species Goldenrod	●	●	●
Sorbus species Rowan, Mountain ash		●	●
Symphytum species Comfrey		●	●
Tagetes species French marigold, African marigold		●	●
Tanacetum vulgare Tansy		●	●
Taraxacum officinale Dandelion		●	●
Ulmus species Elm	●	●	●
Urtica dioica Nettle		●	●

Cool dyeing method

Some natural plant dyes can be applied successfully to animal and vegetable fibers without heat. It is always worthwhile to try this cool dyeing method to see what colors can be achieved before heating the fibers in the dye bath.

Before adding fibers to the dye bath, first make sure that they are thoroughly wetted by soaking them in water for one or two hours. Strain the extracted plant dye liquid into the dye bath, and reserve the pieces of plant material for reuse. If the plant material was heated to extract the color (see pp.46–48), let the dye bath cool to room temperature before adding the wetted fibers. If necessary, fill the dye pot with water to make sure that the fibers have enough room to move freely in the dye bath, or uneven coloring may occur. Leave the fibers to soak overnight in the dye bath, and then check to see how much color they have absorbed. For deeper colors, leave the fibers to soak for several days. If the results are still unsatisfactory, apply gentle heat to the dye bath.

Processing vegetable fibers

Vegetable fibers respond well to dyeing at room temperature, and bright colors can be achieved. To process vegetable fibers, leave them in the dye bath for several days or longer. If the color achieved without heat is good, remove the fibers and rinse them well before washing them in a pH-neutral washing medium. If the dye liquid still appears to have color potential, add some more vegetable fibers, and either repeat the cool dyeing process, or apply heat for quicker color results.

Processing animal fibers

Most animal fibers can also absorb dye colors without heat. Cool dyeing is particularly useful when dyeing lustrous silk, which tends to lose some of its silky sheen if too much heat is applied. There are other situations, too, where cool dyeing may be more appropriate. Raw fleece, delicate wool, or mohair, for example, can sometimes "felt" if heated too much, and the same applies to woolen and mohair garments, especially those that are thick and closely woven.

Shrinking can also be a problem with wool if too much heat is applied. Skeins of wool become shorter in length, and pieces of fabric become smaller. Any woolen garments dyed with more than very gentle heat are likely to shrink in size. For all these reasons, it is a good idea to try cool dyeing temperatures on test samples of animal fibers.

above *Dyeing vegetable fibers in cutch (*Acacia catechu*) at room temperature produces rich chocolate-brown colors on fibers. Leave the vegetable fibers to soak in the dye liquid overnight to absorb more color. For even stronger shades, soak the fibers for several days.*

Concentration of dye liquid

Cool dyeing is usually more successful if the dye solution is strong. So more plant dyestuff may be needed to prepare the dye bath than is required when applying the dye with heat. Once fibers have been dyed following the cool dyeing method, any remaining dye color can be used on fibers that will tolerate heat. Alternatively, store the plant dye liquid in an airtight container for use at a later date.

Yielding true colors at cool temperatures

When deciding at what temperature to apply the dye color to the fibers, bear in mind that some dyes do not yield their true colors without heat. Dye baths made from logwood (*Haematoxylon campechianum*, see p.94) for example, only produce purples with heat.

Some plants contain more than one dye, and hot and cold dyeing methods may release different pigments. Madder (*Rubia tinctorum*, see pp.124–125), for instance, contains five pigments, including reds, yellows, and browns. For reds, the dye is applied with gentle heat or no heat, while simmering gives browns.

Some yellow-producing dyes, such as weld (*Reseda luteola*, see p.119), give yellows when used in a cool dye bath and mustard hues with heat. This tendency can be exploited by using a cool bath to obtain the first shade and then the hot method for the second color.

Hot dyeing method

Many plant dyes can be applied successfully with or without heat, but heating the dye bath reduces the amount of time it takes for the colors to develop on fibers. Some dyes, however, require heat to help them release their true colors.

When experimenting with hot dyeing methods, place the fibers in the dye bath and gradually raise the temperature to simmering point. Simmer the dye bath for 30 minutes to one hour, or as long as it takes to achieve the desired depth of color on the fibers. Move the fibers around gently in the dye liquid as they simmer to ensure an even distribution of dye color, but do not agitate them too much or they may become matted.

To allow the color to develop fully, and to ensure the maximum degrees of light- and washfastness, remove the dye pot from the heat and leave the fibers to cool in the dye bath overnight. Alternatively, when the fibers reach the desired color in the hot dye bath, turn off the heat, remove the fibers, and, wearing rubber gloves, gently squeeze any excess liquid back into the pot and put it to one side. Let the dyed fibers cool, then rinse them thoroughly before washing them briefly in a pH-neutral washing medium.

Some fibers, especially cotton, appear much paler in color when dried. If they are too pale, wet them thoroughly again and repeat the dyeing process, using the reserved dye liquid. If the used dye bath has little color remaining, prepare a fresh one.

Solar dyeing

When summers are hot and sunny, save energy by using the sun as a source of heat for dyeing with plant dyes. This solar dyeing method can be a useful way of testing the dye potential of various new plants during the summer months.

To construct a simple "solar oven," take two strong cardboard boxes that fit one inside the other. Make sure there is enough room between the two boxes to create an insulating layer. Before the smaller box is placed inside the larger box, line the inside of the larger box with aluminum foil, and cover the smaller box both inside and out with foil. Then place the smaller box inside the larger, and pack the space between the boxes with straw, newspaper, or polystyrene granules.

above *Brazilwood (*Caesalpinia *species) is one of the few dyes that do not release their full color until heat is applied. Simmer the fibers in the prepared dye bath for 30 minutes to one hour and a pinky-red will develop on the fibers.*

Make a large square lid out of cardboard for the solar oven, and line it with aluminum foil. Draw a large square on the lid, and cut out three sides of the square. Prop the lid open to act as a reflector, and place a sheet of glass over the opening to let light into the oven, but to prevent heat from escaping.

Dye pots for solar ovens must have lids and be dark colored to absorb heat from the sun. Enamel pots are ideal, as they can be painted with matte black paint.

To process dye colors in a solar oven, place the dye liquid and fibers in the dye pots and lower them inside the oven. Fit the lid over the oven, then prop open the reflector at a suitable angle to reflect the sun's rays into the oven. Replace the sheet of glass over the opening. Check the progress of the color development on the fibers after three or four hours. Use pot holders to lift the dye pots out of the oven and to remove the lids, as they will be extremely hot.

All-in-one method

Cool dyeing is not the only way to save energy. It is also possible to extract dye color and to apply it to the animal or vegetable fibers in one process, either with or without heat, depending on the plant dyestuff being used.

To try this all-in-one method, use a large pot, because the dyestuff and fibers need room to move freely to take up the color evenly, and the plant material may also expand when wet.

First place the dyestuff in the pot, and then half-fill the pot with boiling water. Leave the dyestuff to steep in the hot water for one hour or so, and then fill up the pot with cool water, and add the wetted fibers. To use the cool dyeing method, leave the fibers to steep in the dye liquid for as long as it takes to develop the desired color on the fibers. To use the hot dyeing method, slowly bring the dye liquid to simmering point, and simmer until the desired shade is achieved.

Whichever method is chosen, remember to move the fibers around gently in the pot, otherwise fibers that come into direct contact with the plant dyestuff may absorb more color than those that do not.

Testing new plant dyes

This all-in-one method is useful for testing out the properties of new plant dyes on fibers, because it is much quicker than extracting the dye color separately. However, it does have its disadvantages when dyeing large quantities of fibers. With large quantities, it is much more difficult to get evenly dyed fibers, and removing the plant pieces from the dyed fibers afterward can be tedious, especially if they are small or sharp.

Heartwood, which is available from specialist dye suppliers in the form of wood chips or shavings, is particularly troublesome to remove from fibers and may cause small holes in fabrics or become embedded in yarns. Also, if the plant pieces stick to the fibers, spotting may occur. Try putting the dyestuff in a muslin bag to avoid direct contact with fibers, but the bag will need to be moved around in the pan and the muslin itself will also take up some of the dye color.

As a general rule, this all-in-one method is better used on fabrics rather than yarns especially if the yarns are to be made into clothing. Otherwise, stubborn plant particles may remain in the fibers and cause irritation when the final garment is worn. Of course, this is not such a problem if the dyed yarns are used for wall-hangings, rugs, or tapestries.

above *If the dyestuffs and fibers are processed together in the dye pot, extracting the plant materials from the fibers can take time and patience. However, this disadvantage is outweighed for many by the fact that the all-in-one method saves precious time, and is useful for testing out new plant dyes on different fibers.*

Exploring pattern effects

Despite these minor drawbacks, there are some occasions when the all-in-one method of dyeing can be exploited to produce special effects, particularly on fabrics. Attractive variegated effects can be achieved by wrapping or tying dyestuff into a piece of cloth before it is added to the dye bath. This will produce stronger colors on the areas that come into direct contact with the plant pieces and paler shades elsewhere. Larger pieces of bark, handfuls of leaves, whole flower heads, onion skins, and pomegranate rind can all be used in this way for interesting pattern effects.

Further color possibilities occur if more than one dyestuff is wrapped into the fabric, and a little color from each dyestuff runs into the other and overlaps. It is important to wrap up each dyestuff separately in the fabric, to avoid too much color blending into one another, and producing an overall murky brown color.

Dyeing with safflower

Safflower is an unusual dyestuff because, by following different methods, both a yellow and pinky-red color can be extracted from its petals. The red dye was used in India and Japan to dye cotton and silk vivid shades of pink and orange-red.

All dyers should experience the brilliance of safflower pinks, even though they fade with time and exposure to light. The yellow dye, although brilliant at first, also tends to fade.

The yellow dye from safflower can be applied to both animal and vegetable fibers. The red dye is suitable for cotton, linen, and silk, but not for wool. It is applied to fibers using a cool dyeing method described below.

Extracting dye color

Yellow is always the first dye color to be extracted from the safflower petals. Wear rubber gloves to avoid staining and be patient, because this process can take a long time. Begin by wrapping the petals in a muslin bag. If the yellow dye is not needed for a dye bath, place the muslin bag filled with petals under cool running water, squeezing it until the point when the water runs clear.

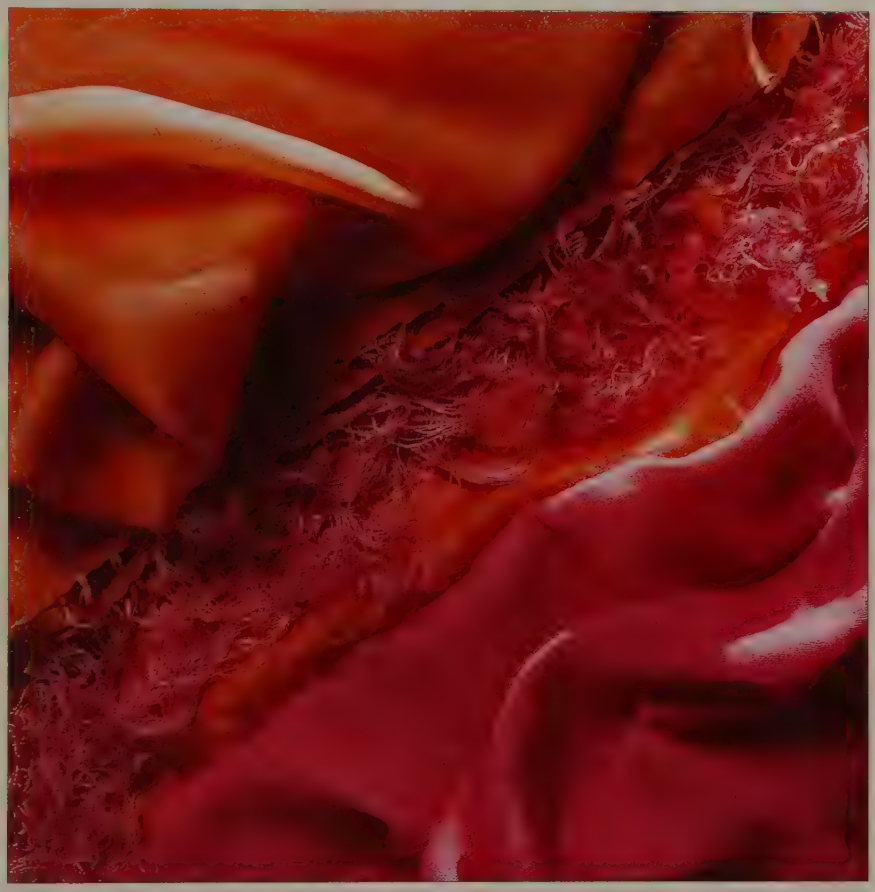
To save and use the extracted yellow dye, immerse the muslin bag in a bucket of cool water and leave to soak for one hour or so. Then press and squeeze the bag to extract the yellow dye. Lift the bag out of the water from time to time to check how much color is running out. When the water in the bucket is strongly colored, and the petals no longer yield much yellow dye, squeeze the excess water from the bag. Reserve the safflower petals once the yellow dye has been removed.

Dyeing with safflower

The yellow dye liquid in the bucket can be used on all types of fibers following the instructions on p.81. To extract red dye from the same safflower petals, first treat the petals in an alkaline solution of washing soda. Then make the dye liquid slightly acidic before adding the fibers. The fibers will only absorb the red dye in an acidic solution.

① Place the petals in a pot. Cover them with enough cold water to make a dye bath.

② Add the correct amount of washing soda to the water in the pot to make the solution pH11 (see p.28). The alkaline water will turn the petals reddish-brown.



③ Leave the petals in the solution for one hour, then squeeze them well, and strain off the liquid in the pot.

④ Add enough clear vinegar or lemon juice to the liquid to make the solution acidic, about pH6. The dye liquid should now be bright red and ready for use.

⑤ Add the fibers to the liquid and leave them to soak overnight. By morning, the fibers will be shocking pink or orange-red.

⑥ Rinse the fibers well and dry away from direct sunlight.

Dyeing pink shades on silk

The acidic dye liquid that contains red dye also contains a second yellow dye, which is taken up by silk fibers, but not by cotton or linen. Therefore, silk treated in the red dye bath turns coral or orange rather than pink. To produce shades of bright pink on silk, an extra step must be added. After step 4, add some cotton fibers to the dye bath and leave them overnight to absorb the red dye. Then discharge the red dye from the cotton fibers back into a solution by placing the cotton fibers in an alkaline solution of washing soda (pH11). Soak the cotton in the alkaline solution for 30 minutes. When the solution turns red, remove the cotton. Then acidify the solution as described in step 4, add the silk fibers, and soak overnight.

above *When a silk scarf and cotton scarf are placed in a red dye bath made from safflower petals, the silk turns orange and the cotton pink. Silk takes up a second yellow dye in the red.*

Dyeing with indigo

Indigo is a truly remarkable dye and perhaps the most successful ever known. It gives light- and washfast shades of blue, ranging from pale blue to navy. Once the techniques for application are understood, it is not difficult to master.

For indigo dyeing to be successful, the chemistry must be right. The dye liquid has to be alkaline in order to dissolve the blue-producing indigo dye matter, and also any oxygen must be removed from the dye vat in order for indigo-blue to be able to convert into so-called "indigo-white."

Indigo will only become permanently fixed to fibers in this "white" state. Then, when the fibers in their "white" state are lifted out of the vat, the oxygen in the air converts the "indigo-white" back into indigo-blue, and the blue color is fixed to the fibers.

It is crucial not to stir or agitate the vat, or to allow the fibers to drip into the vat. Oxygen will be introduced in this way, and the effectiveness of the vat will be reduced, eventually becoming useless.

There are various ways of making an indigo vat. Three different methods are described below, and each method should enable at least 8oz (250g) of fibers to be dyed a deep blue. The quantities given are only approximate as you will only really learn from experience what amounts work best. For very deep blues, simply increase the quantities of indigo dyestuff and the other ingredients proportionately, and leave the fibers in the vat for a longer period. For pale blues, reduce the quantities slightly and dip the fibers in the vat for a shorter time.

Before making an indigo vat, wet the fibers. (The fibers do not need to be mordanted.) Squeeze out the water from the fibers as any drips that fall when they are placed into the vat can produce unwanted air bubbles.

To make an indigo vat, the water should be kept at a temperature of 120°F (50°C). The vat can be made in a pot, or in a plastic bucket. Stand the pot or bucket in a container of hot water to maintain the temperature. Once the vat is ready, it does not matter if the water cools down, especially when dyeing silk or vegetable fibers. Wool fibers, however, take up the color better in a hot vat, but they can be left in a cool vat for longer. The pH value of indigo and woad vats should be pH9 or 10. Check the pH occasionally with pH papers and add another teaspoon of washing soda if necessary to achieve pH9.

Method 1: The hydrosulfite vat

In this method washing soda (sodium carbonate) is the source of alkali, and sodium hydrosulfite is the agent used for removing oxygen from the vat. Soda ash may be substituted for washing soda as the source of alkali and thiourea dioxide (Spectralite™) may be used instead of sodium hydrosulfite as the de-oxygenating agent. Consult the safety instructions on p.25 before using de-oxygenating agents and store any remaining agent in a carefully sealed packet in an airtight jar in a dark, dry place.

To make a 2 gallon (9 liter) dye vat:

① Dissolve three teaspoons of washing soda in two to four tablespoons of boiling water and allow to cool slightly. Then add two or three teaspoons of indigo powder to the washing soda solution, and mix the powder into a smooth paste, adding more water if necessary. Make sure no gritty particles remain unmixed. Leave to stand for 30 minutes.

② Put 2 gallons (9 liters) of water at a temperature of 120°F (50°C) into a dye pot. (This is about as hot as a hand will tolerate.)

③ Add three teaspoons of sodium hydrosulfite and one teaspoon of washing soda to the pot and stir very gently. Leave to stand for one or two minutes, then gently stir in the indigo paste, taking care not to create any air bubbles.

④ Keep the temperature constant and leave the vat to stand for 30 to 45 minutes or until the liquid has changed color from blue to greeny-yellow. If after 45 minutes the vat still appears blue below the surface or if there is a metallic blue film on the surface, add a little more sodium hydrosulfite and leave the vat for a further five to 10 minutes, or until it turns greeny-yellow.

⑤ Gently place the yarn or fabric in the vat. Make sure that the fibers are immersed in the greeny-yellow solution. Any sections of fiber above the liquid surface will turn blotchy. Leave the fibers in the vat for five to 20 minutes, depending on the desired color.

⑥ Remove the fibers very gently, again making sure that they do not drip into the vat and create air bubbles. As the fibers are lifted out of the vat they will start to turn blue on contact with the air. Before the fibers turn completely blue, quickly plunge them into a bowl of clear water. This will remove any spots of undissolved indigo on the fibers, which can cause unwanted color blotches. Then expose the fibers to the oxygen in the air.

⑦ Leave the fibers exposed to the air for about 20 minutes to allow the blue color to develop fully. To build up the required depth of color, redip the fibers in the indigo vat and air them until the desired shade of blue is reached. If the greeny-yellow "white" vat liquid begins to go blue, add a little more sodium hydrosulfite, but only enough to turn the solution back to greeny-yellow.

⑧ When you have the desired depth of color, rinse the fibers thoroughly several times, then wash them well and rinse them again.

This vat can often be kept going for several days. Put saran over the surface of the vat when not in use to keep it airtight. If the vat cools down overnight, just heat it gently in the morning and, if the vat is slightly blue, add a little more sodium hydrosulfite. When the fibers no longer take up any more color or the vat has turned completely blue, then it is exhausted.

⑨ Exhaust any remaining sodium hydrosulfite by whisking or agitating the vat to add air. Consult with local environmental authorities for advice on safe disposal (see p.45).

Method 2: The yeast vat

This method does not use a chemical reducing agent, such as sodium hydrosulfite, to remove oxygen from the indigo dye vat, but relies on natural ingredients (sugar and yeast) instead. Keep the temperature of the water at 104°F (40°C) for the yeast to take effect. To make a 1 gallon (4.5 liter) dye vat:

THE COLOR RUN REMOVER VAT

Color run remover in powder form contains washing soda and a de-oxygenating agent and can be used as follows to make a 2 gallon (9 liter) indigo vat. First dissolve 1 to 2 teaspoons of washing soda in hot water and stir in 2 to 3 teaspoons of indigo powder and mix well. Heat 2 gallons (9 liters) of water to a temperature of 120°F (50°C) in a pot, add 1oz (25g) of color run remover powder and stir gently. Leave to stand for 5 minutes then carefully stir in the indigo/washing soda mixture. Then follow Method 1, steps 4 to 9, adding more color run remover instead of sodium hydrosulfite as directed, if necessary.

① Fill the dye pot with water at a temperature of 104°F (40°C). Add three tablespoons of sugar and two tablespoons of dried yeast and stir well. Leave the solution until the yeast begins to froth and bubble. Meanwhile, in a measuring jug, dissolve one or two tablespoons of washing soda in hot water and then stir in two or three teaspoons of indigo powder. Mix the powder well to incorporate all the particles.

② Stir the indigo paste into the yeast solution in the dye pot. Place the pot in a warm place, covering it with an airtight lid or a piece of saran. The warm place may be outside in the sunshine or on a food hot plate. Keep the temperature constant, but do not let it exceed 120°F (50°C). Allow the indigo paste and yeast solution to stand until the liquid turns a greeny-yellow color. This can take at least 48 hours, so be patient. Then use the vat to dye fibers in the same way as described in Method 1, steps 5 to 9, but leave the first batch of fibers to soak in the vat for approximately 25 minutes.

Method 3: The urine vat

Dyeing in a urine vat is an ancient way of using indigo and can be very satisfying because it makes use of a readily available natural product.

Stale urine contains ammonia (an alkali) and also the bacteria necessary for removing the oxygen from the indigo vat. Leave the urine for about two weeks to go stale before use. Store the urine in a clearly labeled airtight container. To make a 1 gallon (4.5 liter) dye vat:

① Heat 1 gallon (4.5 liters) of urine to 120°F (50°C), and place it in a pot with a lid.

② Place the pot of warm urine on a hot plate to keep it at a constant temperature or use a solar oven as described on p.51.

③ Dissolve one teaspoon of washing soda in hot water, then stir in two or three teaspoons of indigo powder to make a paste as described in Method 1, step 1. Stir the indigo paste into the urine, put on the lid, and leave it in a warm place for one week or until the solution is greeny-yellow and is ready for use.

④ Add the fibers and proceed as described for Method 1, steps 5 to 9.

Dyeing with woad

Woad contains the same blue coloring matter as indigo, but in lower concentrations. For the best results, woad leaves should be used fresh, as dried leaves rarely give deep blues.

The four methods described below explain how to use fresh woad leaves for dyeing. Woad dye may sometimes be available as a powder and in this form it can be used following the recipes for indigo powder on pages 54 and 55.

Method 1: The hydrosulfite vat

Woad, like indigo (see pp.54–55), needs no mordant and uses washing soda as the source of alkali and sodium hydrosulfite to remove oxygen.

To make a 2 gallon (9 liter) dye vat:

① Tear or cut at least ½lb (250g) of fresh leaves into small pieces and put them in a dye pot. Pour enough boiling water over the leaves to make the dye vat and allow the leaves to steep for about one hour.

❷ Strain off the hot sherry-colored dye liquid, pressing the leaves against the sides of the sieve to extract all of their dye potential. Do not throw away the leaves, but reserve them for a second dye bath, for pinky-tans.

③ When the dye liquid has cooled down to 120°F (50°C), add just enough washing soda to the dye liquid to turn it from sherry-colored to greeny-brown.

❹ Introduce air to the liquid to convert the green liquid to indigo-blue. To add air, either whisk the liquid with an old whisk or pour the dye liquid repeatedly from one container to another. The froth that forms on the surface of the liquid will turn blue after a few minutes. If this does not happen, add a little more washing soda and continue whisking until the froth changes color.

⑤ Let the froth subside a little, then heat the liquid back to a temperature of 120°F (50°C). Keep the temperature constant and sprinkle about three teaspoons of sodium hydrosulfite over the liquid to remove the oxygen.

❻ Take the liquid off the heat and leave it to stand for about 45 minutes, or until it has turned yellowy-green in color. The woad vat is now ready to use. Follow the instructions on p. 54, Method 1, steps 5 to 9, for using the indigo vat. Continue to use the woad vat for successive batches of fibers. Soft pinks, lavenders, and turquoises can be achieved on fibers in later batches as the vat gets weaker.

Method 2: The yeast vat

Like indigo (see p.55 Method 2), yeast and sugar may be used as natural reducing agents. Again, the drawback with this method is that it is time-consuming.

To make a 1 gallon (4.5 liter) dye vat:

① Tear or cut up at least ½lb (250g) of fresh leaves and pour enough boiling water over them to make the vat. Allow the leaves to steep for one hour to extract the dye color.

② Meanwhile, place some hand hot water, 104°F (40°C), in a measuring jug, stir in three tablespoons of sugar and two tablespoons of dried yeast and let the mixture stand until the yeast starts to froth.

③ When the leaves have finished steeping in boiling water make sure the dye liquid has cooled to 120°F (50°C) and stir in two tablespoons of washing soda.

④ Do not remove the leaves from the dye liquid, they should remain in the dye vat for this method. Pour the yeast solution into the dye liquid, stir, and keep the dye vat warm for as long as it takes for it to turn greeny-yellow, which can be as long as 48 hours.

⑤ Follow the instructions on p.54, Method 1, steps 5 to 9, but leave the first batch of fibers in the woad vat for about 45 minutes.

⑥ When you remove the fibers from the vat, plunge them in clear water to remove any leaf particles and then expose them to oxygen in the air.

A yeast vat often produces a variety of shades, ranging from pinks, lavenders, grays, and soft greens to blues.

Method 3: The urine vat

Like indigo, woad blues can be developed in a urine vat. First, collect enough urine to make up half the liquid required for the vat. Leave the urine to "mature" for at least two weeks.

To make a 1 gallon (4.5 liter) dye vat:

① When the urine is ready, harvest the fresh woad leaves and process them as described in

Method 1, steps 1 to 4 up to and including whisking to incorporate oxygen from the air.

② Add the woad dye liquid to the stale urine and heat the mixture to 120°F (50°C). Place the dye liquid in a lidded container to reduce the odor, and keep it warm for one week or so, using one of the techniques suggested for the indigo urine vat p.55, Method 3, step 2. When the vat liquid has turned greeny-yellow, the vat is ready to use.

Method 4: The fermentation vat

This is an ancient method of dyeing with woad leaves and to be successful it requires constant heat, sometimes over a period of several days.

To make a 2 gallon (9 liter) dye vat:

① Collect at least ½lb (250g) of fresh woad leaves, chop them into small pieces and put them into a stainless-steel dye pot that has a well-fitting lid and that will hold at least 2 gallons (9 liters) of liquid. If the pot does

not have a lid, use saran or aluminum foil to cover it. Add enough boiling water to almost fill the pot and allow the leaves to steep for one hour.

② Make sure the liquid has cooled to 120°F (50°C) and add washing soda to bring the liquid to pH9. Stir vigorously to introduce oxygen but do not remove the leaves, which must remain in the vat throughout.

③ Add approximately 1oz (25g) each of wheat bran and chopped madder root, stir well, and put a lid on the pot or cover it with saran or aluminum foil. Then put it on a hotplate, such as those used for keeping food warm, to maintain a constant temperature. Alternatively, use a solar oven as described on p.51. Make sure the temperature does not exceed 140°F (60°C).

④ Stir the vat every 2 hours or so. After several hours, bubbles should start to appear on the surface to indicate that fermentation is beginning. If the fermentation is slow and nothing much seems to be happening after 12 to 18 hours, add 2 chopped dates and a little more bran and madder. Check the alkalinity with pH papers from time to time and, if necessary, add more washing soda to maintain pH9. Add another chopped date to maintain fermentation, especially overnight or if the vat starts to turn blue. After 24 to 36 hours, if the correct temperature and an alkalinity level of pH9 are maintained, a coppery blue sheen should appear on the surface of the vat and the liquid below the surface should eventually become greeny-yellow in color. The vat is then ready to use.

⑤ Add the fibers to be dyed, and gently push them below the surface of the liquid, taking care not to add air bubbles. Leave the fibers to steep for 30 minutes. Then carefully lift the fibers out of the liquid and allow the color to develop fully on exposure to air.

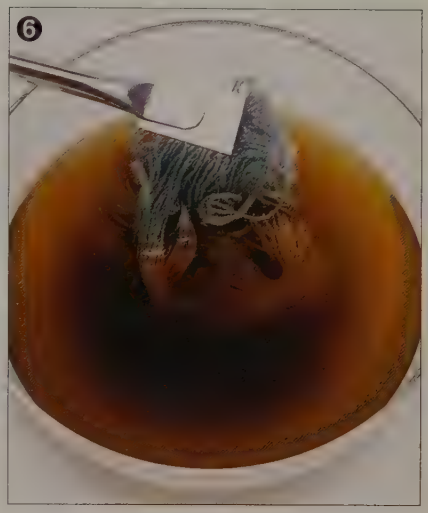
⑥ The fibers often emerge from the vat looking greeny-brown, with some leaf particles clinging to the fibers. Plunge the fibers briefly in clear water to remove the residue and leaf pieces, then hang up the fibers to air.

Further batches can be added to the pot until the dye color has been exhausted. If the growing conditions have been good enough to allow a strong concentration of blue dye potential to develop in the leaves, and if constant heat can be maintained, it is possible to keep the woad vat active for several days.

This fermentation method can also be used with woad or indigo in powder form. Make a paste as described on p.54, Method 1, step 1, and use this instead of the woad leaves.

USING WOAD BALLS

Dried balls of fermented, pressed woad leaves can be used instead of fresh leaves as described in Method 1. They should be broken up before use and left in the dye pot throughout. The froth produced in step 4 may not become blue but ignore this and continue whisking for at least 10 minutes to introduce the necessary oxygen.



Making woad solution for storage

Although woad leaves are usually best used fresh for blue colors, dye liquid, once processed, can be stored for up to a year or so for later use. This is a good way to make use of fresh leaves if the plants yield a bumper crop.

To make a woad solution to store, follow the instructions through Method 1, steps 1 to 4, up to and including whisking or pouring to incorporate air. Leave the liquid for a while to allow the froth to settle, then pour it into an airtight container with a well-fitting lid. Fill the container with liquid until it overflows slightly, then fit on the lid tightly. Add one teaspoon of sodium metabisulfite, which is used in home wine-making as a preservative, if you wish, but as long as the air is excluded this should not really be necessary. The stored woad liquid can be used to make a dye vat any time of the year by heating it to a temperature of 120°F (50°C), and then adding sodium hydrosulfite, Method 1, step 5. It can also be used to make a urine vat, as explained in Method 3.

Modifying dye colors

Once you have dyed yarns and fabrics, they can be treated to create an even more extended range of colors. Color modifiers are substances applied after the initial dyeing process to change the shades produced from the first dye bath.

The use of modifiers extends the range of colors available from a single dye bath. For example, if four skeins of yarn are dyed an identical shade in one dye bath, and then a different modifier is applied to each of them, four differently-colored skeins result.

With some dyestuff, the color differences can be quite dramatic after a modifier is applied, whereas with others the variations are more subtle. To assess the color change, it is a good idea to leave one skein from the initial dye bath unmodified. This will provide you with one further shade and also enable you to compare the range of color variations with the original shade.

Some modifiers change the pH value of the dye or modifier solution to make it more acidic or more alkaline. Others act as after-mordants. For example, using solutions of copper or iron after the dyeing process will enable you to achieve color variations, just as using different mordants before dyeing will produce different shades from one dye bath.

Modifier solutions

Modifier solutions can be stored in airtight glass or plastic bottles until required. The strength of the solution does not really matter, because the results can be seen instantly, so the user need only add as much or as little as necessary to achieve the desired color change to the fiber. The advantage of strong solutions is that they do not have to be made up quite so frequently. One tablespoon of modifier crystals dissolved in 2 pints (1 liter) of boiling water should be enough for several applications, because only one or two teaspoons of modifier are used each time.

To make acidic modifier solutions, citric acid crystals are dissolved in water. Washing soda or soda ash is used to make alkaline modifiers. Copper sulfate crystals make copper modifier solutions and ferrous sulfate crystals make iron modifiers.

Other modifiers and wood ash water

Some familiar household products, such as ammonia and clear vinegar, can be used as modifiers. One or two teaspoons of clear vinegar makes a useful acidic modifier and a few drops of household ammonia can be used as an alkaline modifier. These can be added to the dye liquid or a separate pot of water without any further preparation.

Another useful alkaline modifier is wood ash water, which is easy to make if you have access to a wood-burning stove. To make wood ash water, remove the cold ashes from the stove and place them in a plastic bucket. Fill the bucket with cold water and leave the ashes to steep for one week until the liquid turns yellow and feels slimy. Decant the liquid into a container without disturbing the ash sediment. It can be stored indefinitely. To use wood ash water as an alkaline modifier, add about half a cupful to the dye bath or a separate pot of water before adding the dyed fibers. Homemade copper and iron liquors (see p.42) can also be used as modifiers.

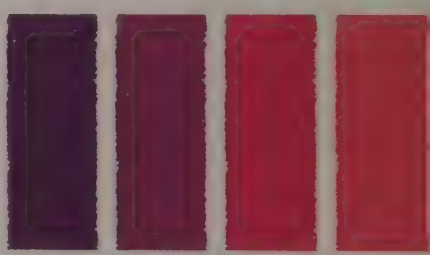
Modifiers in crystal form

Modifiers can also be used in the powder or crystalline form rather than diluted in solution. Simply add one or two teaspoons of powder or crystals to the hot liquid and allow them to dissolve before adding the fibers.

Acidic modifiers

Acidic modifiers tend to make fiber colors yellower in tone. They can shift red tones to orange, and make purple dye colors redder. After the acidic modifier has been added to the dye bath or separate pot of water, place the wetted fibers in the solution and simmer for five to 10 minutes. Remove the fibers as soon as the color changes. Rinse the fibers well and wash them in a pH-neutral washing medium. Acidic modifiers can also be applied without heat, just soak the fibers in the cool solution until the color is right.

above *Changing from red to orange.*
On the far left is an unmodified shade of red, achieved from a dye such as madder. This red becomes increasingly orange in tone according to the quantity of acidic modifier added.



above *Changing from purple to pink.*
The unmodified shade of purple on the far left is achieved from a dye such as logwood. The purple becomes increasingly pink in tone, according to the amount of acidic modifier used.

above *Rust turning yellow.*
The color bar on the far left shows an unmodified shade of rust, obtained from a dye such as onion skins. The more acidic modifier used, the yellower the rust becomes.

OTHER EXPERIMENTS TO TRY

- If you want to do some more experiments, try using tannin or rhubarb leaf solution as a modifier, or using one modifier followed by a second one. For example, a copper modifier can be followed by an acidic or alkaline modifier. By experimenting with different modifiers, new color possibilities can be discovered.
- Modifiers can also be used to create variegated effects on fibers and fabrics. Modify sections of your fibers or fabric in different modifiers to achieve rainbow-colored results.

Alkaline modifiers

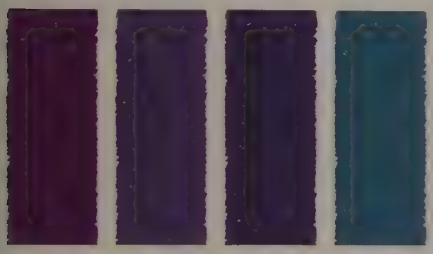
Alkaline modifiers usually make colors pinker in tone but sometimes they can change colors dramatically. Elderberry purples and pinks become green, and rhubarb yellows become coral-red. Apply alkaline modifiers to animal fibers without heat or the fibers may be damaged and disintegrate. Vegetable fibers may be heated; or just add the modifier to the dye bath or pot of water, stir well, add the wetted fibers, and then leave them to soak until the color changes. Rinse the fibers well and wash in pH-neutral washing solution.

Copper modifiers

Copper modifiers usually make colors greener or browner in tone. Sometimes copper hardly affects the shade at all, although its use will generally improve the fastness of the dye color. This can be exploited to make many colors more permanent and is useful in situations where a premordant has not been applied. If you are using copper as a modifier only, stir it into the liquid, add the wetted fibers, and then simmer for 10 to 15 minutes. For the full after-mordanting effect, simmer the fibers for 30 minutes. Rinse and wash fibers.

Iron modifiers

Iron modifiers improve the fastness of most dyes and tend to make colors darker and more somber in tone. This iron modification process is called "saddening." It can turn yellows into olive-green and, if used with dyes rich in tannin, it can make colors dark gray and almost black. Add it to the dye bath or pot of water and stir it well. Put in the wetted fibers and simmer them for about five minutes. Iron usually takes effect very quickly. It can also be applied without heat to many plant dyes. Rinse and wash fibers.

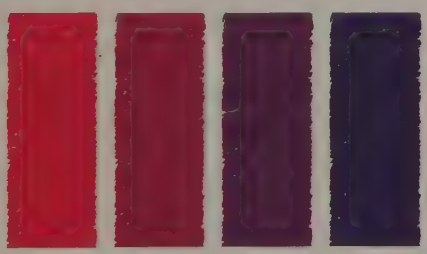


above *Changing from purple to green.*
The unmodified shade of purple (far left), is the result of a dye such as elder berries. The greater the quantity of alkaline modifier added, the more blue-green the tones become.

above *Yellow becoming greener.*
On the left, the color bar shows an unmodified shade of yellow, obtained from a dye such as weld. The yellow becomes greener according to the quantity of copper modifier added.

above *"Saddening" yellow.*
An unmodified yellow, achieved from dyes such as tansy, is shown far left. This yellow becomes increasingly olive-green in shade, depending on the amount of iron modifier used.

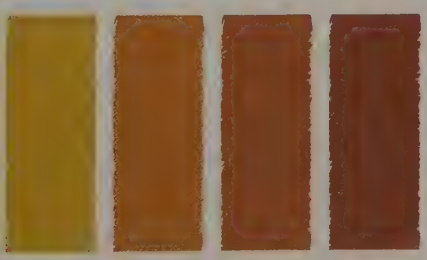
above *Yellow turning pink.*
The unmodified yellow, shown in the color bar on the left, was obtained from a dye such as rhubarb root. The yellow becomes more coral-pink in tone when an alkaline modifier is added.



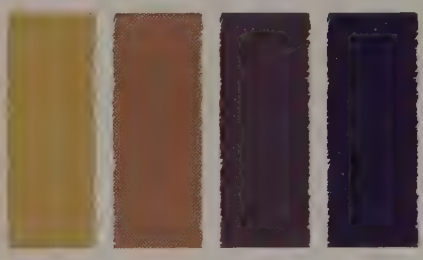
above *Red turning purple.*
These swatches show the changes that take place when a copper modifier is used. An unmodified red, created by a dye such as Lady's bedstraw, becomes increasingly purple.

above *"Saddening" Red.*
Achieved from a dye such as madder root, the unmodified orange-red shown on the left becomes purple-brown, depending on the amount of iron modifier that has been added.

above *Reds becoming pinker.*
Brazilwood yields red tones, as shown in the unmodified color bar on the left. This red becomes increasingly pink in tone, according to the quantity of alkaline modifier used.



above *Ochers turning browner.*
An unmodified ocher (see left), achieved by a dye such as pomegranate, becomes browner and browner, as shown in the color bars above, the more copper modifier is added.



above *"Saddening" brown.*
The four swatches above show how an unmodified beige, achieved by using a dye such as walnut husks, becomes increasingly darker with the addition of an iron modifier.

Testing color modifiers

Unless modifiers are already in liquid form – such as clear vinegar, or copper or iron liquors – it is advisable to make a fairly strong solution of each modifier, and then add a little, either to the dye bath or to a separate pot of water.

There are two ways to apply color modifiers. The modifier can be added to a pot of clear water, in which the dyed fibers are then treated. Alternatively, it can be added to the used dye bath, to which the fibers are then returned for treatment. This second method means that the used dye bath must first be divided into separate pots, one for each modifier, adding more water if necessary. Sometimes adding the modifier to the used dye liquid makes it easier to estimate the amount of modifier to use, because only enough is added to change the color.

If adding the modifier to clear water, prepare a fresh solution for each dyestuff. Otherwise, if the same solution was used for another dyestuff, some dye may leach out into the liquid, and contaminate the colors. Several pots of water are needed, one for each modifier. The fibers are left in the modified solution for as long as it takes to obtain a color variation.

To use modifiers, add one to two teaspoons to start, and stir in well. Do not add more than one modifier to each pot of dye solution or water. Then put in the dyed, wetted fibers and use each modifier as described on pp.58–59. If the color change is hardly noticeable, remove the fibers from the pot, stir in a little more modifier, and repeat. Occasionally only subtle color changes will be created.

Modifiers are usually applied straight away after dyeing, but they can also be used on fibers that have been dyed and put away for storage. Just wet the fibers thoroughly, then treat them in the prescribed way for the chosen modifier. Employ this technique if variations in tone are needed for a particular craft project.

right *A wool skein dyed orange with rhubarb root has been modified in an acidic bath to produce a yellow skein. Add one or two teaspoons of the acidic modifier to the pot of water and stir well. Add the dyed, wetted fibers and simmer for five to 10 minutes. Remove the fibers when the color has changed. Rinse well and wash in pH-neutral washing solution.*

right *Wool skeins that have not been mordanted turn orange when dyed with rhubarb root. To produce further colors, add the fibers to an acidic, alkaline, copper, or iron modifier.*

left *A wool skein dyed orange with rhubarb root has been modified in an alkaline bath to produce a pink skein. Add one or two teaspoons of the alkaline modifier to a pot of water and stir well. Add the dyed, wetted fibers and soak in cool water, without heating, for half an hour. If the color change is negligible, remove the fibers, stir in more alkaline modifier, and return the fibers to the pot. When the desired color change is achieved, remove the fibers, rinse, and wash well in pH-neutral washing solution.*

left *A wool skein dyed orange with rhubarb root has been modified in a copper bath to produce a taupe skein. Add one or two teaspoons of the copper modifier to the pot of water and stir well. Add the dyed, wetted fibers and simmer for 10 to 15 minutes until there is a color change. Remove the fibers, rinse, and wash well.*

below *A wool skein dyed orange with rhubarb root has been modified in an iron bath to produce an olive-green skein. Add one or two teaspoons of the iron modifier to the pot of water and stir well. Add the wetted fibers and simmer for about five minutes. Remove the fibers from the pot, rinse, and wash well.*

25 colors from one dye bath

To increase the colors from one dye bath, begin with five sets of skeins and mordant them in five different ways.

The following experiment uses five sets of wool skeins. To extend the color possibilities even further, prepare and treat silk skeins. Vegetable fibers could also be used after applying suitable mordants.

① Begin by preparing 25 sample skeins of wool as follows:

- No mordant x 5 skeins (A, B, C, D, E)
- Alum mordant x 5 skeins (F, G, H, I, J)
- Copper mordant x 5 skeins (K, L, M, N, O)
- Iron mordant x 5 skeins (P, Q, R, S, T)
- Rhubarb leaf solution x 5 skeins (U, V, W, X, Y)

Make sure each skein is labeled according to the mordant used.

② Prepare the dye bath, following any special instructions outlined in The Dye Plants (see pp.66–139).

③ Put all five skeins from each mordant group listed above into the dye bath and complete the dyeing process, according to the dyestuff used.

④ Remove all five sets of skeins from each mordant group from the dye bath. Rinse and wash one dyed skein from each group and label them "No modifier." These dyed skeins (A, F, K, P, U) do not require any further treatment, as they will remain unmodified.

⑤ Following the instructions on pp.58–59, make four separate modifier solutions, one acidic, one alkaline, one copper, and one iron.

⑥ Put one dyed skein from each of the mordant groups into each of the four modifier solutions and treat as described on pp.58–59.

Note Remember not to apply heat to the wool skeins in the alkaline solution.

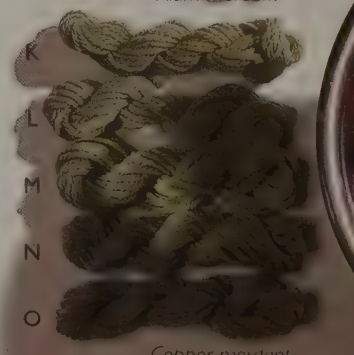
⑦ When each modifying process has been completed, remove the skeins, rinse well, and wash. Then label the skeins according to the modifier used.

This will give you 25 colored skeins.

Note If there is enough color potential remaining in the used dye bath, it may be possible to repeat the process described above on another batch of mordanted skeins. This would yield a further 25 shades, paler in color than those shown here.

Unmordanted skeins

Alum mordant



Copper mordant

Iron mordant

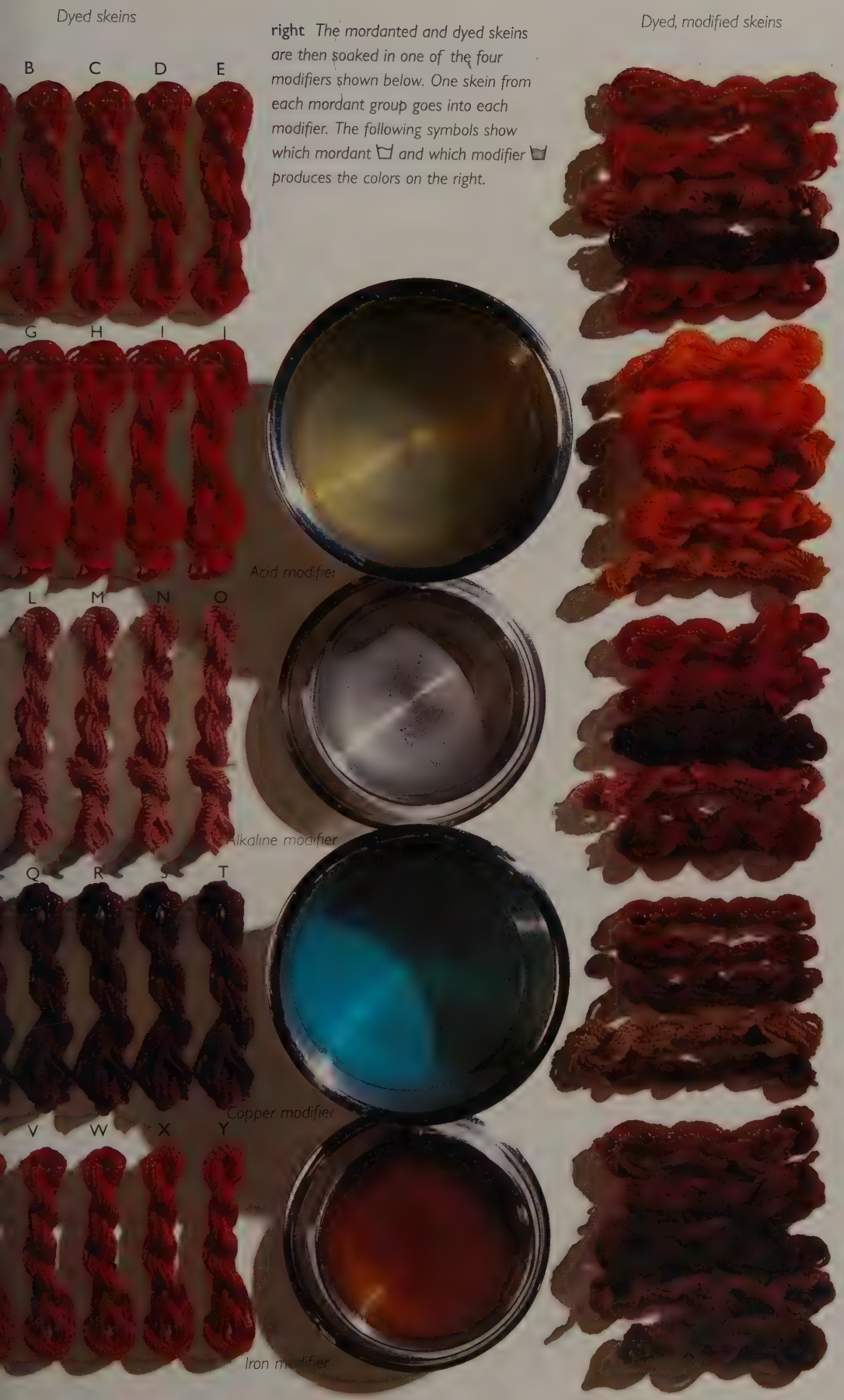
Rhubarb leaf solution mordant

left *The five sets of wool skeins have been mordanted in five different substances. The first set has no mordant; and the following four sets of five skeins (from top to bottom) have alum mordant; copper mordant; iron mordant; and rhubarb leaf solution mordant.*


Madder dye bath

above *All 25 mordanted skeins are added to the dye bath to make five sets of subtlely different colors.*

right *The mordanted skeins all produce slightly different shades of reds, pinks, browns, and oranges once they have been dyed. After dyeing, the fibers are modified to increase the color possibilities.*



right *The mordanted and dyed skeins are then soaked in one of the four modifiers shown below. One skein from each mordant group goes into each modifier. The following symbols show which mordant and which modifier produces the colors on the right.*

Testing the fastness of dye colors

Technically, any change in color is termed "fading," whether the color becomes lighter or darker in tone over a period of time. Many dye colors, both natural and synthetic in origin, will fade if exposed to daylight for prolonged periods.

Sometimes natural dyes are described as "mellowing" or "maturing" with age. With many plant dyes, this means that the colors become softer and less brilliant, but still remain pleasing to the eye. While few natural dyes disappear entirely if properly applied, most "mellow," although some may take longer to do so than others. If several different colors are used together, the harmony between the various shades usually remains, even though they may not "mellow" at the same rate. Washing will also cause some natural dyes to become paler or less vivid in color, and any dye matter that becomes detached from the fibers may also stain other fibers washed at the same time.

Just how light- and washfast dyed materials need to be depends to a large extent on the purpose for which they are used. High degrees of lightfastness are necessary for furnishing materials, tapestries, or wall hangings, and washfastness will be more important for cotton garments or table linens, which might be expected to withstand frequent machine-washes.

Woolen knitwear, though, is not washed so frequently, and is not worn in strong sunlight for long periods. For items in which several colors are combined, the ability of the dyes to remain fixed to the fibers, without running into other colors, is an important consideration, if they are to be washed.

When you have dyed your fibers, conduct the following simple tests on sample fibers to determine their overall fastness. These will demonstrate how much the color fades on exposure to daylight, whether the color is washfast, and whether the color stains other materials when washed, or whether it runs into other colored areas.

Before conducting any tests, rinse and wash the fabrics or yarns after dyeing to remove any unfixed or loosely attached dye particles. Otherwise, any loosely attached dye would wash off or cause staining during the tests, and this might result in misleading conclusions being drawn.

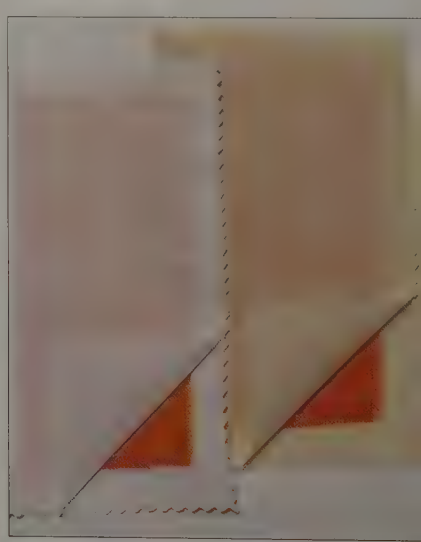
To test for lightfastness, fasten the fabric sample between two layers of card, leaving a portion exposed. Tape the card to the inside of a window that does not face directly into the sun, and leave it for two to three weeks. Compare the exposed and covered sections of the fabric. If the color has faded a great deal by the end of the test period, then the dye is best reserved for items that will not be exposed to more than a few hours of full daylight at any given time.

WASHFASTNESS

- Before testing for washfastness, make sure that the fabric samples have been rinsed and washed after dyeing.
- Prepare two samples of fabric or yarn of each color for each test, so that there is a sample for comparison. Subject the test samples to the same washing procedure that the finished item would receive. Any samples that lose a large amount of color after washing are unsuitable for items that require frequent washing.
- To test whether colored fabrics will stain or run, make two samples of each color. Sew one between two layers of undyed woolen fabric and another between two layers of undyed cotton fabric. Wash the samples, following the most likely procedure for the finished item to see the degree of staining in the washing process.

above *To test for lightfastness, fabrics or yarns should be fastened between two layers of card, one with a window cut out of it, and placed in strong daylight to see how quickly they fade.*

above *The skein of dyed yarn has been kept in the dark and retains the full brilliance of the colors. The garment beneath, knitted from an identical skein, has "mellowed" over the years.*



above *Dyed fabric samples are sewn beween two layers of undyed woolen and cotton fabrics. When washed once or twice the samples will show whether they stain.*

Recording natural dyeing results

Once all the processes involved in creating a particular dye color on fibers have been completed, keep a sample of each shade for a record book, and label the samples so that all the fibers, ingredients, and methods used are carefully noted.

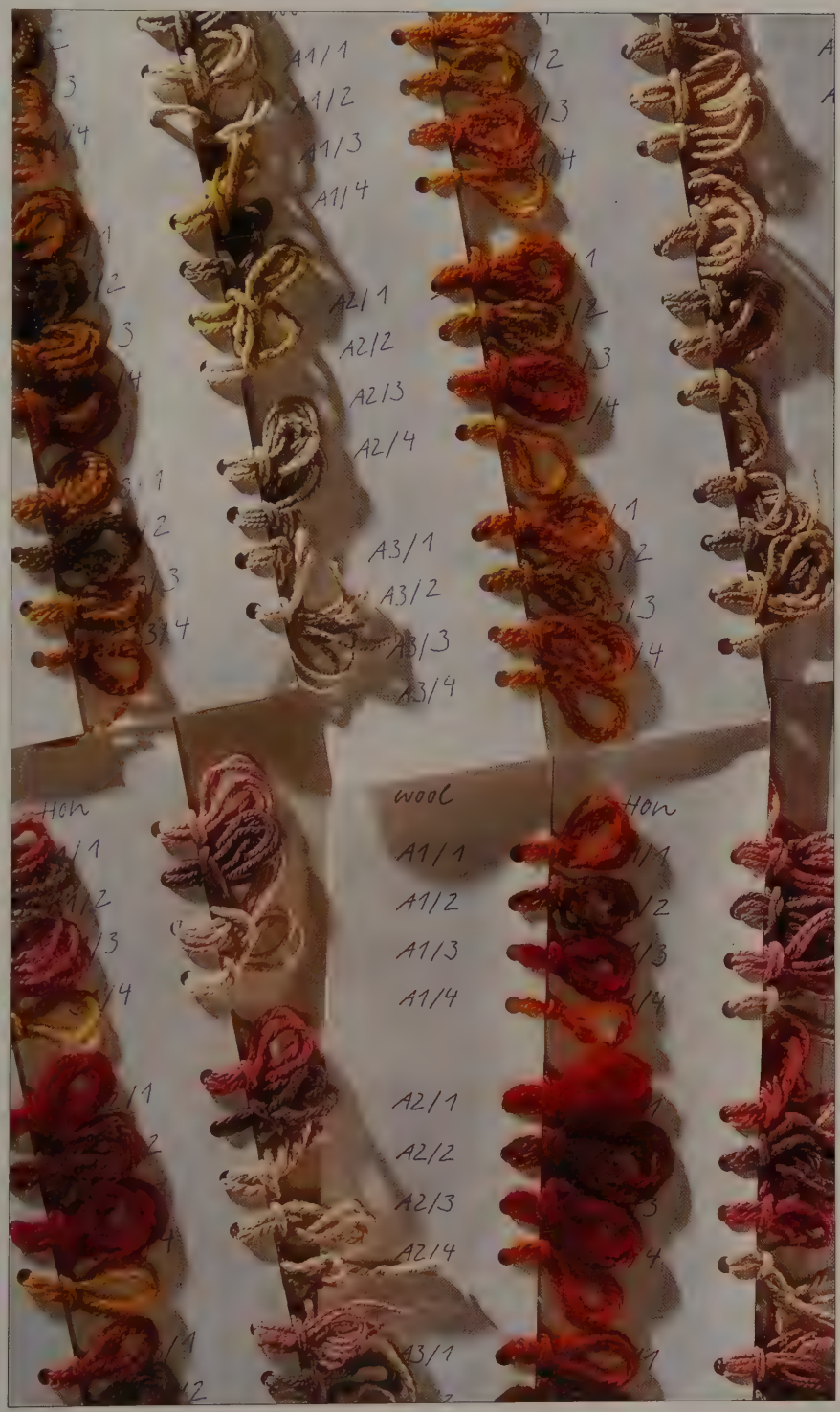
Before filing away fiber samples, label each according to mordant, dyestuff, and method used, plus any other relevant details. It is a good idea to cut off a small piece of each fiber dyed, and fasten it to a sample card in a record book, taking a careful note of all the procedures followed, otherwise it may be hard to achieve the same results again.

While it is not difficult to identify most mordants before dyeing, because each imparts a different color tone to the fibers, the situation changes once the dyeing process has been completed. It can be extremely annoying to produce a lovely shade, but be unable to remember which mordant was used to achieve it. So do not forget to label all mordanted materials before dyeing them.

Sample identification

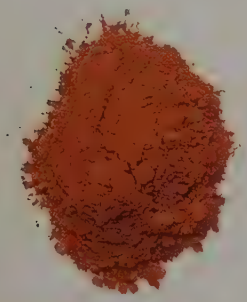
There are various methods of identification, and each dyer has his or her preferred system. Whichever you select, remember that the mordanted materials will be subjected to processes that may involve simmering for long periods. Cardboard labels are unlikely to withstand such treatment.

Some dyers punch a hole in the plastic labels used by gardeners and then write on them with a waterproof marker. They can then be attached to the skeins or fabrics with a length of strong thread. If you choose this method, it is advisable to test the ability of the plastic to tolerate heat and the reliability of the marker, before you use them on samples. A trial run can save much frustration later on, and you can avoid having your plastic label shrivel in the heat or the ink from your marker run into the water, staining your precious fibers.



right *These pages, from the author's sample record book, show color samples attached to sheets of card. All the samples are labeled, using codes to identify the fibers, mordants, and modifiers used. These records are a vital part of the dyer's work and enable knowledge and experience to be passed onto others.*

The Dye Plants



Acacia catechu

Cutch, Catechu

The dyestuff known as cutch or catechu is an extract usually made from the heartwood of Acacia catechu, *a small thorny tree. It yields orange-brown dyes that are rich in tannin, and was used in Indian calico printing before its introduction to the West. It is used mainly to dye cotton and silk.*

HEARTWOOD

Acacia catechu has leaves consisting of many pairs of short, narrow leaflets but each leaf is still identifiable as a single unit. It bears dark yellow flowers in the leaf axils and it is in the axils that the long seed pods develop.

Although cutch has been used traditionally to dye silk and cotton fibers, it is also a valuable dye for wool. It was used to dye the khaki color of military uniforms, usually with a copper mordant. The same dye also comes from the fruits of *Areca catechu*, the Asian betel palm, and a similar dye is prepared from the leaves and twigs of gambier (*Uncaria gambier*), a vine that grows in the East.

Cultivation and harvest

Acacia catechu is cultivated in many tropical regions. The dye extract is made by boiling the heartwood chips in water, then reducing and evaporating the liquid until it becomes very thick. This liquid is then poured onto matting and, as it cools, it hardens into a solid brown mass. This mass is cut into chunks, which may then be powdered. The prepared extract is available from specialist suppliers, as chunks, granules, or as a powder, and is easy to use.

Dyeing procedure

Dissolve the chunks or granules in boiling water. Mix the powder into a paste with warm water, and then stir into the water of the dye bath. No further preparation is required. Fibers are added to the cutch dye bath and no heat is necessary. The use of a copper mordant will intensify the resulting shades of brown and yellow on the fibers and give increased light- and washfastness.

For deep colors, fibers may need to be soaked in the dye liquid for several days. Alternatively, the fibers can be gently simmered for one hour or so.

Cutch is often a difficult dye to exhaust, and will continue to produce paler browns and yellowy shades on several successive batches of fibers.

Cutch can also be used as a source of tannin for mordanting vegetable fibers.

Range	India, East Indies, and Southeast Asia.
Availability	Purchase dyestuff from specialist suppliers.
Planting time	Not applicable.
Growing habit	Not applicable.
Harvesting time	Not applicable.
Dyestuff	Heartwood (extract available as chunks, granules, or as powder).
Dyeing instructions	No mordant necessary. Use half the weight of dyestuff to fibers.

Achillea millefolium and *Achillea* hybrids

Common yarrow

Common yarrow is frequently found growing wild in North America, Europe, and Asia, and there are also many garden hybrids that can be used in the dye pot. The plant tops yield a yellow dye when simmered, and give soft olive-greens with an iron modifier or browner shades with copper.

Achillea millefolium, common yarrow, is a hardy perennial that grows wild on roadsides and in woodlands and fields. It often grows wild among unmown grass in gardens. It has gray-green feathery leaves and flat pink or white flower heads.

From Anglo-Saxon times, common yarrow has been regarded as a powerful herb. It was used as a charm against illness and misfortune and for stanching wounds.

Cultivation and harvest

Plants can be purchased from a nursery and planted out any time between the fall and spring. Otherwise, sow seeds indoors in seed compost in early spring, several weeks before the last frosts. Plants started early will usually flower in their first summer. Transplant the seedlings into pots and then plant them out in their permanent positions when they are well-grown and the weather is milder.

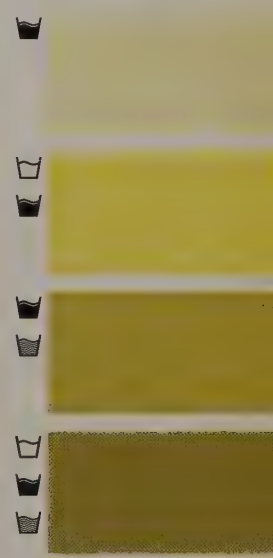
Yarrow likes a well-drained soil and prefers a sunny spot, although it can tolerate some shade. It is generally trouble-free. Cut back the yarrow plants in late fall, when they have finished flowering.

Plants can be propagated by dividing the roots in spring or fall and then replanting them, although the plants spread quite happily of their own accord.

To harvest yarrow for the dye pot, cut off the leaves and whole flowering tops close to the base; this will also encourage new growth.

Dyeing procedure

The plant materials can be used fresh or dried for later use. Simmer the plant material for about one hour to extract the dye color. Add the fibers to the dye bath, and simmer gently for at least one hour for the dye color to take on the animal or vegetable fibers.



PLANT TOPS

Range	North America, Europe, and Asia.
Availability	Grow from seed or purchase as plants.
Planting time	Sow seeds in early spring; plants from fall to spring.
Growing habit	Grows to 12–36in (30cm–90cm) tall.
Harvesting time	Spring to fall.
Dyestuff	Plant tops.
Dyeing instructions	Alum or copper mordants recommended for animal and vegetable fibers. Use equal weights of dyestuff and fibers for plant tops.

Alcea rosea

Hollyhock

Hollyhocks have long flowering stalks and produce an abundance of pastel pink, yellow, dark pink, or red flowers, depending on the variety. The dark-colored flowers can be used fresh or dried and offer a rich source of color for the dye pot, contributing shades of mauve and maroon.

DARK FLOWERS

Hollyhocks can be grown in most temperate regions. They produce tall spikes of funnel-shaped flowers, and occur as single- or double-flowering forms.

Cultivation and harvest

Buy plants in spring and plant them out in their growing positions. Seeds can be sown indoors several weeks before the last frosts, or outdoors between spring and summer. Plants started early enough may flower in their first summer, otherwise they will not flower until the following year.

Thin or transplant the seedlings when they are about 6in (15cm) high, and place them 24in (60cm) apart.

Most varieties will need staking when they reach a height of 36in (90cm), especially in exposed positions, where they are more likely to blow over and split their long stems. After flowering, some hollyhock plants may self-seed.

Hollyhocks prefer a rich, heavy soil and plenty of water. They may be attacked by slugs, snails, and caterpillars.

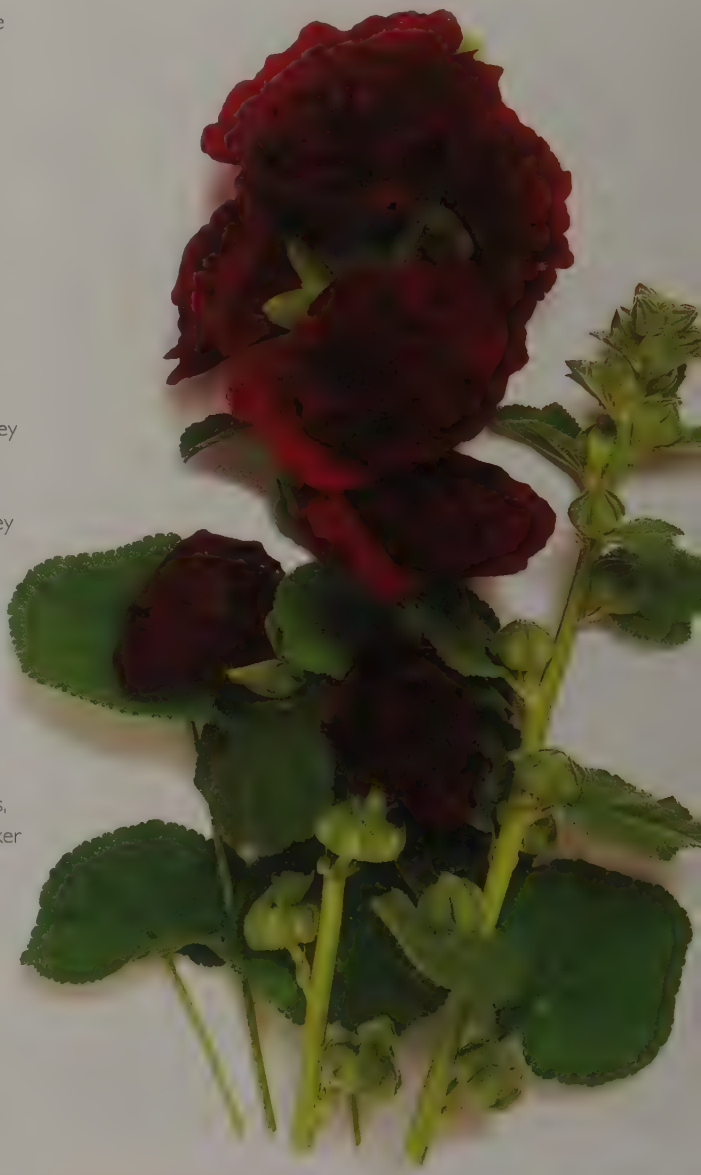
Pick flower heads every one or two days, and separate the pale flowers from the darker ones; the darker flower heads yield the strongest, most interesting colors. If you have plenty of flower heads, use them fresh, otherwise dry the flowers until there are enough for a dye bath.

Dyeing procedure

To extract the dye color from the flowers, soak the flowers in water overnight then simmer them for about 45 minutes.

Add the animal or vegetable fibers to the dye bath, with or without the flower heads, and simmer for about one hour. Dyeing without heat is also possible if the fibers are left to soak in the liquid overnight. On vegetable fibers, hollyhock dyes only give pale results, with or without heat.

Deep pink and red flower dye baths usually react well to modifiers and interesting color variations can be achieved.



Range	China and most temperate regions.
Availability	Grow from seed or purchase as plants.
Planting time	Sow seeds from spring to summer; plants in spring.
Growing habit	Allow 24in (60cm) per plant. Grows to 4–8ft (1.2–2.4m) tall.
Harvesting time	Summer, throughout the flowering period.
Dyestuff	Flowers.
Dyeing instructions	Mordant recommended. Use equal weights of flowers and fibers.

Alkanna tinctoria

Dyer's alkanet

Dyer's alkanet is a sprawling, woody-based perennial plant in the borage family. It has small blue flowers, gray-green leaves, and roots that contain a red pigment that has been used for centuries as a dye and as a cosmetic. In water, the roots yield shades of gray and purple, not red.

ROOTS

The word *alkanna* comes from the Arabic "al hinna," which means "like henna," presumably because both plants are used as dyes and cosmetics. Although alkanet contains a red pigment that is applied as rouge or as a lip stain, this red coloring matter will not dissolve in the water of a dye bath. It can only be dissolved in colorless rubbing alcohol, available from pharmacies, or in methylated spirits or acetone. When used as described in the dyeing procedure below, the dyestuff produces shades of gray, lavender, and purple.

Cultivation and harvest

Seeds of dyer's alkanet are difficult to obtain, but the prepared dyestuff can be bought from specialist suppliers. It is usually sold as dried, chopped roots.

Dyeing procedure

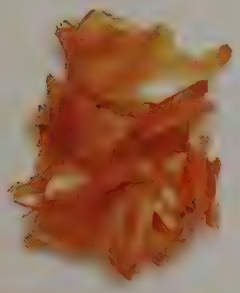
Simmer the dyestuff in water for at least one hour to extract the color. It releases a strong, rather unpleasant odor and is best processed outdoors. If this is not possible, ensure the work area is adequately ventilated.

The extracted dye liquid is a pale greenish-brown color and looks unpromising, but this is deceptive. Strain off the dye liquid, add the fibers, and simmer for at least one hour for strong colors.

Alkanet is sensitive to both the pH value and the mineral content of the water used for dyeing as described in Dyeing Techniques (see p.28). For this reason, color results vary from area to area. Sometimes, dyer's alkanet yields greeny tones, sometimes purple tones, and at other times colors are browner, but all tend to fall within the gray range when no mordant is used. If applied on an alum mordant, lavender and purple colors can be achieved.

Using modifiers does not cause significant color changes, but subtle and attractive variations in shade.

Range	Southern and Eastern Europe.
Availability	Purchase dyestuff from specialist suppliers.
Planting time	Not applicable.
Growing habit	Not applicable.
Harvesting time	Not applicable.
Dyestuff	Roots.
Dyeing instructions	No mordant necessary but alum mordant gives purple and lavender colors. Use equal weights of dyestuff and fibers.



Allium cepa

Onion

The outer skin of this common vegetable is one of the most useful and readily available dyestuffs. It is ideal for the novice dyer's first experiments since it reliably produces rich, vibrant shades of orange, yellow, rust, and brown on all fibers, and does not impart any odor to the dyed materials.

OUTER SKINS

Onion skins have considerable tinctorial properties, either when used on their own or in combination with other dyestuffs.

Cultivation and harvest

It is simple to grow onions from seed. Seeds may be sown in early spring to provide a crop in the fall for winter storage, or in late summer or early fall to harvest the following summer. Sow seeds thinly in rows 12in (30cm) apart. Thin the seedlings to 4in (10cm) apart when they are large enough to handle. Water well during dry spells, but not once the bulbs begin to ripen.

Onions like plenty of sun and a well-drained light, friable soil. They can be grown on the same site year after year, but it is a good idea to dig the ground deeply and work in some well-rotted manure or compost before sowing the next batch of seeds.

Onions are susceptible to a number of pests, including onion fly, maggots, and stem and bulb eelworms.

Store harvested onions in a dry, airy place, so that air can circulate around them. When preparing onions for cooking, peel off the outer skin and store it in a paper bag, until there are enough skins for a dye bath.

Dyeing procedure

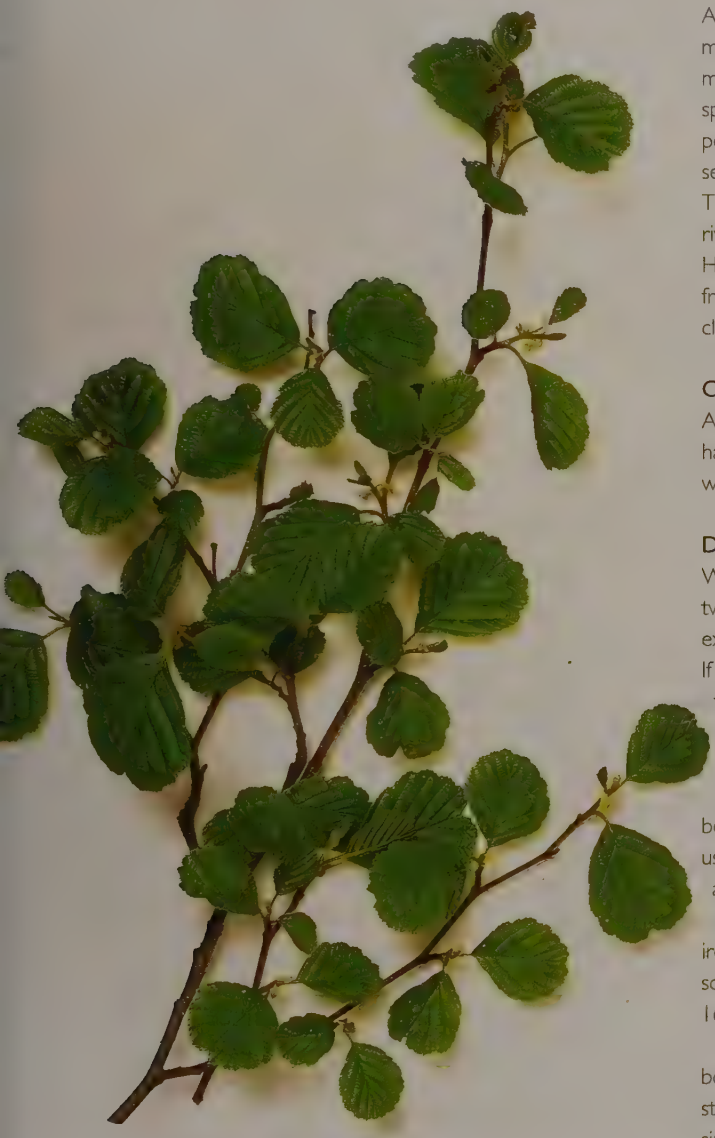
Onion skins can be added to dye baths prepared from tree bark to make the dye yellower and brighter, or introduced to madder dye baths (see pp.124–125) to produce colors that are more orange in tone. Used on their own with an alum mordant, onion skins give orange, rust, and brown shades, depending on the quantity used. The skins from red onions can also be used, although they do not always produce the same colors as white onions. Materials dyed with onion skins produce green shades when overdyed in an indigo vat (see pp.54–55). Onion skins can also be used to supplement a yellow dye bath made from other plant material; the addition of the onion skins brightens the final result.

Range	Grows throughout the world.
Availability	Grow from seed or purchase as a foodstuff.
Planting time	Sow seeds in early spring and late summer or fall.
Growing habit	Allow 4in (10cm) per onion; plant 12in (30cm) apart.
Harvesting time	Fall to late summer, the following year.
Dyestuff	Outer skins.
Dyeing instructions	No mordant necessary, but a mordant, or an iron or copper modifier, improves colorfastness and extends the range. Use half the weight of fibers to dyestuff.

Alnus species

Alder

Alder trees are common in Europe and North America and their bark, twigs, and cones are rich in tannin and can be used as an alternative to oak galls for mordanting vegetable fibers. Dye baths containing mixed plant parts or leaves alone produce shades of pinky-tan and olive-green.



Range	Northern hemisphere.
Availability	Gather from nature.
Planting time	Not applicable.
Growing habit	Not applicable.
Harvesting time	Cones, twigs, and bark: all year. Leaves: spring to fall.
Dyestuff	Leaves, cones, twigs, bark.
Dyeing instructions	No mordant necessary for bark, twigs, and cones. Mordant recommended for leaves. Use at least equal weights of dyestuff and fibers for all plant parts.

Alder trees are considered a nuisance by many farmers, because they crowd out other more desirable trees, such as birch (*Betula* species, see p.76) and wild cherry, plum, peach, almond, and apricot (*Prunus* species, see p.111), and encroach on agricultural land. They are frequently found beside streams and rivers, and most thrive in cool, damp sites. However, alder trees are also found on the fringes of housing estates, and established clumps spread rapidly.

Cultivation and harvest

Alder trees are readily found in nature and harvesting small quantities of leaves and twigs will not endanger the success of this tree.

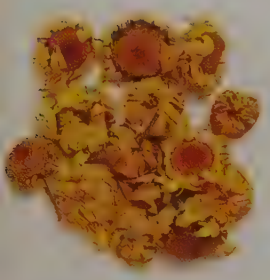
Dyeing procedure

When used as a mordant, simmer the alder twigs, bark, and cones for one hour or so to extract the tannin, then strain off the solution. If these tree parts are used as a dye, treat them in the ways generally described for barks in Dyeing Techniques (see pp.46–48). Simmering the alder parts for prolonged periods results in a browner dye color, because more tannin is extracted. This can be useful if you want to apply an iron modifier afterward, to achieve a dark gray-black. The use of alder bark as a dye, especially with iron to produce black shades, was recorded in some early dyeing manuals, including one from 16th-century Italy.

To use the leaves only as a dye, pour boiling water over them, then leave them to steep for an hour or two, or overnight. Then simmer the leaves gently for 30 minutes or so to extract their full color potential. Strain off the dye liquid, add the fibers, and simmer the fibers for 45 minutes to one hour. Then leave them to soak in the dye bath overnight to get the desired color result. Iron as a modifier produces almost black shades.

LEAVES

CONES, TWIGS, BARK



Anthemis tinctoria

Dyer's chamomile

Dyer's chamomile has feathery leaves and yellow daisy-like flowers, unlike the more common white-flowered type. The dried chamomile, sold for herbal tisanes, can also be used as a dyestuff. Flower heads alone yield clear, bright yellows, while leaves and stalks give shades of green.

FLOWERS

LEAVES, STALKS

Dyer's chamomile is a short-lived, upright perennial plant. Its feathery leaves are often white and hairy on the underside. It is one of the traditional sources of yellow dye in many parts of Europe, and is also used in the dyeing of yarns for Turkish carpets and kilims.

Cultivation and harvest

Dyer's chamomile is frequently planted in herbaceous borders and is easily grown from seed. Sow seeds indoors several weeks before the last frosts. Plants started early will flower in their first summer. Transplant the seedlings to their permanent sites as soon as they are strong enough and keep them well watered. Dyer's chamomile prefers full sun, but can tolerate some shade. It needs regular watering, especially in hot, dry weather, which can cause it to wilt. It is generally trouble-free and will adapt to most soil conditions.

The leaves and stalks can be harvested at any time during the growing season. Pick the flower heads once they are past their prime, and use them fresh or dry. Keep the leaves and stalks separate from the flowers, as they yield slightly different yellow and green shades.

Dyeing procedure

Simmer the plant materials for at least one hour to extract the dye color. Strain off the liquid and add the fibers to the dye bath. Simmer the fibers for about one hour to allow the color to develop fully.

The dye can also be applied without heat. Add the fibers to the dye bath and allow them to steep for about 24 to 36 hours.

Flower heads used alone give clear, bright yellows. A dye bath made from leaves and stalks, without the flowers, will often produce soft shades of green.

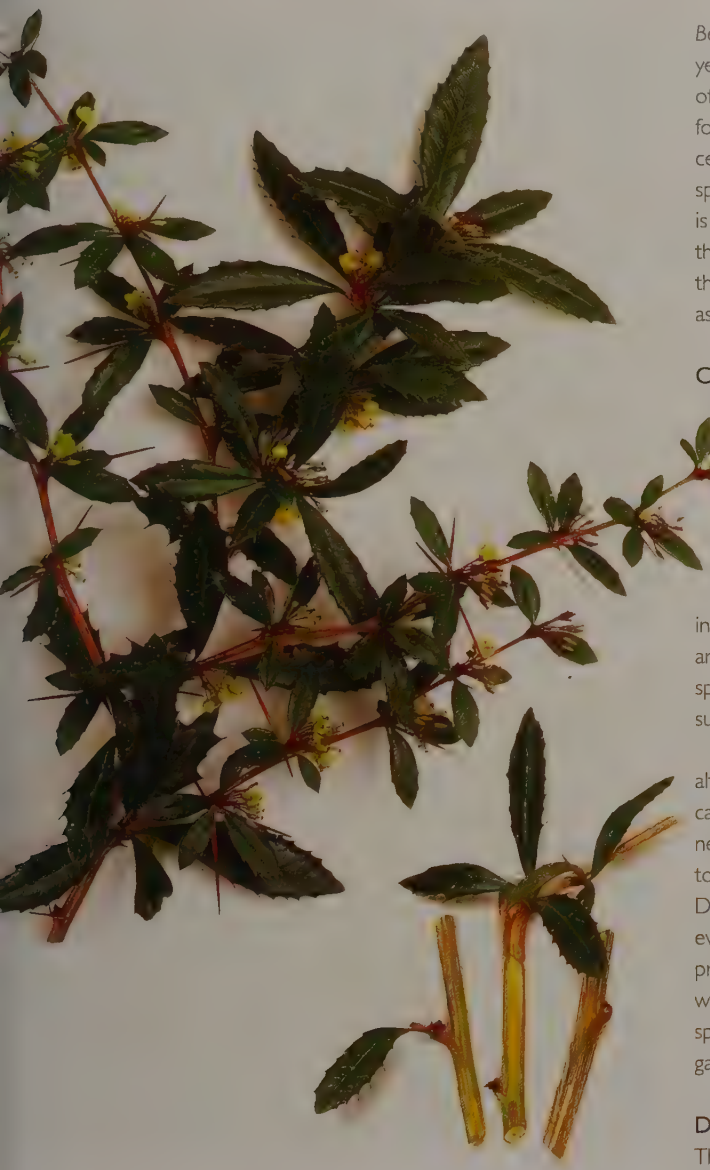
Bear in mind that other types of chamomile, such as *Anthemis* species or *Matricaria* species, contain similar dye properties and can also be used.

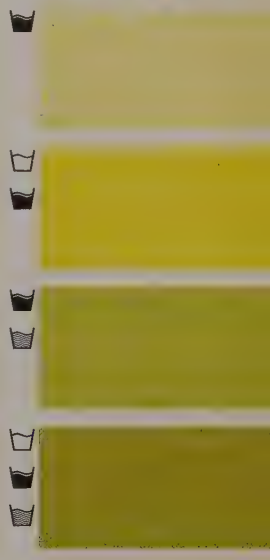
Range	Europe and most temperate regions.
Availability	Gather from nature or grow from seed.
Planting time	Sow seeds in early spring.
Growing habit	Allow 24in (60cm) per plant. Grows to 36in (90cm) tall.
Harvesting time	Throughout the growing season.
Dyestuff	Flowers, leaves, stalks.
Dyeing instructions	Mordant recommended. Use at least equal weights of dyestuff and fibers, more dyestuff for strong colors.

Berberis thunbergii

Barberry

Barberry produces a strong yellow dye from its bark. Dyers in North America and Canada may find barberry growing in the wild or can buy it as a dyestuff from specialist suppliers. When overdyed in an indigo vat, barberry produces turquoise colors, making it a valuable dyestuff.





BARK

Range	Temperate regions.
Availability	Grow shrub or purchase dyestuff from specialist suppliers.
Planting time	Fall to early spring.
Growing habit	Allow 8ft (2.5m) per shrub. Grows to 10ft (3m) tall.
Harvesting time	Throughout the year.
Dyestuff	Bark.
Dyeing instructions	No mordant necessary. Use half the weight of dyestuff to fibers, more for deep shades.

Berberis vulgaris, the most common source of yellow dyestuff, is banned in Canada and parts of the United States because it acts as a host for stem rust, which can cause damage to cereal and grain crops. The only *Berberis* species that can be grown in North America is *Berberis thunbergii*, but dyers should consult the local planting restrictions before cultivating this shrub, or alternatively buy barberry bark as a dyestuff from specialist suppliers.

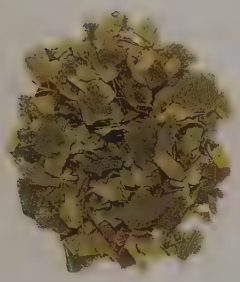
Cultivation and harvest

If the growing of *Berberis thunbergii* is permitted in your region, plant this deciduous shrub between fall and early spring. Deciduous species such as this prefer a sunny position and are grown for their glossy red berries and colorful foliage, which turns orange and red in fall. Evergreen and the more tender species are best planted either in early fall or mid-spring. Evergreen species generally flourish in sun or light shade.

Barberry shrubs are generally trouble-free, although honey fungus, if allowed to spread, can rapidly kill them off. No regular pruning is necessary, but old stems should be cut back to ground level or a healthy young shoot. Deciduous shrubs are best pruned in winter, evergreens after flowering. The bark from prunings can be stripped from the branches with a sharp knife. Some species have sharp spines, so it is advisable to wear protective gardening gloves.

Dyeing procedure

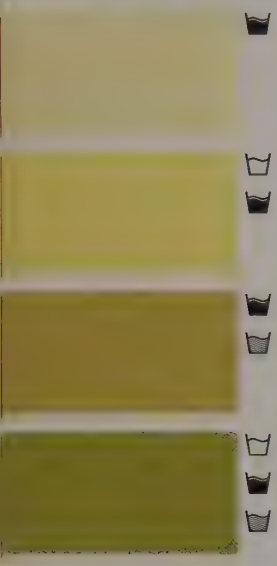
The use of copper as a mordant or modifier improves the fastness of barberry dye colors and tends to produce slightly greener tones that will often produce a turquoise color when overdyed in an indigo vat as described in Dyeing Techniques (see pp.54–55). Turquoise is one of the more difficult shades to achieve from natural dyes.



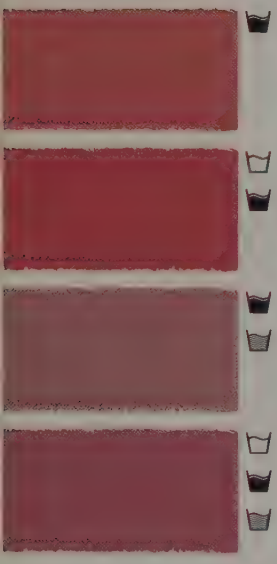
Betula species

Birch

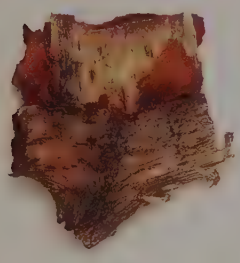
Birch trees have a graceful habit, delicate catkins, and beautiful barks making them easy to identify. The leaves and bark of these ancient trees have been used as a dye source for centuries in many parts of the world and yield clear yellows, olive-greens, and shades of pink.



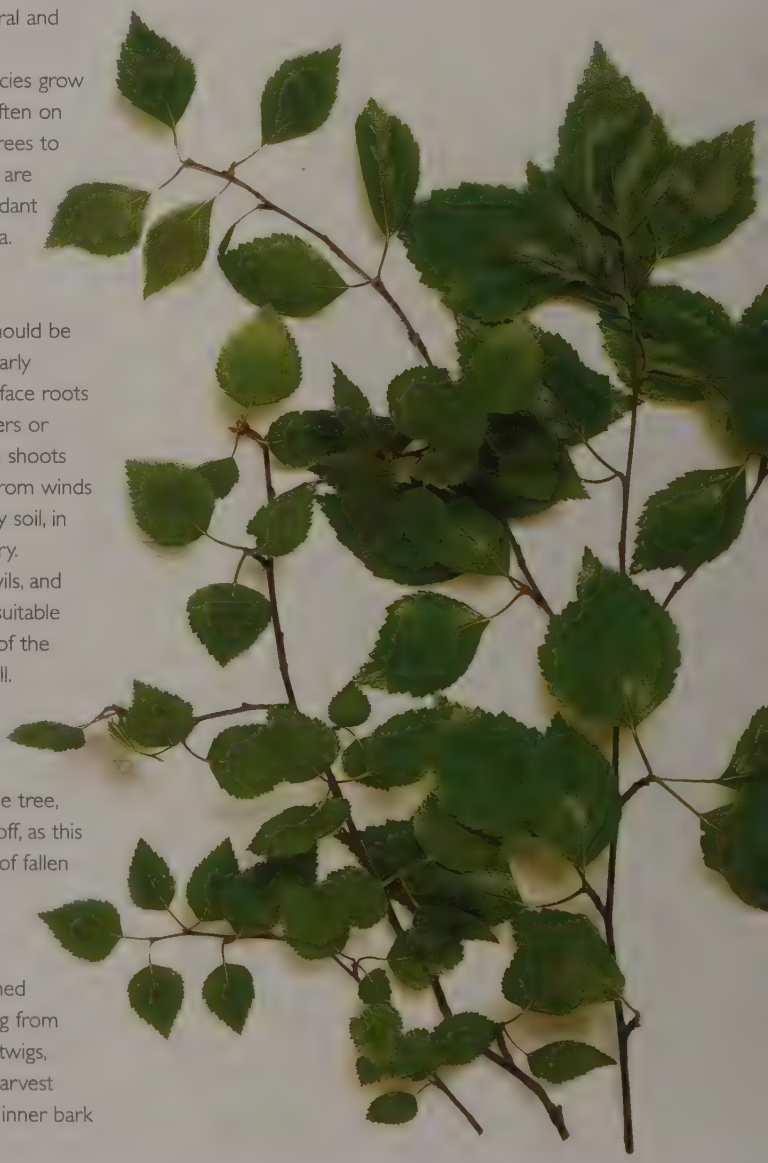
LEAVES



BARK



Birch trees can be found in many rural and urban situations and are popular as ornamental garden trees. Native species grow on dry hillsides and scrubby areas, often on poor soils, and are among the first trees to colonize bare ground. *Betula* species are among the most common and abundant trees in northeastern North America.



Cultivation and harvest

Birch trees bought from nurseries should be planted out between early fall and early spring. They have wide-spreading surface roots so do not plant them close to borders or fences. Species that start to produce shoots early in the year appreciate shelter from winds and frost. They thrive on good, loamy soil, in sun or shade. No pruning is necessary.

Aphids, caterpillars, sawflies, weevils, and honey fungus can be a problem. Unsuitable soil conditions may cause yellowing of the leaves, followed by premature leaf-fall.

Gather leaves from early to late summer to produce lovely clear yellows. Bark should never be harvested from the main trunk of the tree, even when it appears to be curling off, as this may cause damage. Look for pieces of fallen bark beneath the trees or on fallen branches. If you have to cut twigs from living trees, only do so in early spring. Choose mature, well-established trees and then only remove one twig from each branch. Peel off the bark from twigs, using a sharp knife, making sure to harvest both the outer and inner barks. The inner bark often gives stronger colors.

Dyeing procedure

To make a dye bath from birch leaves, simmer them for 45 minutes to one hour, then strain off the dye liquid into the dye pot. Simmer the fibers in the dye bath for about 45 minutes, or more for stronger colors.

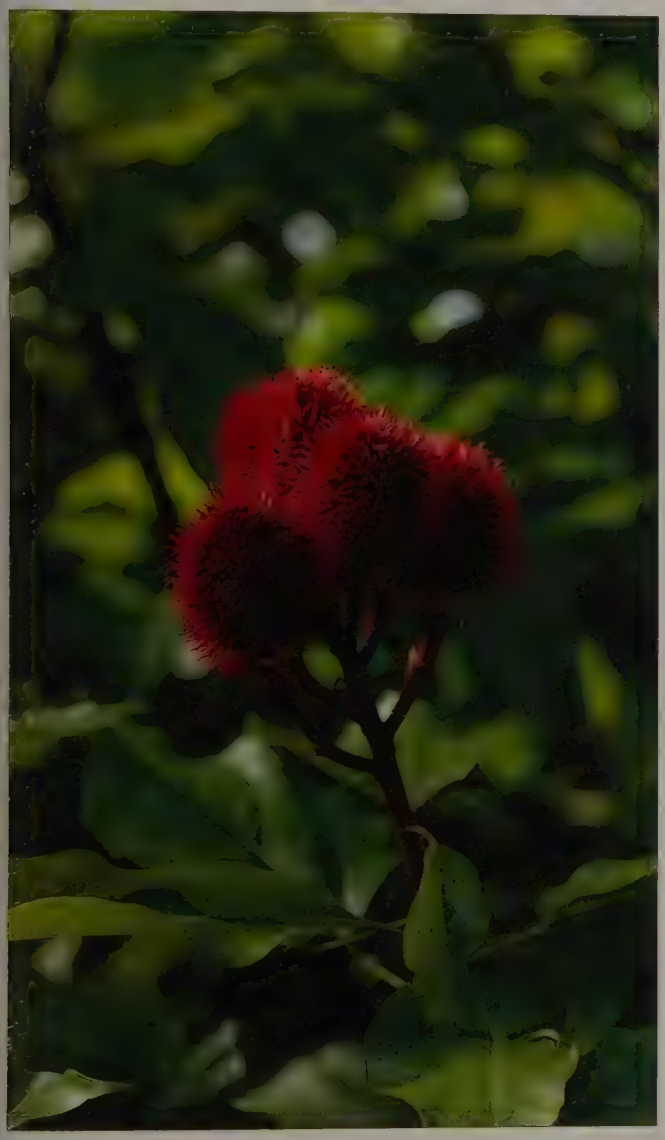
To extract dye color from the bark, treat as generally described in Dyeing Techniques (see pp.46–48).

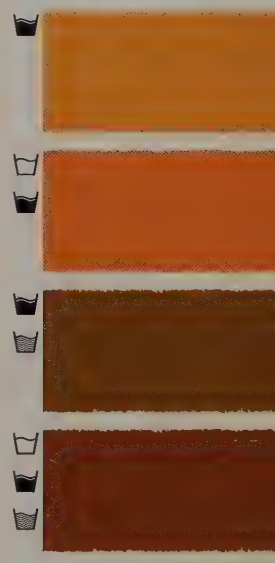
Range	North America, Europe, and Asia to the Himalayas.
Availability	Gather from nature or grow from plantlets.
Planting time	Fall to spring.
Growing habit	Allow 15ft (5m). Grows to 8–30ft (2.5–10m) tall.
Harvesting time	Leaves: late spring to early fall. Bark: all year.
Dyestuff	Leaves, bark.
Dyeing instructions	Leaves: use a mordant. Use equal weights of dyestuff and fibers. Bark: no mordant necessary. Use equal weights of dyestuff and fibers.

Bixa orellana

Annatto

Annatto seeds were pulped into a paste and used by natives of Central and South America as a body paint, a tradition that still survives in Mexico. Annatto is also used as a food coloring, especially for butter, margarine, and cheese, and produces rich shades of orange on all fibers.





SEEDS

Annatto trees have large, heart-shaped, papery leaves. It takes several years of growth before they flower and form dye-producing seeds. When the rosy-pink flowers do eventually appear they form attractive clusters before developing into bunches of red or maroon seed pods. The pods open when ripe to reveal small seeds with a red sticky pulp.

Cultivation and harvest

While growing annatto plants is a lengthy business, the results will be worth the effort. Sow the seeds in individual pots indoors or in a heated greenhouse in warm soil; they should germinate in two or three weeks. Annatto plants grow quite rapidly and will need to be transplanted into successively larger pots. Put the pots outside during the summer, but bring them inside for the winter.

The seed pods will open when the seeds are mature and, at this stage, the seeds are ready for harvesting.

Dyeing procedure

To extract the dye, gently simmer the annatto seeds in water for about one hour. The seeds can either be removed from the dye bath or left in the dye bath during the dyeing process. Stronger colors will result if the seeds are left in the dye bath when the fibers are added.

Simmer the fibers in the dye bath for one hour, then leave the fibers to cool overnight in the dye liquid. Annatto can also be successfully applied without heat.

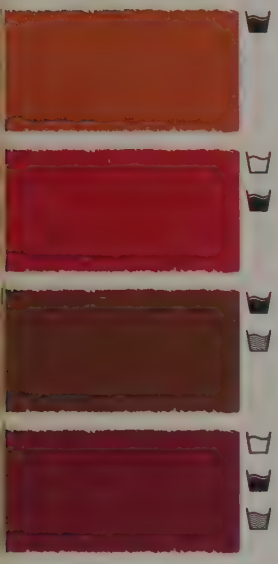
To get the maximum color from the seeds, add one or two teaspoons of washing soda to the water in which the seeds are simmered to extract the dye. Then strain off the dye liquid and allow it to cool before adding the fibers. Soak the fibers in the cool solution until the depth of color required is achieved.

Range	Central and South America and other tropical regions.
Availability	Grow from seed or purchase dyestuff from specialist suppliers.
Planting time	Sow seeds in late spring to early summer.
Growing habit	Grows to 10–15ft (3–5m) tall.
Harvesting time	When seed pods open.
Dyestuff	Seeds.
Dyeing instructions	No mordant is necessary. Use half the weight of dyestuff to fibers.

Caesalpinia species

Brazilwood

Extracted from the heartwood, this strong red dye was known to Europeans from the 13th century as a source of textile color in India and Malaysia. Although it does not have the fastness properties of madder, brazilwood gives rich red and claret colors; applied with logwood it gives browns.



HEARTWOOD

Brazilwood comes from the heartwood of two species, *Caesalpinia sappan*, found in the East, and *Caesalpinia echinata* (also known as Pernambuco), native to Brazil.

From the late Middle Ages to the mid-19th century, brazilwood from *Caesalpinia sappan* was an important commercial dyestuff, and recipes for this plant appear frequently in old master dyers' manuals. It was imported into Europe in large quantities from India, Ceylon, and Malaysia and was referred to as "Sappanwood" to distinguish it from other brazilwoods.

The wood and the dye were known locally as "bresil" or "brasil," meaning "glowing like fire." When early 16th-century explorers found forests of similar trees growing in the part of South America now known as Brazil, they called the region "terra de brasil" and so the country became named after the tree. Once the dye properties from *Caesalpinia echinata* were discovered, it also became an important export. It was still in commercial use as a dye at the beginning of the 20th century but was superseded by synthetic dyestuff. Today, it is used mainly by craft dyers.

Cultivation and harvest

Brazilwood is now only available as a dyestuff from specialist suppliers. The heartwood usually derives from *Caesalpinia echinata* and is sold as wood chips or shavings.

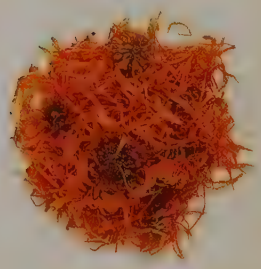
Dyeing procedure

Brazilwood is sensitive to the pH value of water used for dyeing. Acidic water or acidic modifiers produce orange shades and alkaline solutions yield rich plum colors. Brazilwood is a strong dye and one batch of wood chips can be used for several dye baths. Pour boiling water over the wood chips, and leave them to steep overnight. Then, strain off the dye liquid, reserve the wood chips, and use this dye liquid for a first dye bath. Then simmer the chips to make a second dye bath. The wood chips can then be dried and stored. Pink tones can be achieved from exhaust dye baths.

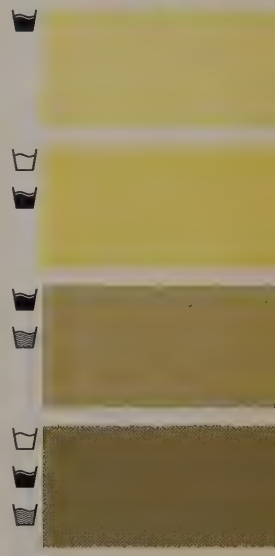
Range	South America, India, East Indies, and Malaysia.
Availability	Purchase dyestuff from specialist suppliers.
Planting time	Not applicable.
Growing habit	Not applicable.
Harvesting time	Not applicable.
Dyestuff	Heartwood (wood chips or shavings).
Dyeing instructions	Mordant recommended. Use equal weights of dyestuff and fibers for strong red and claret colors from the first dye bath.

Calendula officinalis

Pot marigold



Native to southern Europe, pot marigold can be grown in most temperate regions and used for the dye pot, either on its own or mixed with other yellow-producing flowers. The flowers give shades of pale yellow and olive-brown, and yield the brightest colors on animal fibers.



FLOWERS

Calendula officinalis is a hardy annual with daisy-like, often double flowers in shades of yellow, orange, and cream. It is a bushy plant that grows to 15in (38cm) tall. It is excellent for borders and for cut flowers and reproduces itself freely from self-sown seeds. As well as their dye colors, pot marigold flowers have remarkable healing properties and are used for creams and ointments to soothe sore skin, sunburn, and wounds.

Cultivation and harvest

Pot marigold seeds are sown in spring for summer flowering, or in early fall for late spring flowering. Sow the seeds directly into the ground and cover with ½in (1cm) of soil. If you already have pot marigold plants, leave them to flower and when the flowers die back, shake the seeds from the dead flower heads, and let nature do the rest.

Pot marigolds thrive on the poorest soil, with little or no attention, and seem able to tolerate the worst possible conditions. For best results, a well-drained medium garden soil is required. Pinch out the terminal buds to encourage bushy growth and take off the dead heads to prolong the flowering season. Pick the flowers for the dye pot throughout the growing season.

Dyeing procedure

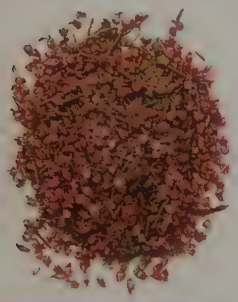
Fresh flowers produce the clearest yellows and olive-browns, but they can also be dried for later use. Dried flowers, however, may give paler dye colors.

Process the flowers as described for French marigold (*Tagetes* species, see p.135).

Pot marigolds give pretty yellow shades with alum mordant and soft greeny-yellows with a copper modifier. Iron used as a modifier gives olive-greens and browns.

The plant material should be simmered for one hour or so to make the dye bath. Strain off the dye liquid and simmer the fibers in the dye bath for about 30 minutes to one hour. To allow the color to develop fully, leave the fibers to soak in the dye bath overnight.

Range	Southern Europe and most temperate regions.
Availability	Grow from seed or purchase plants.
Planting time	Sow seeds in spring or early fall.
Growing habit	Allow 12–18in (30–45cm) per plant. Grows to 15in (38cm) tall.
Harvesting time	Summer to fall.
Dyestuff	Flowers.
Dyeing instructions	Mordant recommended. Use equal weights of dyestuff and fibers.



Calluna vulgaris

Heather

Heathers are hardy evergreen shrubs whose foliage looks attractive throughout the year. In late summer, a blanket of purple heather flowers covers the hills in Scotland, where it has long been valued as a source of mustard yellow and sage green dye for Scottish tweeds.

FLOWERS

PLANT TOPS

A wide variety of heathers can be bought from nurseries, and many have beautiful foliage in colors ranging from greens to russets, reds, and bronzes. The flowers may be pink, purple, red, or white. Heathers make good ground-cover plants and some are used as cut flowers.

Cultivation and harvest

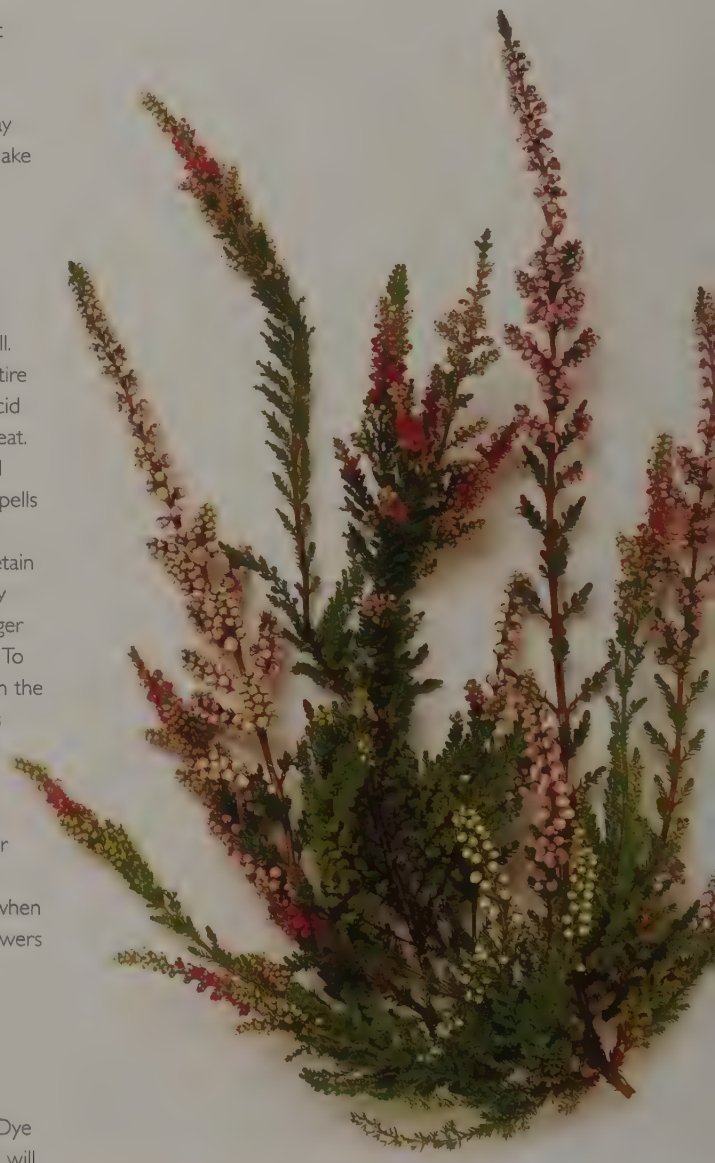
Heathers bought from nurseries are best planted out in the garden in spring and fall. They should be set deeply, so that the entire stem is buried. They grow best in peaty, acid soils, but should not be planted in pure peat. Heathers like an open, sunny position and require plenty of water, especially in dry spells and during the first year after planting. An annual top-dressing of peat will help to retain moisture. Heathers may be propagated by cuttings taken in summer to early fall. Larger plants can also be propagated by layering. To do this, select healthy stems in spring from the outer edges of the plants. Bend the stems down to soil level and bury them so that only their tips show. They should root after about one year and can then be cut from the parent plants and set out in their permanent sites.

To harvest heather, cut off the stems when the plant is in flower and separate the flowers from the stalks and foliage. Use the parts fresh, or dry them for later use.

Dyeing procedure

Dye baths made from flowers only can produce rust, orange, and yellow shades. Dye baths made from both flowers and stems will yield greeny-gold tones. The stems add tannin to the dye bath and this makes the dye colors more muted in tone.

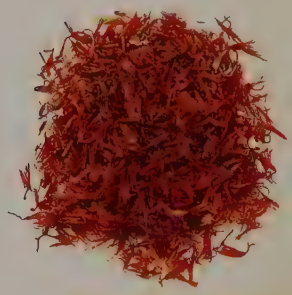
The plant pieces need to be simmered for about one hour to extract the dye color. Add the fibers to the dye bath and gently simmer them for about 20 minutes to achieve yellow shades. To allow the color to develop fully, leave the fibers to soak in the dye bath overnight.



Range	Europe and most temperate regions.
Availability	Gather from nature or grow from plants.
Planting time	Spring or fall.
Growing habit	Allow 30in (75cm) per plant. Grows to 6–12in (15–30cm) tall.
Harvesting time	Mid- to late summer.
Dyestuff	Flowers, plant tops.
Dyeing instructions	Mordant recommended. Use equal weights of dyestuff and fibers for both flowers and plant tops.

Carthamus tinctorius

Safflower



The flowers of this thistle-like plant have been used by dyers for centuries. It is one of the dyes identified on early Egyptian textiles, and is remarkable in that both a yellow and a red dye can be extracted from the petals. In the East, it was also used to make pigments and cosmetics.

Range	Asia, the Middle East, and Southern Europe.
Availability	Grow from seed or buy from specialist suppliers.
Planting time	Sow seeds in early spring.
Growing habit	Allow 12in (30cm) per plant. Grows to 4ft (1.2m) tall.
Harvesting time	Late summer.
Dyestuff	Flowers.
Dyeing instructions	No mordant needed for pinks and reds but improves the fastness of yellows. Use equal weights of dyestuff and fibers.

Today, safflower is grown mainly for the seeds, which are used to make a popular cooking oil. It is also occasionally referred to as "bastard saffron," because it can be used as a substitute for the true saffron, which comes from the stigmas of a fall-flowering crocus. Stems of safflowers can also be bought at florists, where they are sold for dried flower displays.

Cultivation and harvest

Sow safflower seeds indoors in early spring and transplant the seedlings to their growing positions as soon as the soil is warm and the seedlings are large enough to handle. Safflower tolerates most soils, but requires plenty of full sun. In areas where the summers are not long, hot, and sunny, it may be difficult to harvest a good crop of petals for a dye bath before the plants are hit by unfavorable weather conditions.

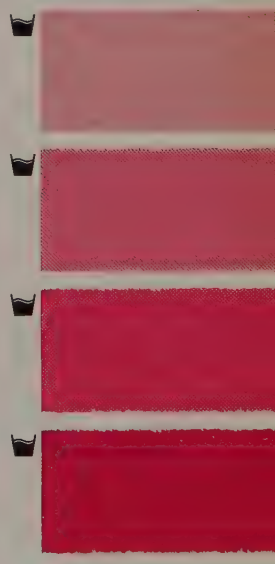
As soon as the flowers begin to bloom, remove fresh petals every few days and spread them out to dry. Keep picking them until there is enough for a dye bath. This may take several weeks, but be patient.

Dyeing procedure

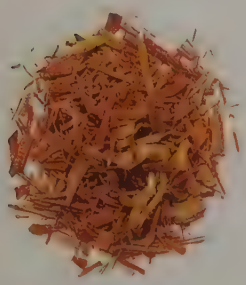
To extract yellow dye from the safflower petals, simmer them for 45 minutes to one hour, then strain off the dye liquid into the dye bath. Simmer the fibers in the dye liquid for about 45 minutes to apply the dye color. Longer simmering produces rich mustard yellow tones.

The red and pink dyes are extracted from the safflower petals by more lengthy processing techniques than for yellow dye, as the yellow coloring has to be removed from the petals first. The process is explained in detail in Dyeing Techniques (see p.53), as are details of how to extract yellow and pink dye colors from the same batch of petals.

FLOWERS
METHOD 1



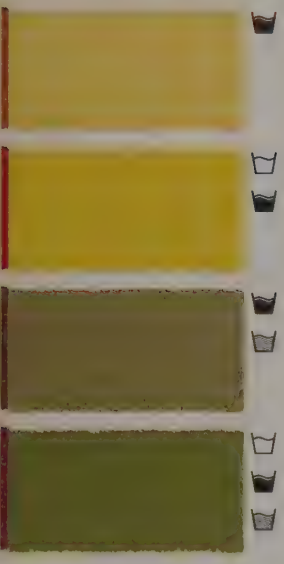
FLOWERS
METHOD 2



Chlorophora tinctoria

Fustic, Dyer's mulberry

Fustic was introduced into Europe in the 16th century and became one of the most popular sources of yellow because of its strong tinctorial qualities. The strength of its coloring made it more economical than other yellow dyes, and it was used with indigo to make green.



HEARTWOOD

For dyers who do not have the opportunity to grow or gather sources of good yellows, fustic is probably one of the most valuable of the yellow dyestuff that can be purchased from specialist suppliers. Fustic comes from the heartwood of *Chlorophora tinctoria* or *Morus tinctoria*, belonging to the mulberry family. It was introduced into Europe in the 16th century from the Americas and the West Indies, and was used not only as a yellow dye, but also for its value when applied with other dyes to create compound colors. The heartwood of fustic is bright yellow when fresh, but exposure to air turns the bright yellow color a shade darker.

Cultivation and harvest

When prepared as a dyestuff, the heartwood is cut or ground into wood chips, and it is in this form that it can be bought from suppliers.

Dyeing procedure

The strength of fustic can vary from batch to batch, but it can be relied on to produce shades ranging from clear yellows to mustards, even when relatively small quantities are used.

If you want a clear yellow, begin by simply pouring enough boiling water on the wood chips to make a dye bath, and leave it to steep overnight. Then strain off the liquid into the dye bath and dry the wood chips to use again later. (When reusing wood chips, simmer them for 45 minutes to make the dye bath.) Sometimes it is possible to use the same wood chips for several dye baths, before the color is exhausted. Simmering the dye bath for a longer period tends to produce mustard tones and the use of iron as a modifier gives glowing shades of olive-green.

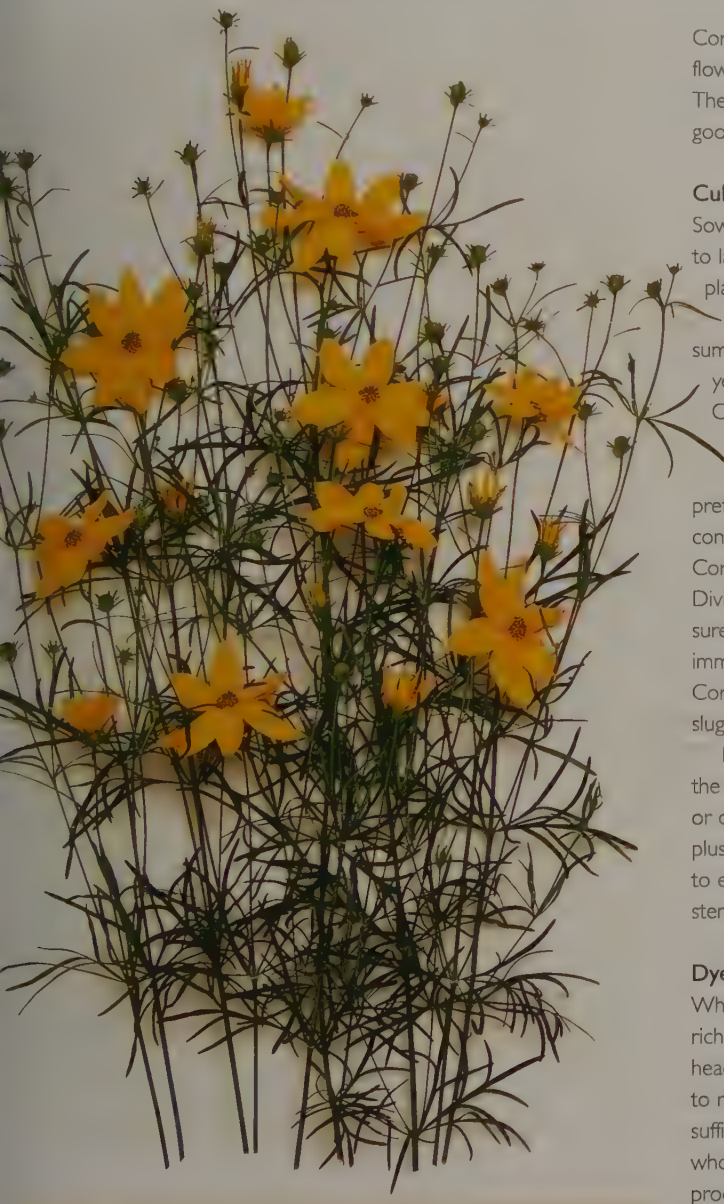
Colors from fustic heartwood have good fastness to light, although strong sunlight may cause them to become a little darker.

Range	South and Central America, and the West Indies.
Availability	Purchase dyestuff from specialist suppliers.
Planting time	Not applicable.
Growing habit	Not applicable.
Harvesting time	Not applicable
Dyestuff	Heartwood (wood chips).
Dyeing instructions	No mordant needed but use of a mordant will increase the colorfastness of the dye. Use at least half the weight of dyestuff to fibers.

Coreopsis grandiflora, Coreopsis lanceolata, Coreopsis verticillata

Coreopsis, Tickseed

Perennial coreopsis plants have a long flowering period, producing plenty of material for the dye pot. Flowers alone produce rich yellows and golds. Whole plant tops, including flowers, give shades of gold and brown, and leaves and stems without flowers tend to give greener tones.



Range	North America and temperate regions.
Availability	Grow from seed or plants.
Planting time	Sow seeds in mid- to late spring.
Growing habit	Allow 18in (45cm) per plant. Grows to 12–36in (30–90cm) tall.
Harvesting time	Midsummer to late fall.
Dyestuff	Flowers, plant tops.
Dyeing instructions	Mordant recommended. Use equal weights of dyestuff and fibers for both flowers and plant tops.

Coreopsis plants, with their bright yellow flowers, are a lovely addition to the garden. They make excellent cut flowers and are a good source of plant color in the dye pot.

Cultivation and harvest

Sow seeds outdoors in open ground in mid- to late spring. The seedlings can then be planted in a nursery bed, before being transferred to their flowering sites in late summer. They will not flower until the second year and look best if grown in groups. Coreopsis thrives in industrial areas and grows best in light soils, although any well-drained garden soil is acceptable. It prefers an open, sunny site and tolerates dry conditions. Tall plants may require staking. Coreopsis can be propagated by division. Divide the plants in the fall or spring, making sure each portion has several roots. Replant immediately in their permanent positions. Coreopsis is generally trouble-free, although slugs may sometimes eat the flowers.

Harvest flower heads regularly to extend the flowering period. They can be used fresh or dried. After flowering, cut off the stems, plus the leaves, just above the next flower bud to encourage new growth. Use the leafy stems fresh or dried in the dye pot.

Dyeing procedure

When used alone, the flower heads produce rich yellows and golds. Simmer the flower heads for about one hour to encourage them to release all their color, which is often sufficient for two dye batches. A dye bath of whole plant tops, including the flower heads, produces warm shades of gold and brown. Adding an iron modifier to the dye bath will give greener tones, as will stems and leaves added to the dye bath without flowers.

FLOWERS

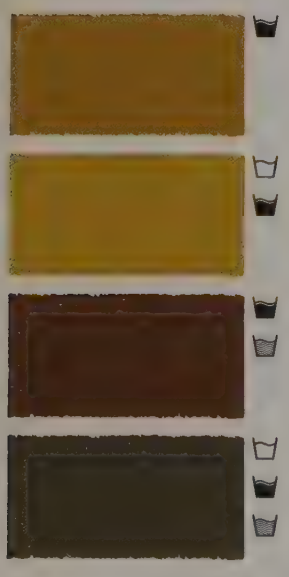
PLANT TOPS

Coreopsis tinctoria

Dyer's coreopsis

Several species of coreopsis can be used for dyeing. Coreopsis tinctoria *is known as dyer's coreopsis and grows wild in parts of North America although it is easy to cultivate. Plant tops flowers give yellows, oranges, and browns, flowers only with alkaline modifiers yield coral-reds.*

FLOWERS



PLANT TOPS

Dyer's coreopsis is a charming annual. It has delightful small gold, maroon, or red flowers that appear in summer and dark green leaves.

Cultivation and harvest

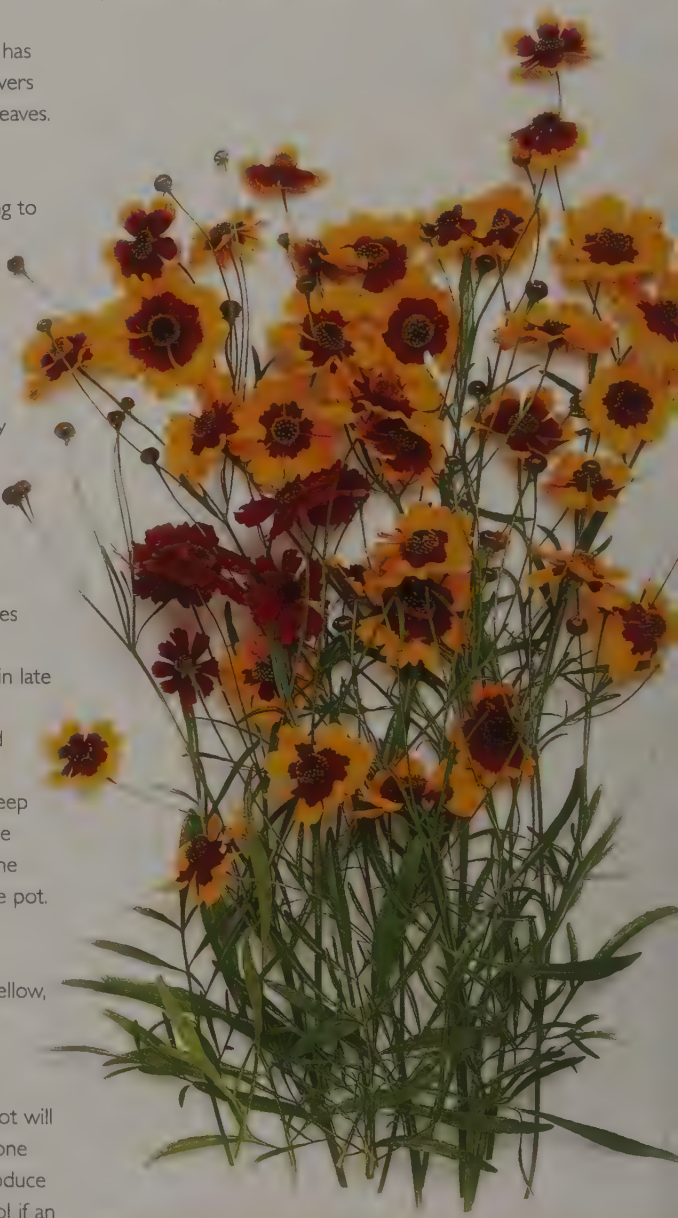
Sow the seeds outdoors from mid-spring to early summer in the flowering site, and thin out the seedlings as necessary. Successive sowings will ensure a crop throughout the summer and into fall.

Dyer's coreopsis favors full sun and will grow in most garden soils. Keep the plants well watered, especially during dry periods to prolong the flowering season and prevent the flowers from going to seed too soon. Plants from early sowings can be cut back after they have flowered to encourage a second flowering. Dyer's coreopsis will sometimes seed itself if the surrounding soil is undisturbed, so watch out for seedlings in late fall or early spring.

Harvest the flowers as they fade and use them fresh or dry and store them until there are enough for a dye bath. Keep the flowers separate from the rest of the plant tops. Cut off the plant tops after the flowers have bloomed for use in the dye pot.

Dyeing procedure

The plant tops yield varying shades of yellow, gold, and brown, depending on the concentration of the dye bath and the length of simmering. Leaving the plant materials to soak overnight in the dye pot will intensify the colors. The flowers used alone give similar shades, but they will also produce a reddish coral on alum-mordanted wool if an alkali is used as a modifier. Dye the wool in the usual way, then remove it from the dye pot, add your alkaline modifier, and watch the color change. Soak the dyed fibers in this alkaline solution overnight. An iron modifier gives shades of greeny-brown.



Range	North America and temperate regions.
Availability	Grow from seed.
Planting time	Sow seeds in mid-spring to early summer.
Growing habit	Allow 12–18in (30–45cm) per plant. Grows to 12–24in (30–60cm) tall.
Harvesting time	Midsummer to fall.
Dyestuff	Flowers, plant tops.
Dyeing instructions	Mordant recommended. Use equal weights of and fibers for both flowers and plant tops.

Cosmos sulphureus

Yellow cosmos

Yellow cosmos has brightly-colored yellow, orange, or reddish flowers that can be harvested throughout summer and fall. When used in conjunction with an alum mordant, yellow cosmos produces golden yellows, and gray-browns with iron or copper modifiers.

FLOWERS

Yellow cosmos is an ideal annual for growing in borders and it makes excellent cut flowers for floral displays. It has a long flowering period, up until the first frosts in the fall.

Cultivation and harvest

Sow the seeds indoors several weeks before the last frosts. Then transfer the seedlings into pots before planting them out in their growing positions in late spring, when the soil has warmed up and all danger of frost has passed. Yellow cosmos prefers a light, rather poor soil. In rich soils it tends to produce too much foliage and flowering may be delayed. It likes full sun and will flourish in hot dry conditions as long as it is watered regularly. Yellow cosmos is generally trouble-free but the plants may need staking when fully grown.

Pick the flower heads at regular intervals throughout the summer and fall as soon as they begin to fade; this will also help to extend the flowering period. The flowers can be used in the dye pot fresh or dried.

Dyeing procedure

To make the dye bath, simmer the flowers for one hour or so to extract the dye color, then strain off the solution into the dye pot. The animal or vegetable fibers should be simmered in the dye pot for 30 minutes to one hour, and then left to cool in the liquid overnight for deeper shades.

For a golden yellow color on alum-mordanted animal fibers, add an alkaline modifier to the used dye bath (see pp.58–59) and then soak the dyed fibers overnight in this solution, without applying any further heat.

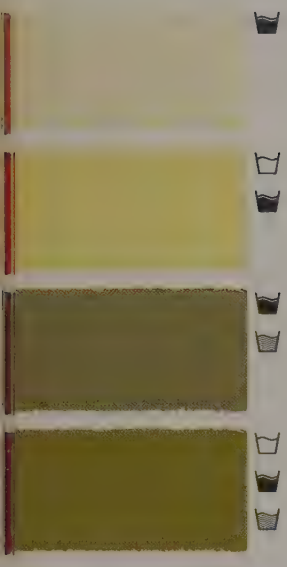
Using iron or copper modifiers will produce rich, gray-brown shades on both animal and vegetable fibers.

Range	Mexico and most temperate regions.
Availability	Grow from seed.
Planting time	Sow seeds in early spring.
Growing habit	Allow 18in (45cm) per plant. Grows to 4½ft (1.3m) tall.
Harvesting time	Summer to fall.
Dyestuff	Flowers.
Dyeing instructions	Mordant recommended. Use equal weights of dyestuff and fibers.

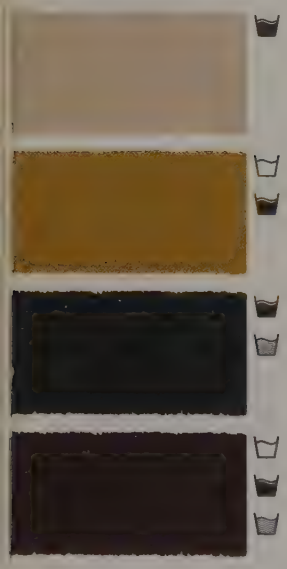
Crataegus species

Hawthorn

In many parts of Northern Europe and North America, hawthorn trees and shrubs are one of the most common hedge and scrub plants. While it is not a remarkable dye source, it can contribute useful shades of yellow and beige to the dye pot, and hawthorn dye works well on animal fibers.



FLOWERS



BERRIES, LEAVES, TWIGS

Hawthorn trees and shrubs are commonly found in parks and along the edges of agricultural land. In spring, white and pink-tinged flowers wave gently in the breeze and fill the air with delicate fragrance. In the fall, dark red apple-like berries glow against glossy dark green leaves, which turn to crimson and purple, before falling as winter sets in.

Cultivation and harvest

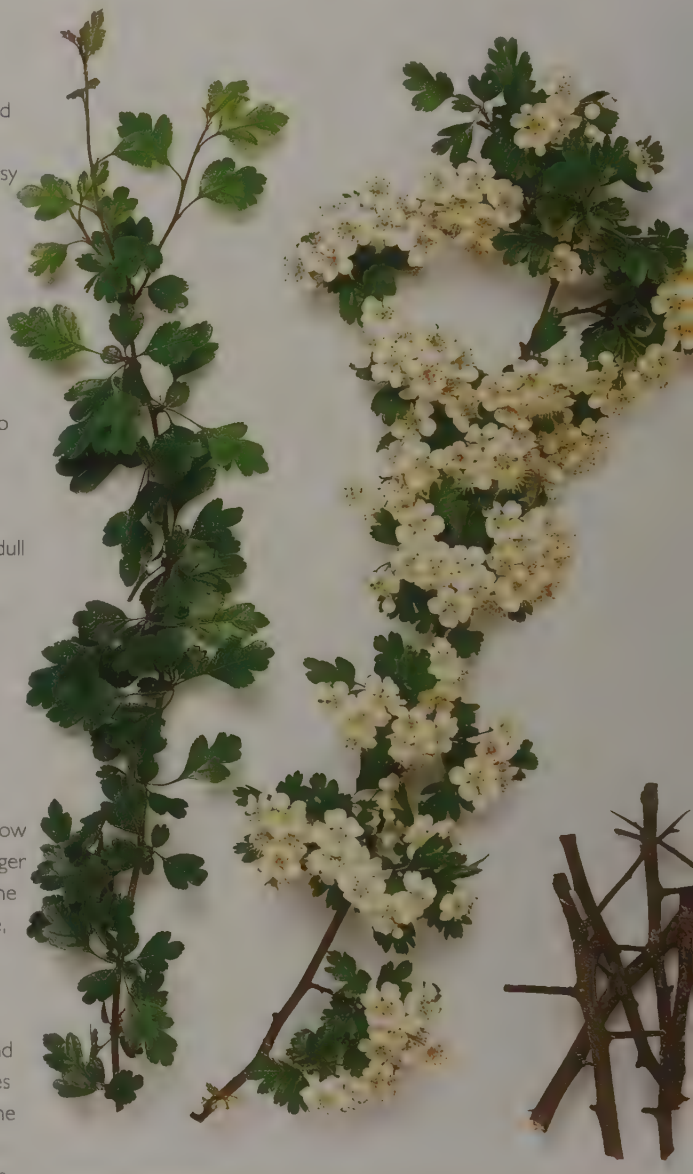
Hawthorn's wide availability ensures that you can harvest it freely from nature without damaging the environment.

As its name suggests, hawthorn has sharp thorns, so wear sturdy gardening gloves to protect your hands when harvesting it. Pick mature flowers in late spring, and separate them from the twigs and leaves, which will dull the color of the dye bath. Pick just a few flowers from each branch. In the fall, gather ripe berries, leaves, and twigs.

Dyeing procedure

Hawthorn is most successful as a dye when used on animal fibers. When dyeing with flowers, an alum mordant is used to fix the color. Hawthorn flowers yield shades of yellow and continue to release more color the longer they are processed. Simmer or gently boil the flowers for several hours to extract the dye, then add the fibers to the dye bath and simmer until they turn yellow. For stronger colors, soak the fibers overnight.

When dyeing with berries, add leaves and twigs to the dye pot. The tannin in the leaves and bark helps to increase the fastness of the dye and produce deeper colors. Cut up the twigs into small pieces and crush the berries, then soak the twigs, berries, and leaves in cool water for one or two days. Next, simmer the soaked plant materials for one hour and strain the liquid through a fine sieve, crushing the berries against the sieve. Add the fibers to the dye solution. Keep hot, but do not boil, and let the fibers "cook" for one hour or so. Remove from the heat and leave the fibers to cool in the dye pot overnight.



Range	North America and Northern Europe to Afghanistan.
Availability	Gather from nature.
Planting time	Not applicable.
Growing habit	Not applicable.
Harvesting time	Flowers: spring. Berries, leaves, twigs: fall.
Dyestuff	Flowers, berries, leaves, twigs.
Dyeing instructions	Use alum mordant for clear, colorfast yellows from flowers. Use equal weights of dyestuff and fibers for all plant parts.

Curcuma longa

Turmeric

Turmeric belongs to the same family as ginger. Sometimes known as "Indian saffron," it is the source of the familiar yellow color of many Asian curry dishes. Both the culinary spice and the dye are obtained from its root. Turmeric was and still is used for textile painting and printing in India.

Range	Southern Asia.
Availability	Purchase as powdered culinary spice.
Planting time	Not applicable.
Growing habit	Not applicable.
Harvesting time	Not applicable.
Dyestuff	Roots.
Dyeing instructions	No mordant necessary. Use half the weight of dyestuff to fibers. An iron modifier gives olive-green shades. An alkaline modifier gives reddish-orange tones.

Turmeric has long been used for bright, clear yellows, and greens when used in combination with indigo (see pp.54–55 and pp.98–99). It will fix on all fibers with or without the use of a mordant, but, in both cases, fades more quickly than most yellow dyes.

Despite its tendency to fade rapidly in sunlight and its sensitivity to soap and other alkalis, turmeric was still used extensively in the early part of the 20th century for shading and dyeing wool, silk, and cotton and, when used with logwood (see p.94), for dyeing ostrich feathers and skin rugs black. Turmeric was also used with the insect dye cochineal (see p.15) for dyeing military coats scarlet, and, in combination with other dyes, to produce browns and olive-greens. Like annatto (*Bixa orellana*, see p.77), turmeric is used to color foods, such as margarine.

ROOTS

Dyeing procedure

Turmeric is attractive for the craft dyer because of its availability and depth of color. However, yellow from turmeric is likely to be less fast than most other yellow dyes, even when used with a mordant or in combination with other dyes. In India, it is frequently mixed with pomegranate rind (*Punica granatum*, see p.115), as turmeric brightens the color, and the tannin in the pomegranate rind makes the color more permanent. When the turmeric dye fades, the ocher shade from the pomegranate remains.

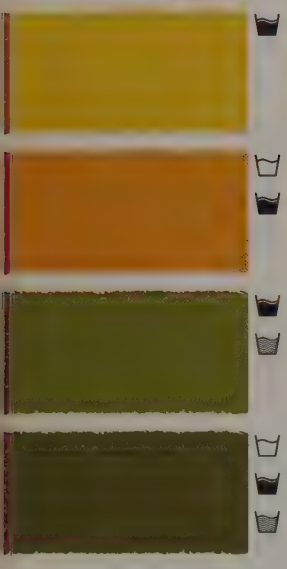
To use turmeric powder, mix it to a paste with a little warm water, stirring well to incorporate all the particles. Add more water, continuing to stir well before pouring it into the dye bath. This dye solution can be applied to all fibers, with or without heat.

If you are dyeing skeins of yarn, it can be difficult to rinse turmeric powder particles out of the fibers. To avoid this problem, simmer the dye solution for one hour, and then strain it through a coffee filter before adding the fibers. Rinse the fibers well after dyeing but always use a pH-neutral washing solution to prevent an unwanted color change.

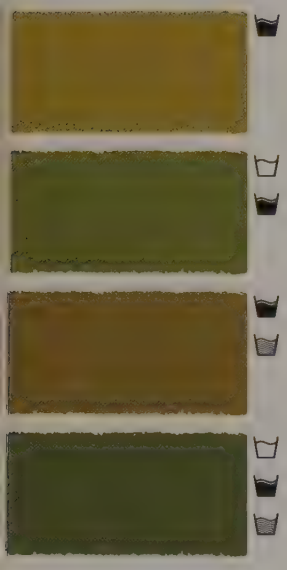
Dahlia species

Dahlia

Gently simmering fresh or dried dahlia flowers will release shades of rich yellows, golds, and oranges for dyeing vegetable and animal fibers. The leaves and stems of dahlias will give lovely soft olive-green hues, which wool fibers will take on without a mordant.



FLOWERS



LEAVES, STEMS

Dahlias are beautiful, showy garden plants. They produce flowers in a wide variety of sizes, shapes, and glorious colors. Except for white dahlias, which do not produce much dye color, all other colors, sizes, and shapes of dahlia produce similar shades to one another in the dye pot.

Cultivation and harvest

The bushy plants can be raised from seed as annuals and used as bedding plants, or grown from tubers for planting in borders. To grow as annual bedding plants, sow dahlia seeds indoors in individual pots in early spring, several weeks before the last frost. Harden off the plants in a cold frame outdoors from mid-spring, then plant them out in late spring, when all danger of frost is over.

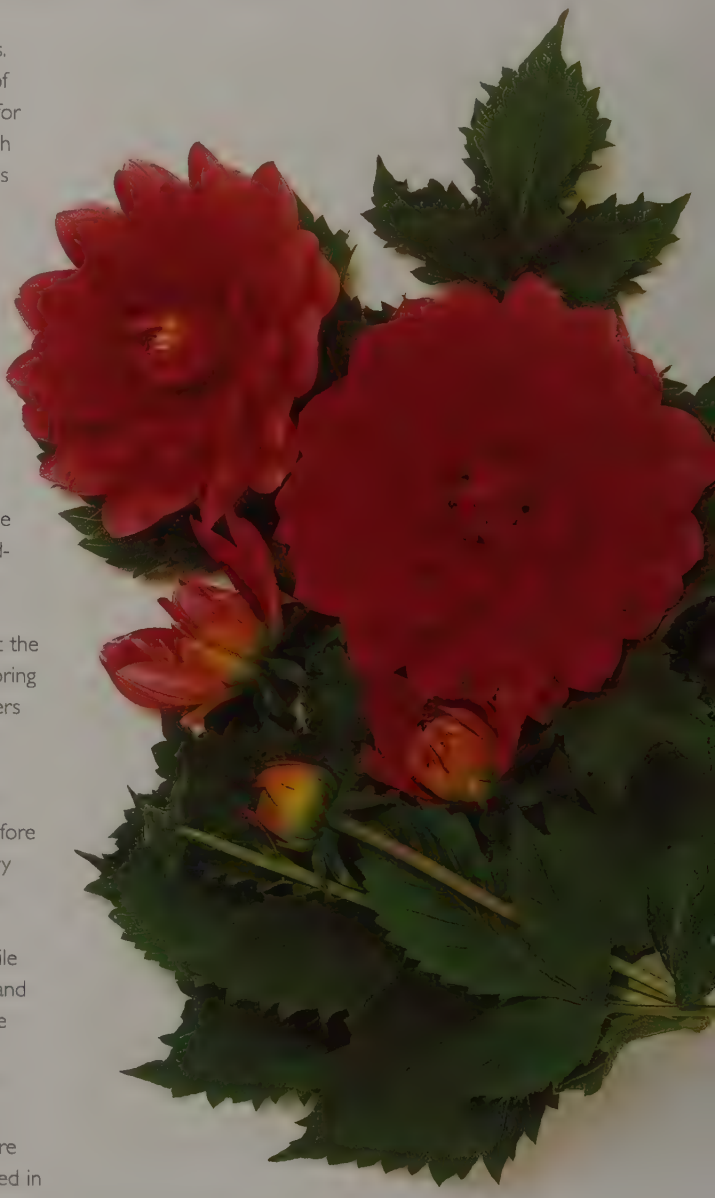
To grow dahlias from tubers, plant out the tubers at least 4in (20cm) deep in mid-spring after the last frost. In regions where winters are mild, dahlia tubers can be left in the ground when the plants have flowered. Alternatively, dig up the tubers in fall, and spread them out on wire racks to dry before storing them for winter in a cool, dark, dry place. Replant the tubers the next spring when they start to form shoots.

Dahlias thrive in any well-drained, fertile soil. They prefer an open, sunny position and need regular watering. Taller plants require staking. They may be attacked by aphids, caterpillars, and earwigs, which like to eat holes in the petals and leaves.

Gather the flower heads when they are past their best, and use them fresh or dried in the dye pot. Leaves and stems should be kept separate from the flowers; they can also be used as a source of dye and are processed in the same way as flower heads.

Dyeing procedure

Simmer or gently boil the plant parts for about one hour to extract the color. Then for strong shades, simmer the dye bath for one hour. Dahlia flowers react well to modifiers.

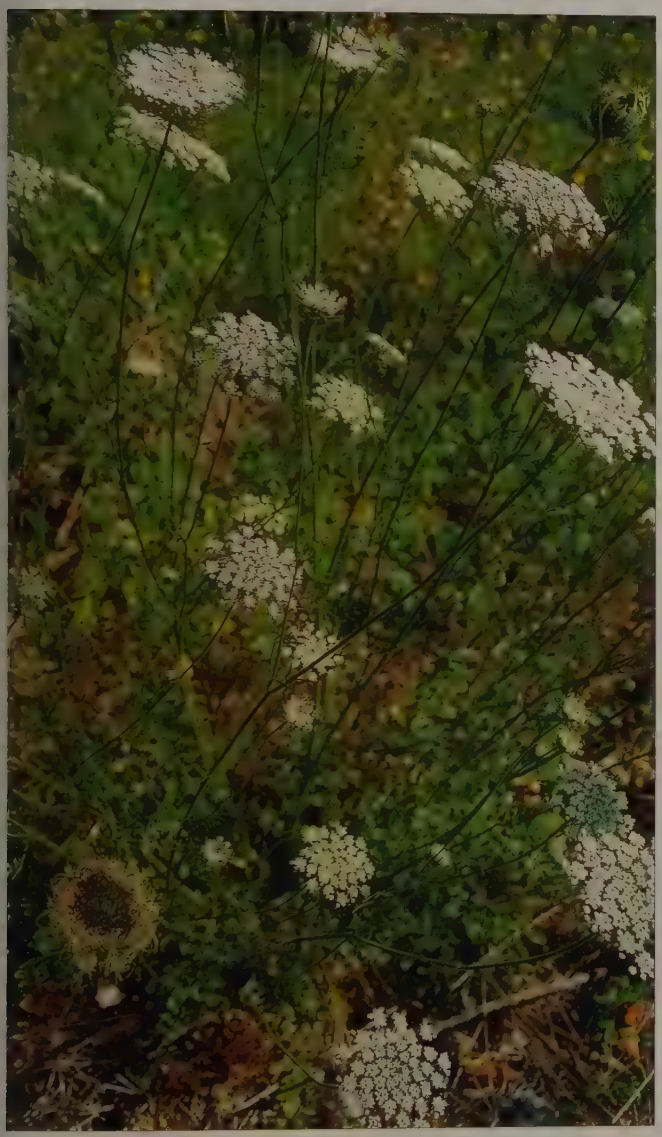


Range	Mexico, Central America, and temperate regions.
Availability	Grow from seed or purchase as cut flowers.
Planting time	Sow seeds in early spring or plant tubers in mid-spring
Growing habit	Allow 24in (60cm) per plant. Grows to 1–4ft (30cm–1.2m) tall.
Harvesting time	Late summer to mid-fall.
Dyestuff	Flowers, leaves, stems.
Dyeing instructions	Mordant recommended for flowers. Use equal weights of dyestuff and fibers for strong colors from all parts.

Daucus carota

Wild/Domestic carrot, Queen Anne's lace

The leafy tops of both wild carrot and the edible domestic carrot can be used for dyeing, although stronger shades may often be obtained from the tops of domestic carrots. The carrot tops are best used fresh and are more suitable for use on animal fibers, giving paler shades on vegetable fibers.



Range	Most temperate regions.
Availability	Gather wild carrots. Grow or buy domestic carrots.
Planting time	Sow seeds from early spring to midsummer.
Growing habit	Allow 6in (15cm) per plant.
Harvesting time	Wild carrots: spring to summer. Domestic carrots: all year.
Dyestuff	Plant tops.
Dyeing instructions	Mordant recommended. Use at least equal weights of dyestuff and fibers for strong colors.

Wild carrot, sometimes called Queen Anne's lace, can be found in North America and throughout Europe, on grassland and often near the sea. It has umbels of white flowers and fine, segmented leaves.

Cultivation and harvest

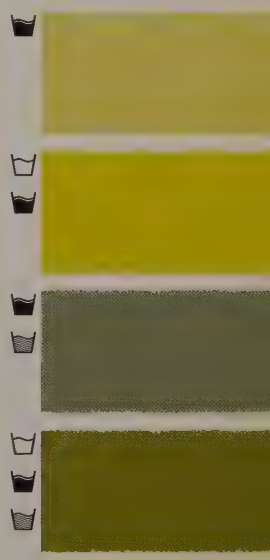
To grow domestic carrots, sow the first seeds outdoors in early spring as soon as the soil has warmed up. Successive sowings can be made until midsummer. Seeds can also be sown in a cold frame from the fall throughout winter for crops early in the year. Sow the seeds in rows, and thin out the seedlings until they are 6in (15cm) apart.

Carrots grow best in deep, light loamy soil, in full sun or partial shade, although early crops may require full sun. If possible, dig plenty of manure into the soil the previous season, but do not add manure when you sow the seeds, as this may cause the roots to fork. Dig the soil deeply in the fall and leave it rough, so the winter frosts can break it down.

Harvest the carrots when they have reached the desired size. Main crop carrots should be dug up in the fall. Cut off the leafy tops about ½in (1cm) above the crown, and use them fresh for dyeing. Clean off the soil and store the carrots in layers in boxes of sand, in a cool, dry, frost-free place.

Dyeing procedure

The tops of both wild and domestic carrots are best used fresh in the dye bath. Simmer the leafy tops for 30 minutes to one hour to extract the dye color. Strain off the dye solution and then add the fibers. Simmer the fibers for about 45 minutes. Domestic carrot tops give brilliant green-yellow shades on alum-mordanted wool. The colors from wild carrot tops tend to be less vibrant.

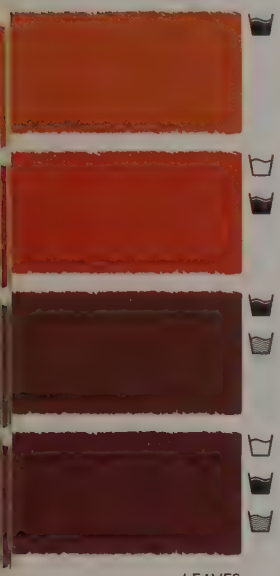


PLANT TOPS

Eucalyptus species

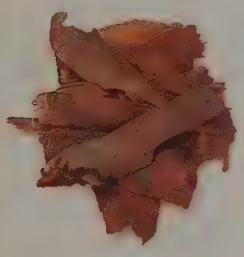
Eucalyptus

Over 600 species, varieties, and hybrids of these evergreen trees and shrubs exist. Although native to Australia, they have been introduced worldwide. The leaves and bark yield a remarkable range of dye colors, from deep rusty-brown to rich dark red, and green for some species.



LEAVES

BARK



There are species of eucalyptus adapted to almost every climatic condition, from freezing alpine regions to tropical rainforests and arid deserts. When mature, they range in size from shrubs under 10ft (3m) to the towering *E. regnans*, which at 373ft (113m) is the tallest-known broadleaved tree in the world.

Cultivation and harvest

Hardy eucalyptus grows well as garden trees and shrubs, and has beautiful foliage of unusual shape, color, and texture.

Most species are fast-growing and will reach a height of 10–15ft (3–5m) in under five years. Pot-grown trees should be planted and securely staked in midsummer. Eucalyptus requires full sun and a well-drained, moderately fertile soil. Avoid very dry sites and those liable to become waterlogged, and choose a sheltered spot, in full light, away from freezing winds and gales. Keep the plants moist in the summer months until they are well established.

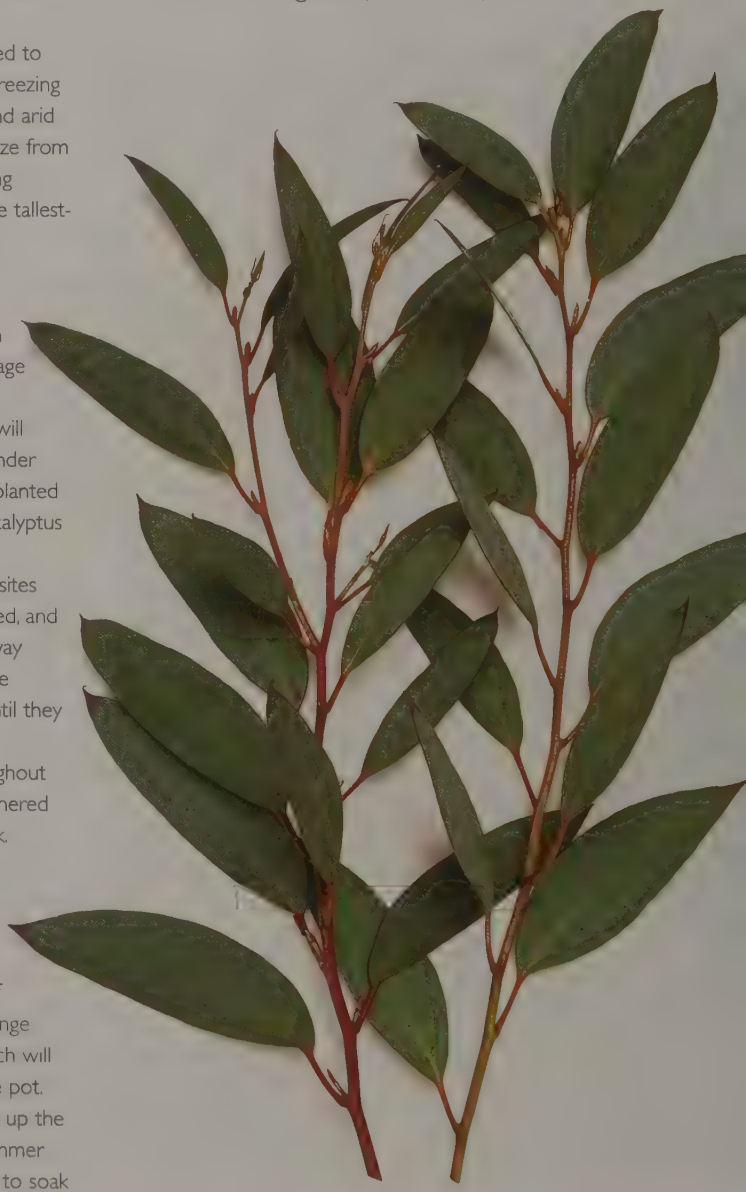
The leaves can be harvested throughout the year, but ideally they should be gathered when the trees are pruned or cut back.

Dyeing procedure

Dyes from eucalyptus require long processing to achieve their full color potential. The leaves from all species of eucalyptus produce color, and these range from rusty-brown to dark red, but much will depend on the species used in the dye pot.

To make a dye bath of leaves, chop up the leaves and cover with boiling water. Simmer gently for at least one hour, then leave to soak overnight. Add the fibers to be dyed and simmer gently for three to four hours, depending on the species. Deeper colors will result if the leaves are left in the dye bath with the fibers. Eucalyptus leaves produce rich colors on animal fibers, especially wool.

Eucalyptus barks usually produce muted shades of beige and tan on fibers. Treat the bark as generally described in Dyeing Techniques (see pp.46–48).

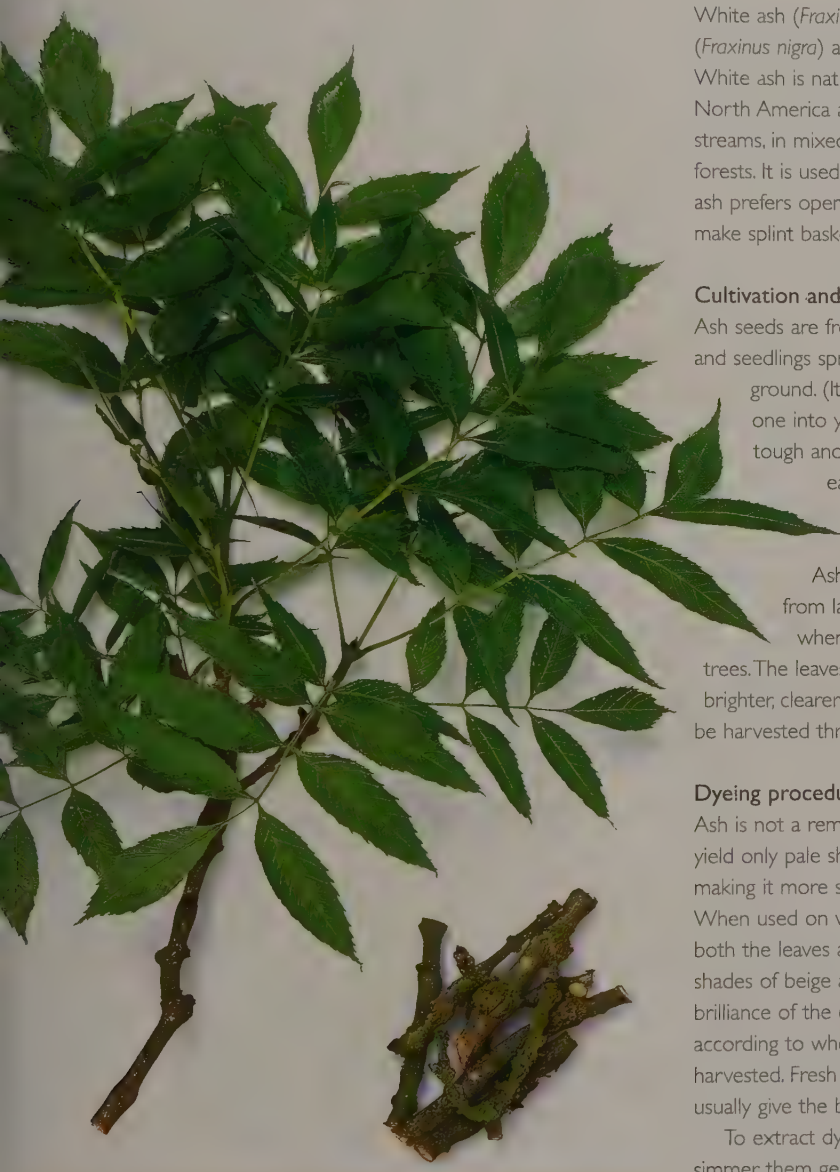


Range	Australia and worldwide.
Availability	Grow tree or purchase leaves from specialist supplier.
Planting time	Plant out pot-grown trees in midsummer.
Growing habit	Allow 12ft (4m) per tree. Grows to 10ft (3m) tall.
Harvesting time	Leaves and bark: all year.
Dyestuff	Leaves, bark.
Dyeing instructions	No mordant needed, but can be used to extend color range. Use equal weights of dyestuff and fibers for both leaves and bark; more for strong colors.

Fraxinus species

Ash

All species of ash can be used for dyeing. The European ash (F. excelsior), as its name suggests, is native to Europe and Asia Minor, the flowering ash (F. ornus) is native to Southern Europe, while white ash (F. americana) and black ash (F. nigra) grow in North America.



Range	Northern hemisphere, south to Mexico and Java.
Availability	Gather from nature.
Planting time	Not applicable.
Growing habit	Not applicable.
Harvesting time	Leaves: late spring to early fall. Bark: all year.
Dyestuff	Leaves, bark.
Dyeing instructions	No mordant necessary for wool but recommended for other fibers. Use equal weights of dyestuff and fibers for both leaves and bark.

White ash (*Fraxinus americana*) and black ash (*Fraxinus nigra*) are large deciduous trees. White ash is native to the eastern half of North America and is found beside rivers and streams, in mixed broadleaved woodland and forests. It is used to make hockey sticks. Black ash prefers open, wet locations and is used to make splint baskets.

Cultivation and harvest

Ash seeds are frequently carried by the wind, and seedlings spring up readily on bare ground. (It may be possible to transplant one into your garden.) Ash wood is tough and supple and does not splinter easily. It is ideal for tool handles and oars, and is used to make furniture.

Ash leaves can be harvested from late spring through to early fall, when the leaves drop off the trees. The leaves can be dried, but give brighter, clearer colors if used fresh. Bark can be harvested throughout the year.

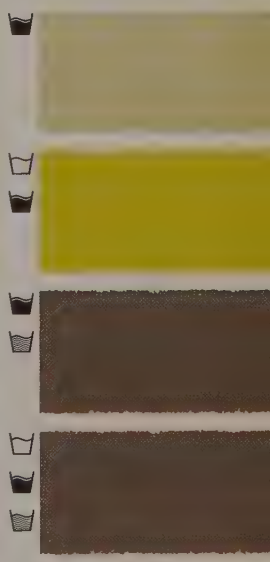
Dyeing procedure

Ash is not a remarkable dye and tends to yield only pale shades on vegetable fibers, making it more suitable for animal fibers. When used on wool with an alum mordant both the leaves and bark produce various shades of beige and yellow. The depth and brilliance of the colors from the leaves vary according to when the plant material is harvested. Fresh leaves harvested in late spring usually give the brightest, clearest tones.

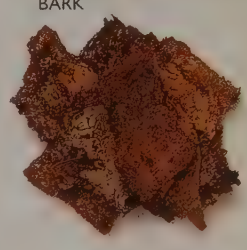
To extract dye color from the leaves, simmer them gently for 30 minutes to one hour. When the dye liquid is ready, add the fibers to the dye bath and simmer them for up to one hour. For strong colors, the fibers may need to be heated in the dye bath for the full hour or longer.

The ash bark should be processed as described generally for barks in Dyeing Techniques (see pp.46–48).

LEAVES



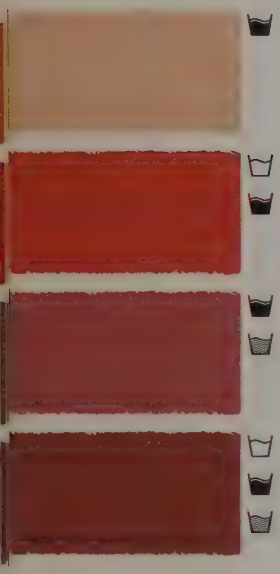
BARK



Galium verum

Lady's bedstraw, Yellow bedstraw

Lady's bedstraw was the main source of red dye in Scotland, where it grows extensively, especially in sandy coastal soils. The roots contain the same red coloring matter as madder plants, although in lower concentrations. Lady's bedstraw yields its strongest colors on animal fibers, especially wool.



ROOTS

Lady's bedstraw is a fragrant European wild flower. In North America, it is found in old fields, pastures, and near old homesteads. In summer, it has masses of tiny yellow flowers in clusters at the end of branching shoots.

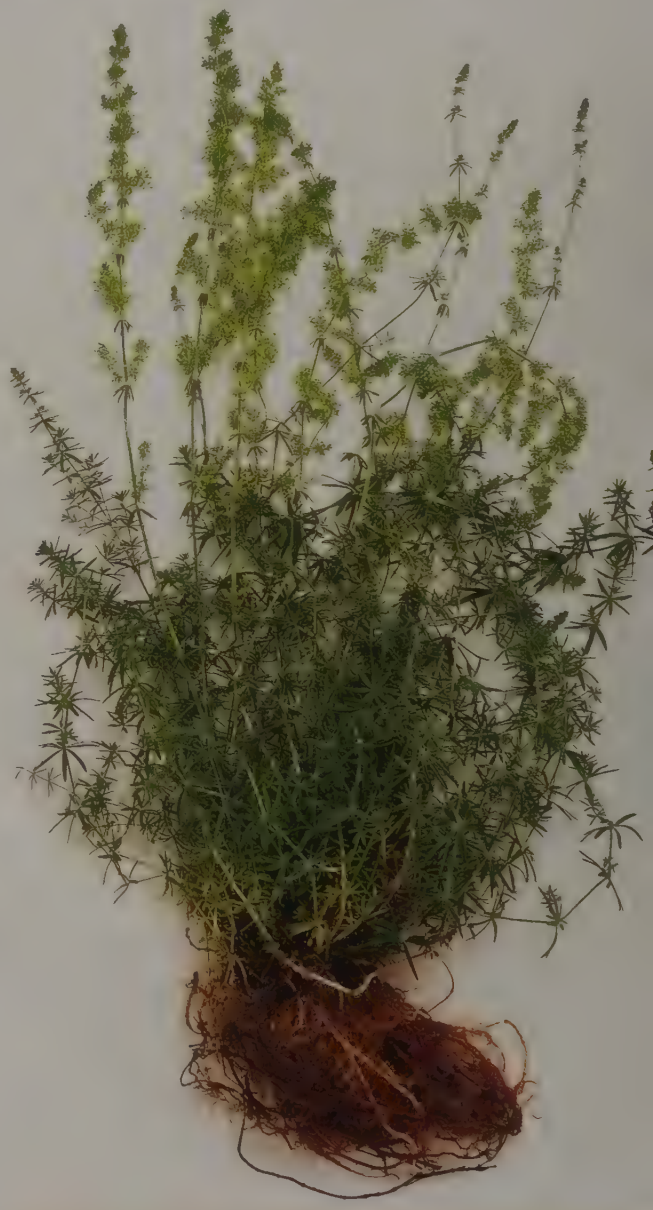
Cultivation and harvest

Sow the seeds indoors in early spring and transplant the seedlings into individual pots when they are strong enough. Plant them out in their growing positions in early summer. Once established, they spread quickly by underground runners. Lady's bedstraw favors full sun and moist well-drained sandy soil. The plants can be propagated by dividing them in spring or fall.

The roots should be left undisturbed for at least two years before they are harvested. Then dig them up in late fall, when the tops have died down, making sure to dig deeply enough to reach the thicker, woody roots, which contain the best dye color. The roots can be used fresh or dried, but wash them well to remove any soil, before chopping them into small pieces for dyeing.

Dyeing procedure

To extract the dye color, soak the chopped roots for at least 24 hours, then simmer them for one or two hours. Leave the roots to soak overnight, then strain off the red dye liquid. Simmer the roots again to extract every last bit of color and add this liquid to the first extraction of red dye liquid. Transfer the dye liquid into the dye pot and add the fibers. Heat to just below simmering point. Keep the dye bath at this temperature for about one hour, then turn off the heat and leave the fibers to soak in the dye pot overnight. If the color is deep enough, remove the fibers and rinse well. If a deeper shade is desired, and the dye liquid is still colored, repeat the dyeing process. The exhaust dye bath can be used to produce coral and tan shades.



Range	Europe and most temperate regions.
Availability	Grow from seed or purchase as plants.
Planting time	Sow seeds in early spring.
Growing habit	Allow 6in (15cm) per plant. Grows to 24–36in (60–90cm) tall.
Harvesting time	Late fall after at least two years' growth.
Dyestuff	Roots.
Dyeing instructions	Mordant recommended. Use four times the weight of dyestuff to fibers for reds; less for tan and coral shades.

Genista tinctoria

Dyer's greenweed, Woadwaxen

Dyer's greenweed is a shrub found throughout Europe and parts of North America in open woodland, scrub, and grassland. It has a long history as a dye plant and its use in the 9th to 11th centuries is documented. The plant tops contain the same yellow coloring matter as weld plants.

PLANT TOPS

The early use of dyer's greenweed as a dyestuff was verified by archaeological excavations at the Viking-age site in York, Great Britain, where dye plant remains including dyer's greenweed were unearthed. In North America, the early existence of dyer's greenweed is also localized to a few settlements where it was probably planted for use as a dyestuff.

Cultivation and harvest

Dyer's greenweed plants can be bought from nurseries, but it is not difficult to grow from seed. Soak the seeds overnight in warm water, then sow them in individual pots either in the fall (to leave outside over the winter), or outdoors in mid-spring. In late spring, when the young plants are 3–4in (8–10cm) tall, plant them out in their flowering positions. Although they may only grow slowly in the first year, they should produce flowers in the second season.

Dyer's greenweed prefers full sun and light, well-drained soil. The plants are not prone to serious pests or diseases but whitefly can be a problem. Plants infested with whitefly should be washed after harvesting but this does not affect the dye color.

Harvest the flowering plant tops for the dye pot throughout the growing season since cutting the plants back encourages new growth. Harvest the first crop of flowering stems as the flowers fade and then harvest another batch later in the growing season. Leaves, stems, and flowers can be mixed together in the dye pot.

Range	Europe and most temperate regions.
Availability	Grow from seed or purchase plants.
Planting time	Sow seeds in mid-spring or fall.
Growing habit	Allow 4ft (1.2m) per plant. Grows to 24in (60cm) tall.
Harvesting time	Throughout the growing season.
Dyestuff	Plant tops.
Dyeing instructions	Mordant recommended. Use equal weights of dyestuff and fibers.

Dyeing procedure

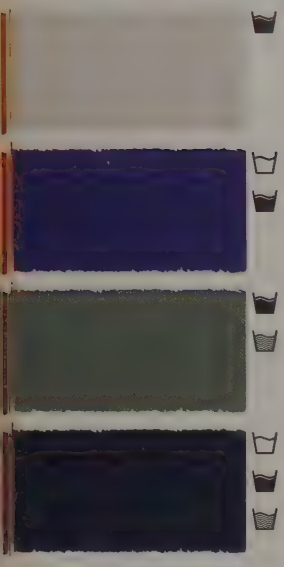
To prepare the dye bath, simmer the plant materials for about one hour. Leave to cool overnight then strain off the dye solution.

For light, clear yellows, leave the fibers to soak in the dye bath overnight and then simmer for 15 to 20 minutes. Longer simmering yields deeper, golden shades. An iron modifier produces olive-greens.

Haematoxylon campechianum

Logwood

The heartwood of the logwood tree offers deep rich purples. Valued as a dyestuff since the 16th century, it was used with an iron mordant to dye fibers black – a color that is difficult to achieve.



HEARTWOOD

Logwood dyestuff was imported in large, irregularly-shaped blocks, each weighing about 400lb (181kg), and the name "logwood" derived from this practice. The heartwood was prepared by first reducing the block to small chips, which were then soaked in water and allowed to ferment.

In the early years of its use in Europe, the dye was not generally well received since it tended to fade badly, probably because dyers had not yet mastered the techniques for applying it successfully. Logwood continued to be used as a dye until the 20th century.

Cultivation and harvest

Today, logwood is available from specialist suppliers in the form of wood chips. A member of the pea family, logwood trees grow to a height of 40ft (12m). They are ready to harvest after about 10 years.

Dyeing procedure

To make a dye bath from logwood chips, first pour boiling water over the chips and leave them to soak for 8 to 12 hours. Then add enough water to make the dye bath and simmer the wood chips for 15 to 20 minutes. Strain off the dye liquid and use this for the first dye bath. Add the fibers, simmer them for 45 minutes, then leave them to cool in the dye bath. Then remove the fibers, squeeze out any excess dye, and rinse well several times. Take particular care with this rinsing process, as logwood dye tends to "bleed" out if the fibers have not been thoroughly rinsed. The logwood chips can be simmered again for 45 minutes to 1 hour to extract more color. The dye liquid can then be strained off and used to make a second dye bath for a further batch of fibers.

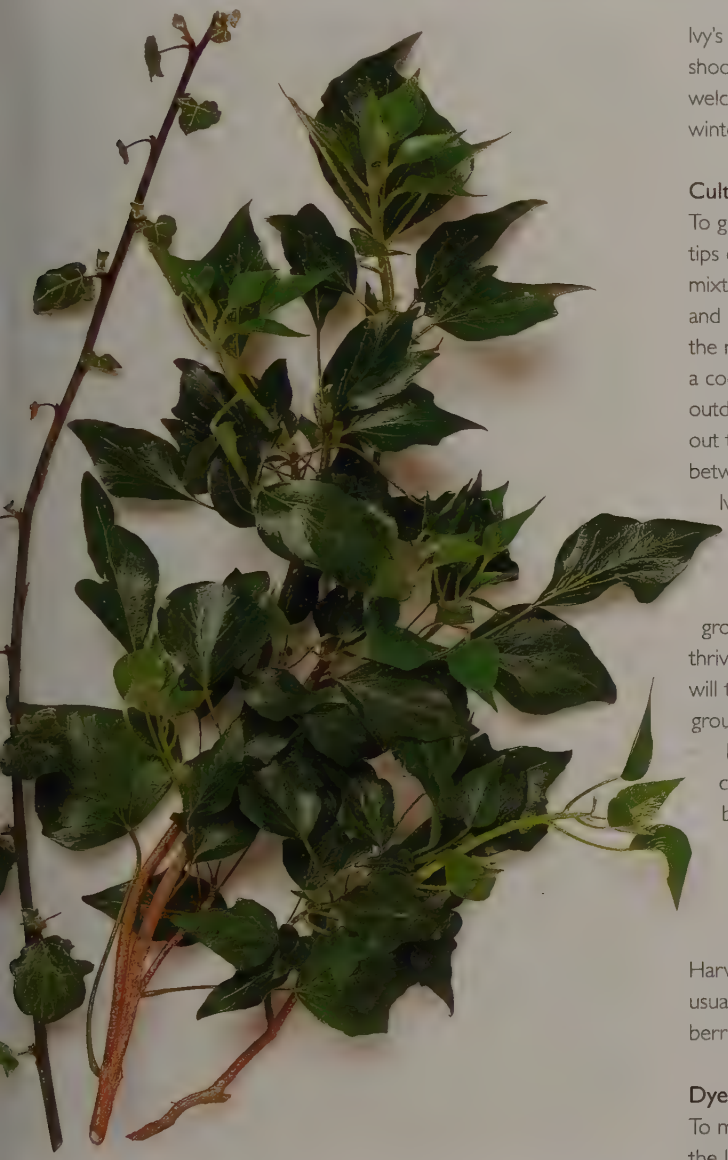
Lovely purple shades result with an alum mordant, but they tend to fade to gray fairly rapidly. Copper or iron mordants will increase colorfastness on all fibers. Iron mordant or modifier gives dark purples and black, while copper gives bluer hues.

Range	Central America.
Availability	Purchase dyestuff from specialist suppliers.
Planting time	Not applicable.
Growing habit	Not applicable.
Harvesting time	Not applicable.
Dyestuff	Heartwood (wood chips).
Dyeing instructions	Mordant required. Wood chips: use half the weight of dyestuff to fibers.

Hedera helix

Ivy

Ivy is a hardy, vigorous, evergreen climber or creeper. Its stems have clinging aerial roots that attach themselves to any surface, allowing the plant to spread rapidly. Dyes from ivy are more suitable for animal fibers. Its leaves and berries are used to give shades of gray and greeny-yellow.



Range	Most temperate regions.
Availability	Gather from nature or grow from cuttings.
Planting time	Take cuttings in summer.
Growing habit	Outdoor climbers cover large areas.
Harvesting time	Leaves: all year. Berries: winter to spring.
Dyestuff	Leaves, berries.
Dyeing instructions	Mordant recommended. Use equal weights of dyestuff and fibers for both leaves and berries. Dyes from ivy are more suitable for animal fibers.

Ivy's glossy green leaves, attractive flowering shoots, and green or black berries make it a welcome addition to the garden, especially in winter when many plants are dormant.

Cultivation and harvest

To grow ivy, take 6in (15cm) cuttings from the tips of shoots in summer. Root them in a mixture of peat and sand in individual pots and put a plastic bag over each pot to retain the moisture. Once rooted, grow the plants in a cold frame, greenhouse, or in a sheltered outdoor site, until they are established. Plant out the ivy plants in their permanent position between spring and fall.

Ivy can also be grown in outdoor containers and trained up thin canes. Most ivies need to be pruned in spring and summer to remove unwanted growth or excessively long runners. Ivy thrives in any soil and virtually any situation. It will tolerate shade and can be grown as ground cover.

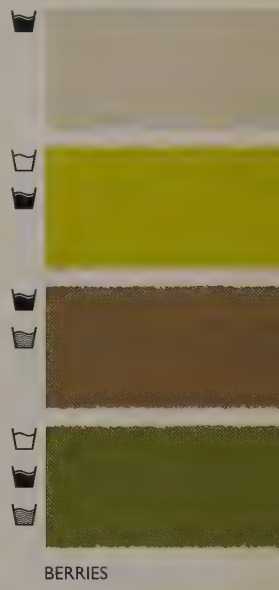
Ivy is also common in the wild, where it clings tenaciously to the trunks and lower branches of trees. It can be harvested for the dye pot without fear of damaging the ivy plant; doing so will probably favor the "host" trees as well.

Leaves can be gathered all year. Harvest the berries when they are black, usually from winter to spring. Keep leaves and berries separate, as they yield different colors.

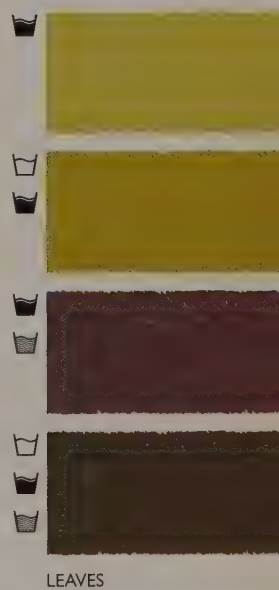
Dyeing procedure

To make a dye bath from ivy leaves, simmer the leaves for about one hour until they are soft, then add the fibers. Leave the plant matter in the dye bath during the dyeing process. Simmer for about one hour or so until you arrive at the desired depth of color.

For a dye bath from berries, mash the berries well in hot water and leave them to soak overnight. Then gently simmer the berries for one hour or so to extract the dye color. Add the fibers and simmer gently for a further hour to achieve a strong color.



BERRIES

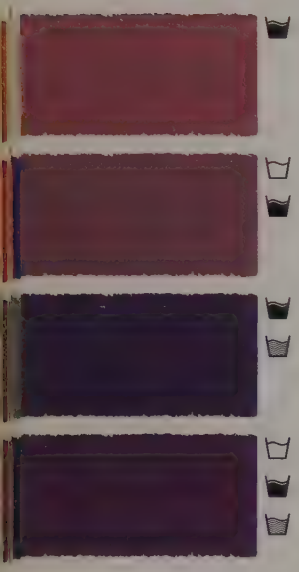


LEAVES

Hibiscus species

Hardy hibiscus, Rose mallow

Dark red- or deep pink-flowered hibiscus give attractive colors when used fresh or dried in the dye pot. The colors from these dark hibiscus flowers can range from lilac to maroon. Using different mordants will give shade variations, and modifiers produce interesting color changes.



FLOWERS

Hardy hibiscus are bushy shrubs with attractive flowers that may sometimes measure up to 10in (25cm) in diameter. Modern hardy hibiscus hybrids were developed from native rose mallows, which grow on the eastern coast of North America. Dried red hibiscus flowers can be bought from health food shops, where they are sold for hibiscus tisanes, or hibiscus can be cultivated from seeds or plants.

Cultivation and harvest

Sow the seeds indoors in a warm place, in early spring several weeks before the last frost. If started early enough in spring, the plants should flower in their first season. When the seedlings are large enough to handle, transfer them to individual pots. In late spring, once the weather is milder, plant them out into their permanent sites.

Hardy hibiscus can also be propagated by taking 4in (10cm) semi-ripe heel cuttings in midsummer from established plants. Place them in a propagator in a warm site and once they have rooted, transplant them into individual pots filled with potting compost. Leave them in a sheltered location in a cold frame over winter, then plant out the hibiscus into the garden the following late spring to early summer.

Sometimes plants will self-seed if the soil is left undisturbed. Hibiscus prefers full sun and will grow in any well-drained soil. It will need watering during dry weather. Harvest the red and deep pink flowers every two to three days and use them fresh. Alternatively dry the flowers until you have enough for a dye bath.

Dyeing procedure

To extract the dye color, pour boiling water over the flowers, then simmer them for half an hour. Strain off the dye liquid or leave the flowers in the dye bath.

Simmer the fibers in the dye liquid for about 45 minutes then leave them to soak in the dye bath at least overnight and longer for really deep shades.

Range	Most temperate regions.
Availability	Grow from seed or cuttings, or buy dried flowers.
Planting time	Sow seeds in spring, or root cuttings in midsummer.
Growing habit	Allow 4ft (1.2m) per plant. Grows to 4–6ft (1.2–1.8m) tall.
Harvesting time	Midsummer to late fall.
Dyestuff	Red and deep pink flowers only.
Dyeing instructions	No mordant necessary for animal fibers. Use equal weights of dyestuff and fibers.

Hypericum perforatum

Saint-John's-wort

Saint-John's-wort is common in woods and grasslands throughout Europe. It has become naturalized in parts of North America where it is classified as a noxious weed. Several species of Hypericum *produce yellow and brown dyes, however, only* H. perforatum *produces maroon and green shades.*

H. perforatum has a ridged but hairless stem, lined with pairs of small oval leaves and clusters of small yellow flowers with black dots along the petal edge. The flower stamens form a raised central tuft.

Cultivation and harvest

H. perforatum is considered to be a noxious weed in parts of North America, so check local regulations before growing it in the garden. If allowed, sow seeds in early spring indoors, or late spring outdoors. Plant out the seedlings as soon as they are well grown. Saint-John's-wort favors full sun, but tolerates partial shade. It thrives in most garden soils. It is trouble-free, hardy, and long-lived. To propagate Saint-John's-wort, lift and divide established plants in spring.

Harvest flowers for the dye bath in midsummer. They must be fresh to achieve their true color potential and a large crop of these tiny flowers is needed for one dye bath. The plant tops can be cut during the growing season and used fresh or dried as described in Dyeing Techniques (see pp.46–49).

Dyeing procedure

The flowers are interesting because they produce a series of four different shades on wool, if used in the correct sequence. To do this, take two or three wool skeins mordanted with alum (see pp.38–39) and one or two unmordanted wool skeins. First, simmer the flowers until the dye liquid is deep red. Then, strain off the liquid. Add an alum-mordanted wool skein to the dye bath and simmer for 15 to 20 minutes or until the skein turns green. Remove this skein and add an unmordanted wool skein to the same dye bath. Simmer this for one hour, or until it turns reddish-maroon. Lift out the skein and add an alum-mordanted or an unmordanted skein to the dye liquid. Leave the skein to soak overnight to absorb the remaining green and red dye for a browner color. Remove this skein, reheat the dye bath, and add the last alum-mordanted skein. Simmer until it turns yellow or gold.

PLANT TOPS

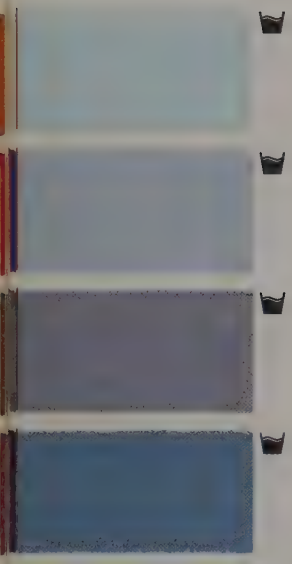
FLOWERS

Range	Europe and most temperate regions
Availability	Gather from nature or grow from seed.
Planting time	Sow seeds in early or late spring.
Growing habit	Allow 12in (30cm) per plant. Grows to 24–36in (60–90cm).
Harvesting time	Flowers: midsummer. Plant tops: summer to fall.
Dyestuff	Flowers, plant tops.
Dyeing instructions	Mordant recommended for plant tops. Use equal weights of dyestuff and fibers for all plant parts.

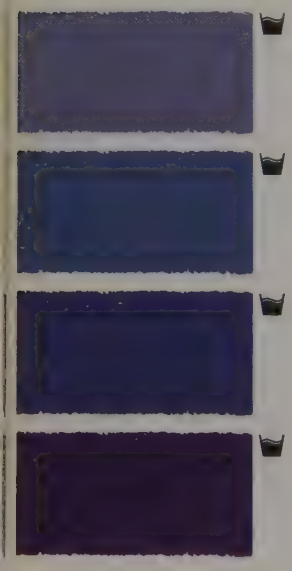
Indigofera species

Indigo

Indigo's ability to produce an extensive range of beautiful blue shades has made it the most successful dye plant ever known. The commercially available indigo powder is made from the leaves of Indigofera tinctoria, *which requires hot, sunny, and humid growing conditions to flourish.*



LEAVES: WEAK VAT



LEAVES: STRONG VAT

Indigo-bearing plants occur all over the world in various forms. The same blue pigment is found not only in species of *Indigofera*, but also in woad (*Isatis tinctoria*, see pp.100–101), native to Europe and parts of the near East, and in Japanese indigo (*Persicaria tinctoria*/*Polygonum tinctorium*, see p.110), native to Southeast Asia, China, and Japan. There are many other sources of indigo-blue, including *Lonchocarpus cyanescens*, native to west Africa, and *Marsdenia tinctoria*, found in Southeast Asia.

Species of *Indigofera* are shrubby perennial plants in the legume family. They thrive in fertile soil and require a long hot season with plenty of sun and humidity to develop their full color potential. The two most important species are *Indigofera tinctoria*, native to India and Southeast Asia, and *I. suffruticosa*, native to Central and South America and the Caribbean islands.

Like many dye plants, indigo was considered to have medicinal properties. It was believed to lessen pain and was applied to burns and other skin ailments. The smell of indigo was also thought to repel harmful insects. It had cosmetic uses, too, as eye makeup and also for tattooing.

Indigofera tinctoria was the most important indigo of commerce and after Vasco da Gama had discovered the sea route to the East Indies in 1498 and the European trading settlements had been established, indigo became widely available in Europe. Eventually, indigo replaced woad as the primary source of blue dye in Europe. Although Marco Polo's description of indigo production and its use in the East in the late 13th century made it clear that this was a dye of plant origin, for some time in Europe it was believed to be of mineral origin. This was because it was often traded in the form of solid blocks of pressed powder which resembled a mineral substance.

Indigo powder production

Indigofera tinctoria, the species from which today's commercially available dye powder is made, is grown for this purpose on the Indian

Range	*Indigofera tinctoria* and *Indigofera suffruticosa*: tropical and sub-tropical regions.
Availability	Grow from seed or buy dye powder from supplier.
Planting time	Sow seeds in late spring.
Growing habit	Allow 24–36in (60–90cm) per plant. Grows to 3–6ft (90cm–1.8m) tall.
Harvesting time	Late summer to fall.
Dyestuff	Leaves, dye powder.
Dyeing instructions	See pp.54–55 for instructions on dyeing with indigo.

subcontinent. To make the dye powder, the harvested leaves are first placed in huge vats filled with water and left to soak for a day or so. Then the liquid is drained into another vat and the leaves are discarded. Next, the liquid is converted into indigo-blue by adding an alkali and then beating the solution vigorously to oxygenate it. This oxygenation causes tiny blue particles to precipitate and sink to the bottom of the vat where they form a sludge. After a few days, the liquid is drawn off and the blue sludge is removed and left to dry and harden before being shaped into blocks and allowed to dry out completely. These blocks are then ground into indigo powder.

It may take as much as 20 tons (20,320kg) of indigo leaves to produce 100lbs (45kg) of powder, which explains why indigo is so costly.

Indigofera suffruticosa was found in Central and South America by Spanish explorers and centers of indigo production were established by the Spanish and French in their Caribbean colonies. In North America, colonists attempted to set up similar production centers but it was largely due to the efforts of Eliza Lucas, that indigo became a valuable cash crop in South Carolina. Starting from seeds of *I. suffruticosa* sent to her from the West Indies, Lucas eventually succeeded in growing and processing indigo. By 1770 large quantities of indigo were imported annually to Great Britain, grown from seeds Lucas distributed to other planters.

Cultivation and harvest

Dyers in temperate regions are unlikely to be able to grow *Indigofera* species for dyeing purposes and will need to rely on *Isatis tinctoria* (see pp.100–101) or *Persicaria tinctoria* (*Polygonum tinctorium*, see p.110) as their source of blue pigment. However, where climatic conditions allow, both *Indigofera suffruticosa* and *Indigofera tinctoria* can be grown as annual crops. These species have erect stems and compound leaves, with several leaflets. In summer, small bronze flowers develop in clusters at the end of the branches and in the leaf axils. These flowers then develop into dry, brown seed pods. The seeds should be soaked overnight in warm water and then sown in late spring 1½in (4cm) deep in their growing site. They can also be started off indoors a few weeks earlier, but if you do this make sure not to disturb the roots when you transplant the seedlings. Grow the plants in full sun in rich, fertile soil and keep them well watered. Hot weather is important, since cold air or soil can upset the plants and retard their growth and they may not recover. Start to harvest the leaves when the plants come into flower, beginning at the base of the plant. Do not pick more than half the leaves at any one time, and harvest them again about two weeks later.

Dyeing procedure

The leaves are best used fresh, as drying reduces their dyeing potential and results in paler shades. Process the leaves for dyeing following the directions given for *Polygonum tinctorium* (see p.110).

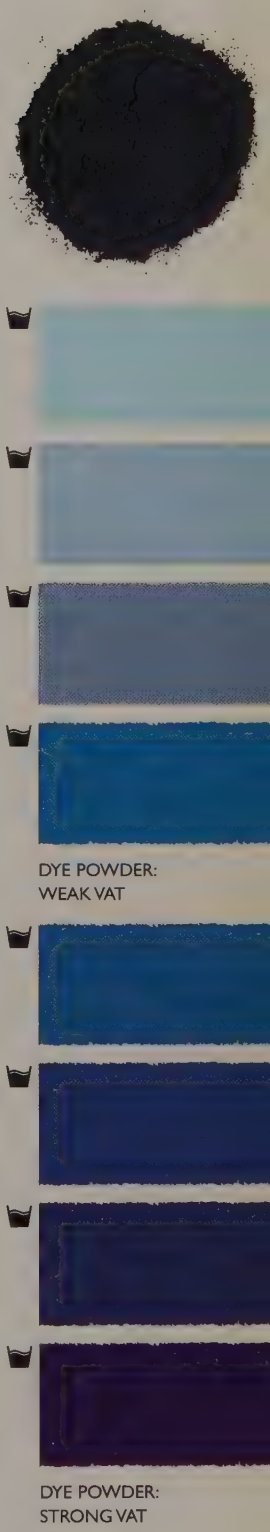
The ancient method of using indigo powder involved fermentation processes; stale urine was used for this purpose, as it contains an alkali, in the form of ammonia, and also the bacteria necessary for converting the insoluble indigo-blue into its soluble "white" form. Indeed, this method is probably the simplest way of using indigo powder, providing the vat can be kept warm for long enough – and the odor is tolerable. Fermentation can also be induced by using yeast to make the vat. (For details of these methods, plus the more commonly used craft dyeing method see Dyeing Techniques pp. 54–55.)

Overdyeing in the indigo vat

This technique is used to produce a true grass green, which is virtually impossible to obtain from a single plant dye. The best way to achieve this shade of green is first to dye the fibers yellow and then to overdye them in the indigo vat. Wet the yellow-dyed fibers thoroughly. Squeeze out any excess water and then immerse them in the indigo vat. It is best to start off with a brief dip – no more than two or three minutes – and then check the shade achieved. If it is not green enough, redip the fibers and build up the color gradually. For lavender and purple shades, overdye pinks and reds in the indigo vat in a similar way. Again, keep the first dip fairly brief and slowly build up the color on the fibers.

Another important point to bear in mind is that, while indigo alone does not require a mordant, some other dyes do, so remember to apply a mordant if the color you are overdyeing requires one.

Indigo is also useful in creating shades of black. To achieve blacks, overdye browns in a strong indigo vat.



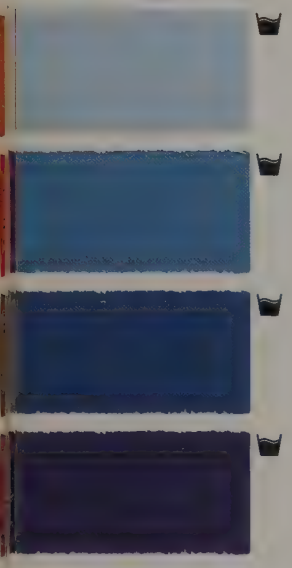
DYE POWDER: WEAK VAT

DYE POWDER: STRONG VAT

Isatis tinctoria

Woad, Dyer's woad

Before indigo became available in Europe in the 16th century, woad was the primary source of blue dye. The coloring matter in woad leaves is the same as that of indigo, but present in lower concentrations. In many areas of North America woad plants are classified as noxious weeds.



LEAVES METHOD 1

LEAVES METHOD 2

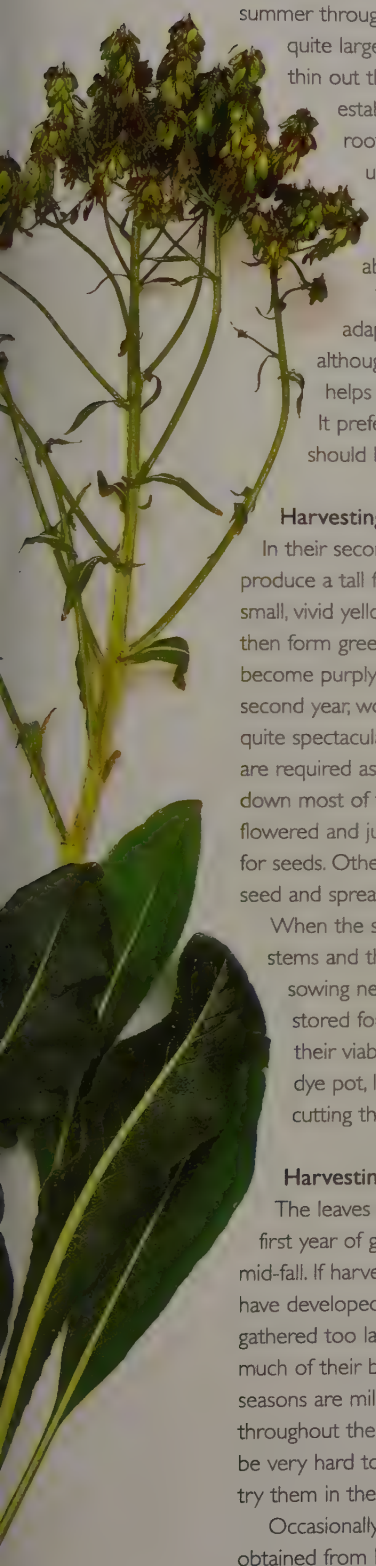
Woad was probably introduced into North America by the earliest colonizers. It was the main source of blue dye, but its importance was diminished once indigo from the West Indies became available around 1700. By the end of the 19th century woad was rarely used, and in modern-day North America attempts are being made to eradicate it from growing in the wild.

Commercially grown woad was traditionally processed into balls. These were made by first crushing the leaves between rollers until they formed a pulp. Then, the excess liquid was drained off and the pulp was rolled into balls, which were left for several weeks on racks to dry. Before they could be used for dyeing, the balls were pulverized and then sprinkled with water and left to ferment. During this process the mass was turned frequently and large lumps were broken up. Finally, the crumbly substance, known as "couched" woad, was dried and packed into barrels. Today's craft dyers do not have to go through these lengthy processes to make a dye vat from woad leaves.

Cultivation and harvest

Woad belongs to the mustard family and is easy to grow. It is a biennial plant that forms leaves in its first year and then flowers and goes to seed the next. It is the first year's leaves that yield blue dye. The leaves are best used fresh, since drying them destroys some of the blue pigment. Woad is sometimes also available as a dye powder, which is made in the same way as indigo powder (see p.98).

Range	Europe and parts of Asia and the near East.
Availability	Grow from seed.
Planting time	Sow seeds in early spring or early fall.
Growing habit	Allow 12in (30cm) per plant. Grows to 3–5ft (90–1.5m) tall.
Harvesting time	Leaves: midsummer to mid-fall. Seeds: summer to fall.
Dyestuff	Leaves, seeds.
Dyeing instructions	No mordant needed for blues and tans from leaves. Alum mordant gives soft green from seeds. Use equal weight of dyestuff and fibers.



Woad seeds should be sown outdoors in rows, either in early spring or in early fall. Sowing seeds in both seasons will supply you with woad leaves for dyeing from early summer through to the fall. The seeds are quite large, so you will not need to thin out the seedlings too much. Once established, woad has a long tap root and is best not transplanted unless care is taken not to damage the tap root. The plants should be planted about 12in (30cm) apart.

Woad favors full sun and adapts to most soil conditions, although adding compost and manure helps to produce good, strong leaves. It prefers plenty of moisture and should be watered well in dry spells.

Harvesting woad seeds

In their second year of growth, woad plants produce a tall flowering stem with masses of small, vivid yellow flowers at the top. They then form green, dangling seed pods, which become purply-black as they mature. In their second year, woad plants are decorative and quite spectacular. However, unless the seeds are required as a dyestuff, it is advisable to cut down most of the stems once the plants have flowered and just reserve one or two stalks for seeds. Otherwise woad plants will self-seed and spread like a weed.

When the seeds are mature, cut off the stems and then dry and store seeds for sowing new plants. The seeds can be stored for several years before they lose their viability. To harvest seeds for the dye pot, let the seeds mature before cutting the stalks and removing seeds.

Harvesting woad leaves

The leaves should be harvested in their first year of growth, from midsummer to mid-fall. If harvested too early, they will not have developed enough blue pigment. Leaves gathered too late in the year will have lost much of their blue dye potential. Where seasons are mild, the leaves remain green throughout the winter months and it can be very hard to resist the temptation to try them in the dye vat.

Occasionally, lovely blue shades can be obtained from leaves harvested in the depths of winter. Sometimes leaves from the second year's growth also defy the "rules" and produce blues. Woad leaves gathered out of the harvesting season will always produce pinky-tans, whether used fresh or dry.

Note In some parts of North America, the cultivation of woad plants may be prohibited as it is classified as a weed. Craft dyers in North America should always check the regulations for their area before planting it in their gardens.

Dyeing procedure

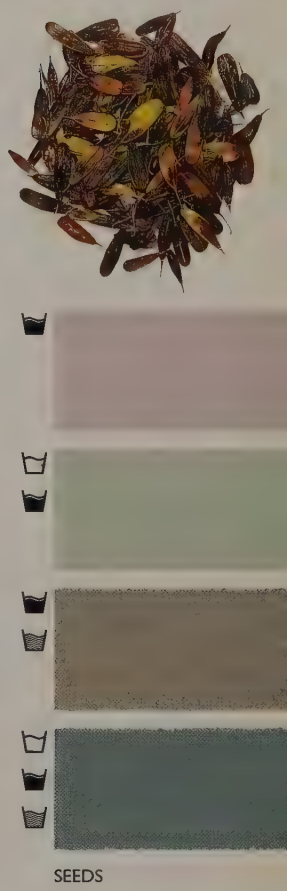
Four different methods for obtaining blues from fresh woad leaves are described in detail in Dyeing Techniques (see pp.56–57).

Pinky-tan dye colors

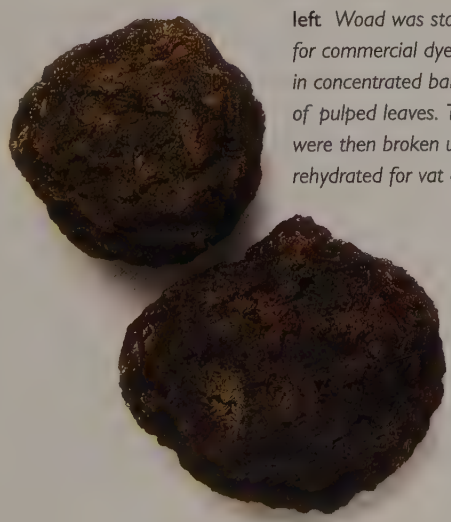
The same leaves or new, unprocessed leaves, can be used to produce pinky-tan shades. No mordant is necessary. Simmer the leaves for about 45 minutes to make the dye bath. Then either strain off the the liquid or keep the leaves in the pot during the dyeing process. Add the fibers and simmer for 30 minutes to one hour. Allow the fibers to cool in the dye bath before removing them.

Woad seed dye colors

To make a dye bath from woad seeds, simmer them for one hour or so to extract the dye color, then strain off the dye liquid and simmer the fibers in the dye bath for 30 minutes to one hour. This gives deeper colors on wool fibers than on other animal or vegetable fibers. No mordant is necessary, but an alum mordant gives soft shades of gray-green from woad seeds.



SEEDS

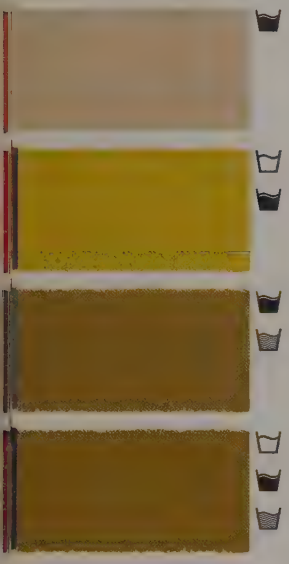


left *Woad was stored for commercial dyeing in concentrated balls of pulped leaves. These were then broken up and rehydrated for vat dyeing.*

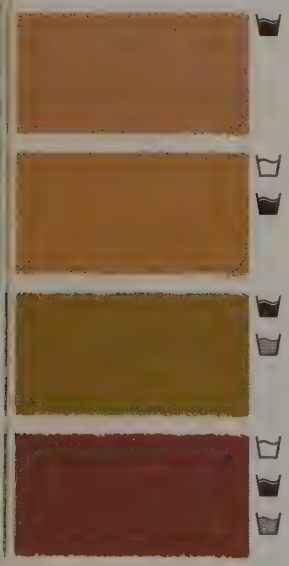
Juglans species

Walnut

Walnuts are ancient trees and the leaves and nut husks of all species have been used for centuries for dyeing fibers yellow, beige, and brown. They include Juglans regia, *the English walnut, which is found throughout Europe and* Juglans nigra, *or black walnut, which is native to North America.*



LEAVES



NUT HUSKS

Rather than plant a walnut tree, most craft dyers rely on gathering fallen leaves and nut husks from plants growing in nature for their source of dye materials.

Cultivation and harvest

Harvest walnut leaves any time from late spring to fall, but strip them carefully from the branches and do not cut off any living branches or twigs. Leaves can be used fresh or dried in the dye pot. Collect the walnuts from trees growing in nature or large gardens when they ripen in the fall.

The part of the walnut that gives the dye color is the outer green casing of the nut, rather than the nut itself. Walnut husks can be used fresh or dried, and turn brown quickly once they have fallen from the tree. If you are collecting walnut husks from the wild or from parks, make sure they have dropped to the ground first.

Dyeing procedure

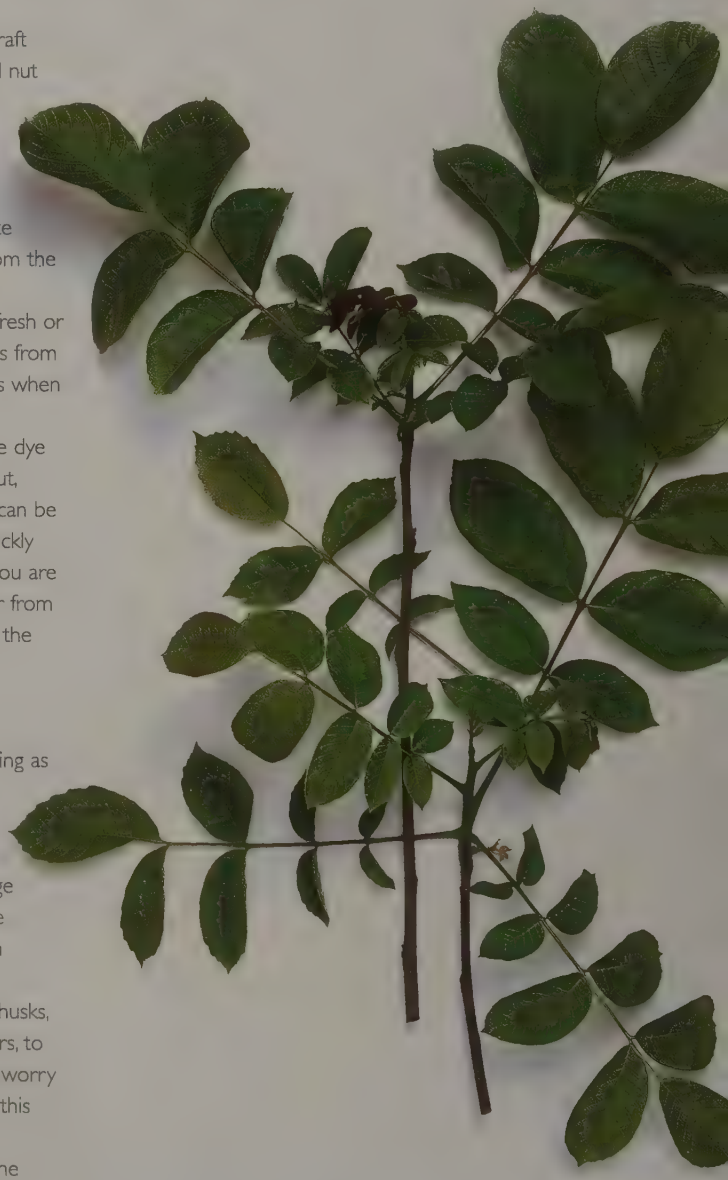
The walnut leaves are prepared for dyeing as generally described for leaves in Dyeing Techniques (see pp.46–48).

Dried walnut leaves tend to give colors in the yellow to moss green range but fresh walnut leaves, harvested in the summer, will sometimes give rich brown shades on wool fibers.

To prepare a dye bath from walnut husks, first soak the husks in water for 24 hours, to make a concentrated dye bath. Do not worry if the soaking husks start to ferment as this only improves the dye color.

Next, simmer the husks for about one hour to extract the dye color and then strain off the dye liquid. Keep the husks to process again. You can dry them or leave them soaking in water until you want to reuse them.

Put the fibers in the dye bath and simmer for one hour and then leave the fibers to soak in the dye liquid overnight. Repeat this method for deeper colors, or use an iron modifier for rich dark brown shades.

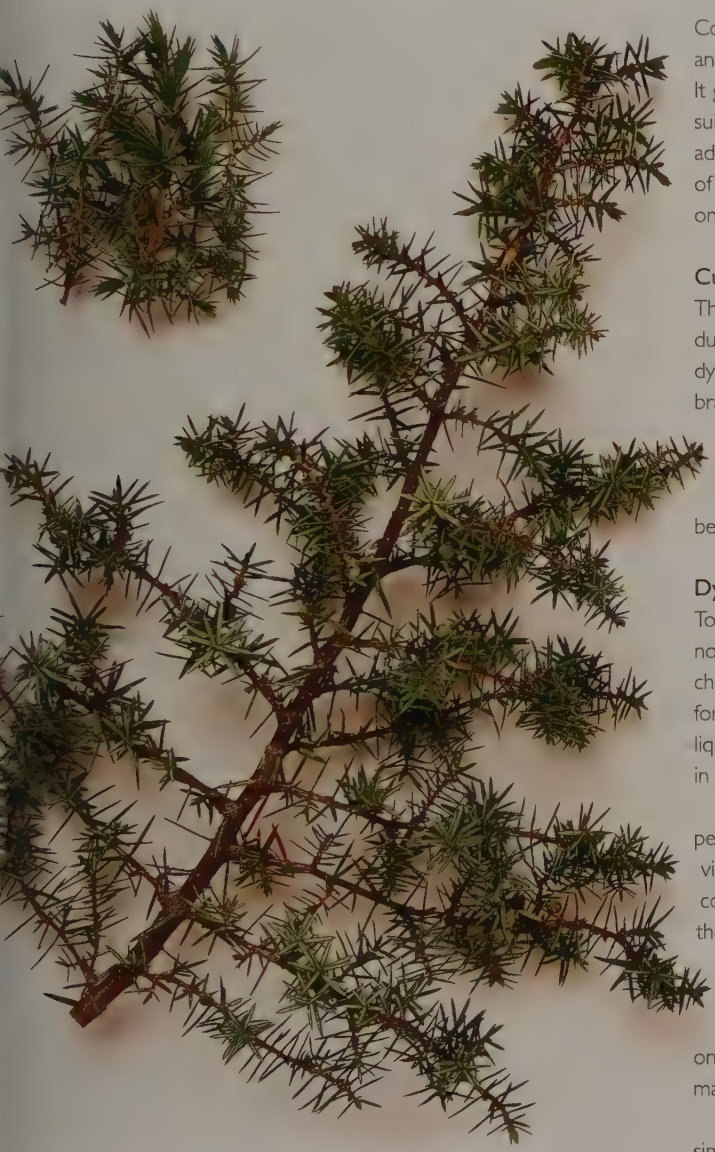


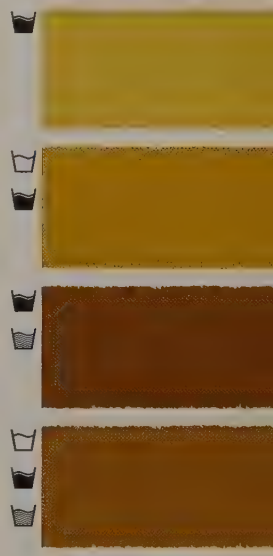
Range	Asia, Europe, North America, and the Middle East.
Availability	Gather from nature.
Planting time	Not applicable.
Growing habit	Not applicable.
Harvesting time	Leaves: late spring to fall. Nut husks: fall.
Dyestuff	Leaves, outer green husks of nut.
Dyeing instructions	No mordant required. Use equal weights of dyestuff and fibers for leaves. Use at least half the weight of dyestuff to fibers for nut husks.

Juniperus communis

Juniper

Juniperus communis is treasured for its berries, which are used in the production of gin and as a flavoring for culinary dishes. It is a hardy evergreen found on chalk, limestone, or peat in Great Britain and North America. Berries and leafy shoots yield bright mustard-yellows in the dye pot.





Range	Northern Europe to Southwest Asia, North America.
Availability	Gather from nature or purchase as shrub or tree.
Planting time	Fall to early spring.
Growing habit	Allow 36in (90cm) per plant. Grows to 10ft (3m) tall.
Harvesting time	Leafy shoots: all year. Berries: summer to fall.
Dyestuff	Leafy shoots, berries.
Dyeing instructions	Mordant recommended for vegetable fibers but not necessary for animal fibers. Use equal weights of dyestuff and fibers for both leafy shoots and berries.

Common juniper has a wide range of habitats and will tolerate both alkaline and acidic soils. It grows as a shrubby bush or small tree and is suitable for exposed sites. Juniper is extremely adaptable to various climates. It needs plenty of light for good growth and is found growing on pastures, heaths, and margins of woods.

Cultivation and harvest

The leafy shoots can be harvested at any time during the year and used fresh or dried for dyeing. Cut off 3in (8cm) from the tips of the branches or prune any straggly growth.

Harvest berries when they are still green, or when they have ripened and turned purple-black and are about to fall. The berries can be used fresh or dried for dyeing.

Dyeing procedure

To make a dye bath from the leafy shoots, do not separate the leaves from the twigs but chop up all of the shoots and simmer them for one hour or so. Next, strain off the dye liquid into the dye bath as generally described in Dyeing Techniques (see pp.46–48).

The berries should be well crushed in a pestle and mortar and then boiled fairly vigorously until the dye liquid is strongly colored. Add more water if necessary, so that the pot does not boil dry. Then strain off the dye liquid, add the fibers to the dye bath, and simmer for between 30 minutes and one hour. Watch the color as it develops on the fibers, as simmering for too long can make the shade duller.

The leafy shoots and the berries give very similar mustard-yellow dye colors and can be mixed together to make a dye bath.

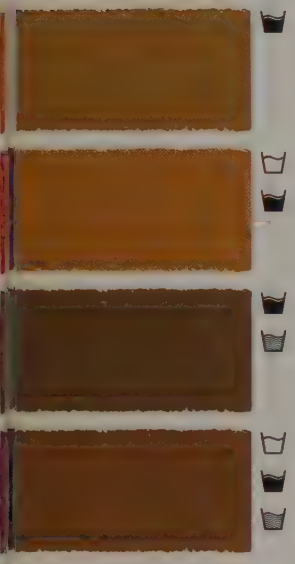
Using juniper ashes

Burnt ashes from the green needles of *Juniperus monosperma* are also used by the Navajo Indians of North America as a fixative for other dye colors. The needles are collected and burnt, and the hot ashes mixed with boiling water. After soaking, the ash water is strained off and used as a mordant (see p.58).

Lawsonia inermis

Henna

Henna is perhaps best known as a dye for hair, hands, and feet, and it is applied as a body decoration. The leaves are harvested from the shrub, and then dried and ground into a fine dye powder. Henna produces shades of rust and brown on animal and vegetable fibers.



POWDERED LEAVES

Henna is a shrub that grows on dry hillsides in the Middle East, in India, and in parts of North Africa. It has fragrant white or pinkish flowers and is also known as Egyptian privet.

Cultivation and harvest

Henna thrives in hot, dry regions, where it may sometimes be trimmed and grown as a hedge. The leaves are harvested and dried in late summer and then crushed into powder.

In the Middle East, henna juice was sometimes added to indigo dye vats, although the reason for this is not entirely clear. It may have been used to aid fermentation in the indigo vat or perhaps it was simply regarded as a lucky ingredient, because the fragrance of its flowers is reputed to have been much loved by the prophet Muhammad. Henna mixed with indigo was known as "black" henna and used as a hair dye and body paint.

Pure henna is usually described as "red" henna, although the powdered substance may be green or greenish-brown in color. This "red" henna is the one usually used for dyeing but other types are also worth trying.

Dyeing procedure

To make the dye bath, mix the henna powder into a paste with warm water, stirring well to incorporate all the fine particles. Then fill the dye bath with water.

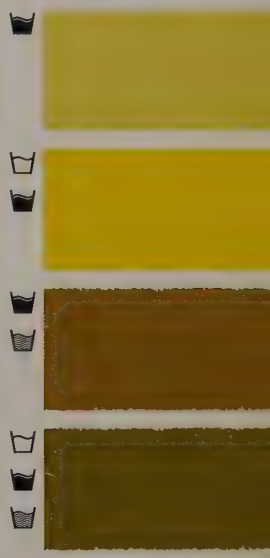
If you are dyeing yarns, it is advisable to simmer the henna dye bath for one hour or so and then strain the dye liquid through a piece of muslin or a coffee filter to remove particles of henna powder. When dyeing fabrics, just add them directly to the prepared henna dye bath without filtering the solution. Simmer the fabrics in the dye bath until the desired depth of color is obtained. An iron modifier produces brown shades but other modifiers only subtly alter the color.

Range	The Middle East, India, and North Africa.
Availability	Purchase from specialist suppliers or as hair coloring from pharmacies.
Planting time	Not applicable.
Growing habit	Not applicable.
Harvesting time	Not applicable.
Dyestuff	Powdered leaves.
Dyeing instructions	No mordant required. Use half the weight of the dyestuff to fibers.

Maclura pomifera

Osage orange, Bois d'arc

A North American tree, osage orange produces a yellow dye similar to fustic (Chlorophora tinctoria). The dye comes from the heartwood of the tree and is available from specialist plant dye suppliers as wood chips, shavings, or in concentrated extract form.



HEARTWOOD

Osage orange is native to the south-central United States and is widely planted in the eastern states, often as a hedge, where it forms a dense, thorny barrier. It belongs to the mulberry family and is also known as hedge apple. It was used by the Osage Indians in North America for making bows and its dark green glossy leaves have been used to feed silkworms. The small greenish flowers are followed by large, but inedible, orange fruits – the size of grapefruits.

Cultivation and harvest

Osage orange is easy to grow from seed and forms a hardy plant. Seeds can be bought from seed suppliers but it is much easier and less time-consuming to use the prepared dyestuff available from specialist suppliers.

Dyers in North America may be able to harvest small quantities of osage orange as prunings. The bark does not need to be stripped off and can be added to the dye bath. Small branches or twigs should be cut up as small as possible and then used as described below.

Dyeing procedure

To use the dye extract, simply dissolve it in hot water before adding it to the dye bath.

To prepare a dye bath from the wood chips, first soak them in water overnight. Then simmer the wood chips for half an hour or so to extract more dye color and strain off the dye liquid. The fibers should be simmered for 45 minutes to one hour to obtain the desired shade of yellow or olive-green.

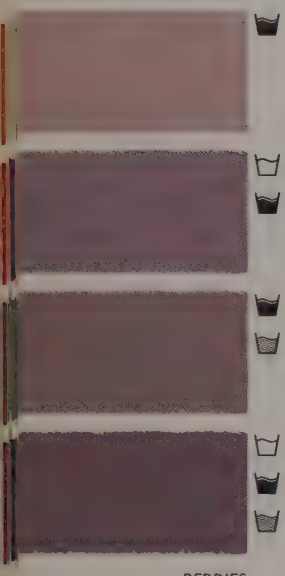
The used dyestuff can be simmered again to extract more dye color for a second dye bath and then added to the dye pot to achieve paler shades on fibers. Alternatively, the soaked wood chips can be dried and stored for later use.

Range	North America.
Availability	Grow from seed or purchase from specialist suppliers.
Planting time	Sow seeds in spring.
Growing habit	Grows up to 65ft (20m).
Harvesting time	All year.
Dyestuff	Heartwood (wood chips, shavings, or extract).
Dyeing instructions	Mordant recommended. Use at least half the weight of the fibers to be dyed for chips and shavings. Use a quarter of the weight of fibers to be dyed for extract.

Mahonia species

Mahonia

Mahonia is not a remarkable dye plant but it can be used throughout the year, particularly at times when few other fresh plants are available. The ripe berries give pale pinks or purples, and the leaves produce pale shades of beige. Both berries and leaves can be used fresh or dried.



BERRIES

LEAVES

Mahonias are attractive evergreen shrubs with leathery leaves and clusters of fragrant yellow flowers. These bloom in late winter and early spring, followed by purple or blue-black berries in late summer.

Cultivation and harvest

Mahonias can be raised from seed, either purchased from a seed supplier or collected from ripe berries. Sow the seeds in compost in mid- to late summer and put them in a cold frame. They should have germinated by the following spring and can be transplanted into pots when large enough to handle. Grow them on for another year or two before moving them to a permanent position. Alternatively, buy a plant from a nursery and plant it in spring or fall.

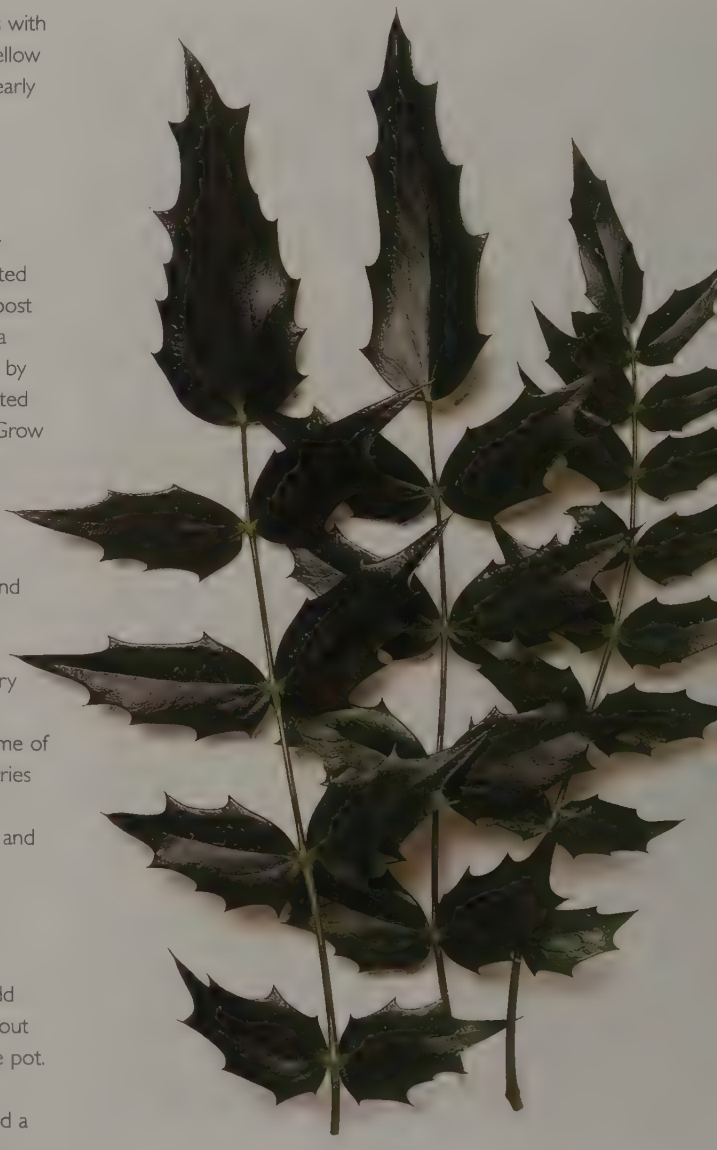
Mahonias thrive in good garden soil and will tolerate sun or partial shade. After planting, they need time to become established, but after that they require very little attention.

The leaves can be harvested at any time of the year and used fresh or dried. The berries should be collected when they are ripe, usually from late summer to early winter, and can also be used fresh or dried.

Dyeing procedure

To prepare a dye bath from the leaves, simmer them for one hour or so, then add the fibers and continue to simmer for about 45 minutes, with the leaves still in the dye pot. Allow the fibers to cool in the dye bath overnight. For light, olive-green shades, add a copper modifier to the dye bath.

To use the mahonia berries, crush them well in a pestle and mortar, then fill the dye pot with water and add the fibers. Heat to simmering point then simmer for no more than 45 minutes. Then leave the fibers to soak in the dye pot, at least overnight. An alum mordant on wool followed by an alkaline modifier after dyeing produces soft green results. However, this treatment strips color from vegetable fibers.

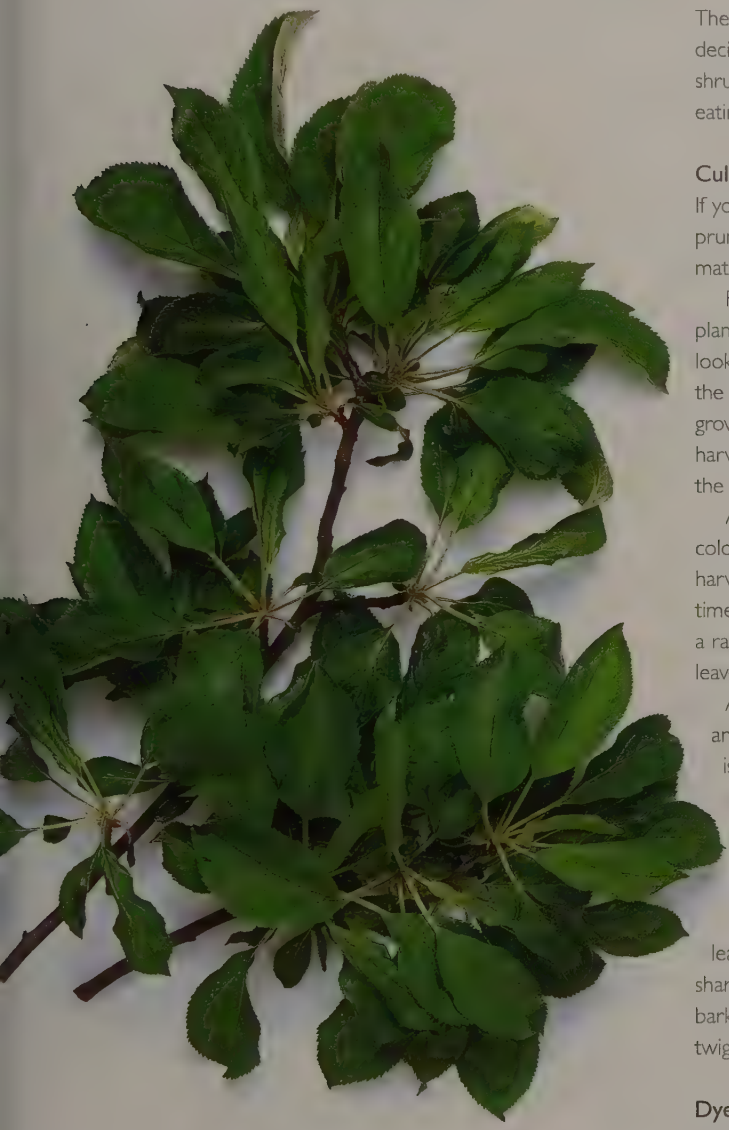


Range	Western North America and China.
Availability	Grow from seed or plantlet.
Planting time	Sow seeds mid- to late summer. Plant plantlet in spring
Growing habit	Allow 4–6ft (1.2–1.8m) per plant. Grows to 4–6ft (1.2–1.8m) tall.
Harvesting time	Leaves: all year. Berries: late summer to early winter.
Dyestuff	Leaves, berries.
Dyeing instructions	No mordant necessary but alum mordant improves colorfastness. Use equal weights of dyestuff and fibers.

Malus species

Apple

The leaves and bark of all three types of apple tree give useful shades of olive-green and brown in the dye pot. Most dyers will have access to one or other of the types, either the domestic eating apple, which is grown for its fruit, the ornamental or flowering crab apple, or the wild crab apple.



Range	Northern temperate regions worldwide.
Availability	Gather from nature.
Planting time	Not applicable.
Growing habit	Not applicable.
Harvesting time	Leaves: late spring to fall. Bark: all year.
Dyestuff	Leaves, bark.
Dyeing instructions	Leaves: mordant recommended for vegetable but not animal fibers. Bark: No mordant required. Use equal weights of dyestuff and fibers for both leaves and bark.

The genus *Malus* includes 35 species of hardy deciduous flowering and fruit-bearing trees or shrubs, including the parents of domestic eating apples. All have fragrant flowers.

Cultivation and harvest

If you have an apple tree in your garden, prunings will provide you with plenty of materials for the dye pot.

Flowering crab apple trees are often planted as ornamental trees in urban areas, so look out for fallen branches or find out when the trees are pruned. Crab apple trees growing in the wild will not be damaged if you harvest some leaves and cut a few twigs from the branches.

Apple leaves produce a different range of colors, depending on when the leaves are harvested. If you collect batches at different times of the year, you should be able to obtain a range of mustard and brown colors. The leaves can be used fresh or dried.

A good method of gathering fallen leaves and extracting the dye color in one process, is to collect apple leaves and then let them soak outside in a bucket of water for several weeks. When the water becomes a rich brown color it is ready to strain into the dye bath.

When collecting prunings, remove the leaves first, then strip off the bark with a sharp knife. However, there is no need to strip bark from smaller prunings, just chop the twigs up into small pieces.

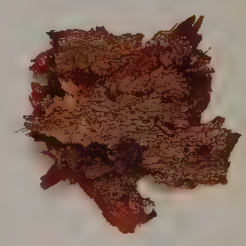
Dyeing procedure

Apple leaves can be used following the general instructions for leaves in Dyeing Techniques (see pp.46–48). Simmer the dye bath for several hours for really deep shades. The exhaust dye bath will usually give pretty, but paler colors.

Apple tree bark needs soaking in water for a week or so, before being gently simmered to make the dye bath. Brighter colors often result if you strip off the outer bark and use only the inner bark for the dye bath.

LEAVES

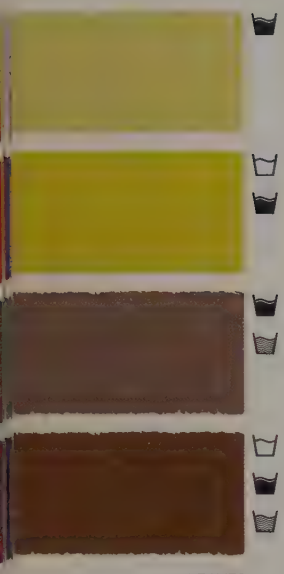
BARK



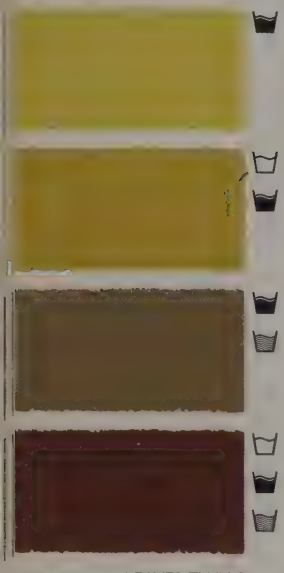
Myrica gale

Bog myrtle, Sweet gale

Apart from being a useful dye plant that produces shades of mustard yellow and olive-green, when combined with a mordant or modifier, bog myrtle's aromatic resin is distilled into an essential oil and used to scent candles and insect repellents. It is also used in brewing beer and cooking.



LEAVES



LEAVES, TWIGS

Bog myrtle is one of the traditional sources of yellow dye in Scandinavia. It was also widely used in Scotland, where it grows freely in many areas. On wool fibers, bog myrtle dye yields clear, bright yellows and golds if applied with an alum mordant. It is less useful as a dye for vegetable fibers.

Cultivation and harvest

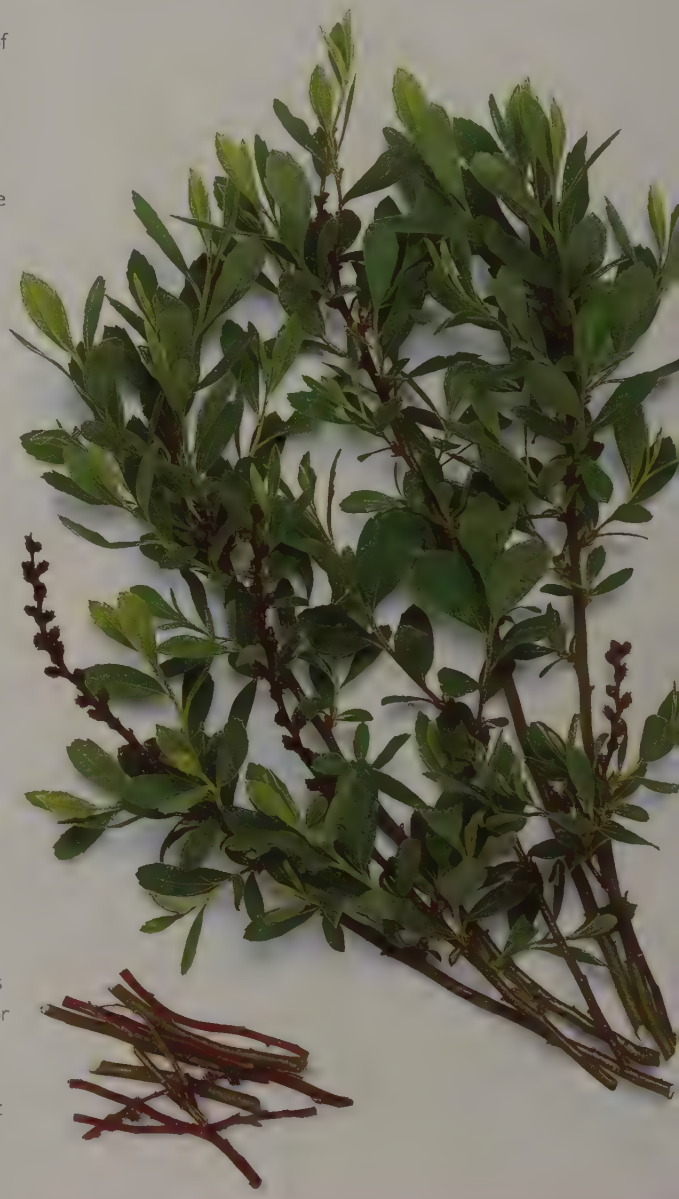
Bog myrtle belongs to the bayberry family and is found in boggy areas on moors and heaths and on the banks of streams and rivers. It is a deciduous, woody shrub that thrives in damp, acid soils. Its leaves are strongly aromatic, with a scent similar to that of eucalyptus. (Crushing the leaves between your fingers will release its scent and help to distinguish the plant.) In spring and early summer, bog myrtle bears yellowy-brown catkins, which develop into small, waxy fruits at the tips of its shoots.

The leaves and twigs are the parts of the plant used for dyeing. Collect the leafy twigs from early summer to mid-fall and use them fresh or dried. The leaves can be stripped from the twigs to make a dye bath, or the twigs and leaves can be cut up and used together to make a dye solution.

Dyeing procedure

A dye bath made from leaves alone produces a clear yellow. But if twigs are added, the color becomes more mustard in tone because of the tannin content in the wood.

To prepare the dye bath, simmer the plant materials for about one hour, then strain off the liquid and transfer this to your dye bath. You may need to simmer the dye bath for longer if the twigs are included and you want the full effect of the tannin. Dye baths prepared from twigs alone benefit from a two to three day soak before simmering.



Range	Western Europe and parts of North America.
Availability	Gather from nature.
Planting time	Not applicable.
Growing habit	Not applicable.
Harvesting time	Early summer to mid-fall.
Dyestuff	Leaves, twigs.
Dyeing instructions	Mordant is recommended but this is not essential if twigs are added to the dye bath. Use equal weights of dyestuff and fibers for leaves and twigs.

Narcissus species

Daffodil

Harvest the golden yellow flowers for the dye pot as soon as they no longer look attractive on the plants. They give the best results used fresh rather than dried, and flowers of all colors can be used, although yellow petals produce stronger yellow and olive-green dye colors.

Range	Europe, North Africa, and most temperate regions.
Availability	Grow from bulbs or purchase as cut flowers.
Planting time	Plant bulbs in the fall.
Growing habit	Allow 4–6in (10–15cm) per bulb. Grows to 6–20in (15–50cm) tall.
Harvesting time	Early to late spring.
Dyestuff	Flowers.
Dyeing instructions	Mordant recommended. Use equal weights of dyestuff and fibers.

Golden yellow daffodils herald the coming of spring. They are a welcome sight in gardens, woodlands, and parks, and are perhaps one of the most popular spring-time bulbs.

Cultivation and harvest

Almost all daffodils are hardy bulbs and once planted, if they are lifted every second year or so to divide the bulbs, they can be left to flower for many years. Many can be grown indoors as houseplants and even the smallest garden will have room for dwarf varieties. Dyers without gardens can enjoy daffodils purchased as cut flowers and then use faded blooms in the dye pot.

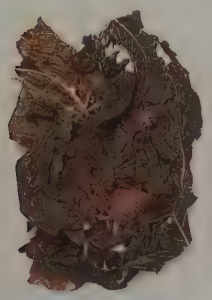
Daffodils are grown from bulbs planted in the fall. For the best effects, plant the bulbs in groups or clumps, in holes that should be twice the depth of the bulb. Make each hole flat at the base so that the bulb rests on the soil, then cover it over. Daffodils thrive in rich, well-manured soil, protected by slight shade. Avoid allowing the soil to become waterlogged, as this can cause the bulbs and plants to rot. In dry weather, keep the soil moist, as drought, especially in late spring, retards regrowth of the bulbs.

Some gardeners prefer to lift the bulbs each year after flowering and then replant them in the fall. Other gardeners prefer to leave the bulbs in their growing positions and lift them every second year. If daffodil bulbs are left in their site, remember not to remove the daffodil leaves or tie them in knots after flowering as this weakens the bulbs.

FLOWERS

Dyeing procedure

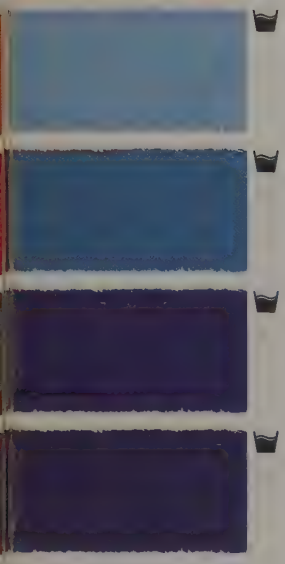
When picking daffodils, remember to handle them with care as the sap is poisonous. If collecting the flowers over several days, soak them in water until there are enough for a dye bath. Leave them to soak for three or four days more, then simmer the flower heads gently until the liquid is strongly yellow colored. Strain off the dye liquid and use it as generally described for flowers in Dyeing Techniques (see pp.46–48).



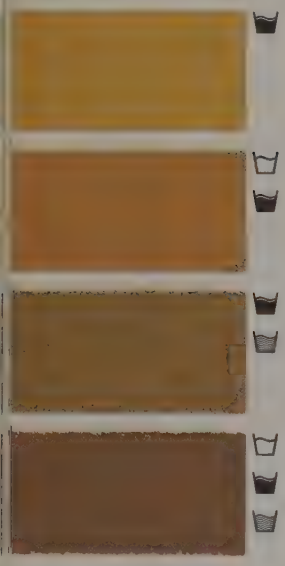
Persicaria tinctoria (Polygonum tinctorium)

Japanese indigo, Dyer's knotweed

Persicaria tinctoria (Polygonum tinctorium) *is a member of the buckwheat family and has been a source of indigo blue for centuries in Japan and Southeast Asia. It is easy to grow, harvest, and process, and produces deep shades of blue very similar to those from* Indigofera *species.*



LEAVES METHOD 1



LEAVES METHOD 2

The advantage of this source of indigo-blue is that it is easier to grow in temperate regions than *Indigofera tinctoria* (see pp.98–99). It forms bushy plants with jointed stems and has pink or white flowers, depending on the variety.

Cultivation and harvest

Sow the seeds indoors in early spring, several weeks before the last frost. The seedlings can be transplanted into their growing positions when they are about 6in (15cm) high and there is little chance of frost damage. Japanese indigo grows in most conditions but prefers full sun. It favors rich, moist soil with added compost or manure and requires plenty of water. Encourage the plants to spread by bending the stems until a stem joint touches the ground. Cover the joint with soil to produce new roots.

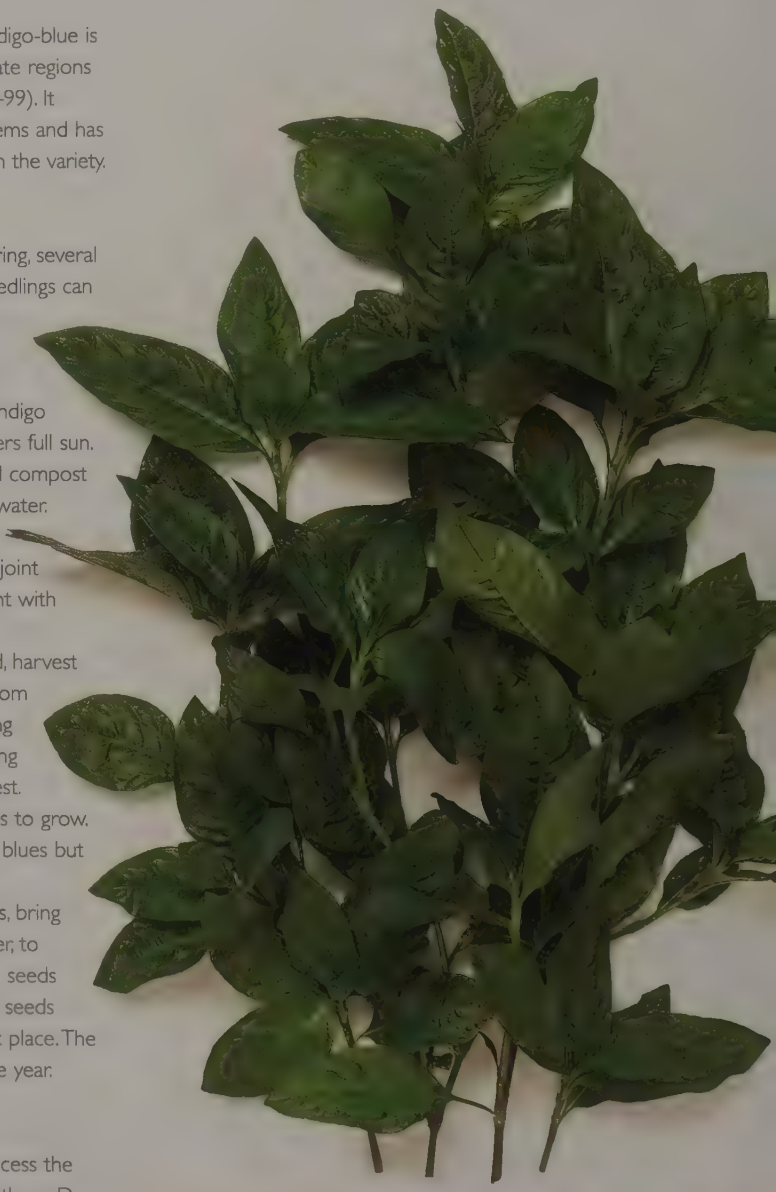
Once the plants are established, harvest the leaves at two week intervals from midsummer to mid-fall. Start picking leaves from the stem base, removing about half the leaves at each harvest. This will also encourage new leaves to grow. Fresh leaves provide the strongest blues but you can dry some for later use.

To collect Japanese indigo seeds, bring a few plants indoors in late summer, to develop during winter. Harvest the seeds individually with tweezers. Dry the seeds before storing them in a cool, dark place. The seeds are only viable for about one year.

Dyeing procedure

To make a Japanese indigo vat, process the leaves by pouring cold water over them. Do not use boiling water as this damages the blue pigment. Then slowly heat the leaves to just below simmering point and leave to steep for about one hour. Strain off the sherry-colored liquid, and continue as described for woad in Dyeing Techniques (see pp.56–57).

For tan shades, boil the leaves to extract the dye color and dye fibers as generally described in Dyeing Techniques (see p.49).

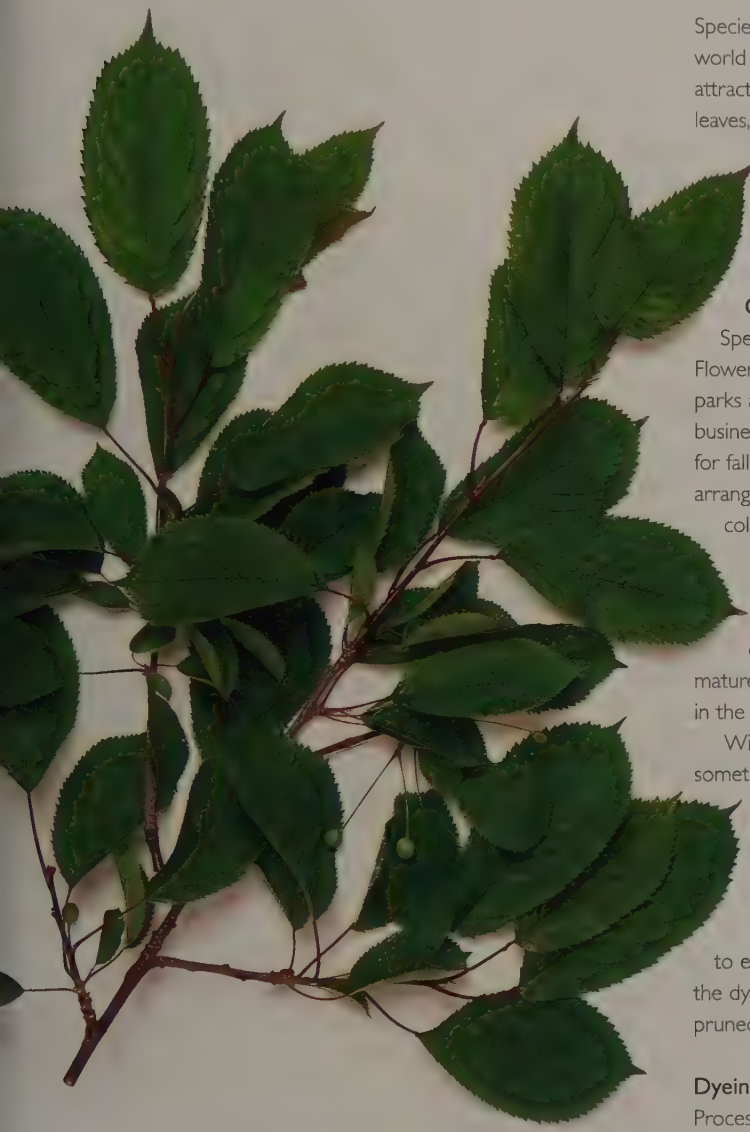


Range	Japan, Southeast Asia, and temperate regions.
Availability	Grow from seed.
Planting time	Sow seeds in early spring.
Growing habit	Allow 12in (30cm) per plant. Grows to 24–36in (60–90cm) tall.
Harvesting time	Midsummer to mid-fall.
Dyestuff	Leaves.
Dyeing instructions	No mordant for blues but use an alum mordant for tans. Use three times the weight of dyestuff to fibers.

Prunus species

Cherry, Plum, Peach, Almond, Apricot

There are over 400 species of Prunus *and the leaves and bark of all species can be used for dyeing. The leaves of plum, peach, and almond trees produce shades of yellow and olive-green, and cherry bark dyes animal and vegetable fibers warm shades of soft pink.*



Species of *Prunus* are distributed around the world in temperate regions. They have attractive bark and flowers and deciduous leaves, and bear various single-stoned fruits. Among the most familiar are the ornamental varieties, whose pink or white blossoms fill the air with fragrance and color in spring.

Cultivation and harvest

Species of *Prunus* are usually easy to find. Flowering cherry trees are planted in many parks and municipal gardens, around factories, business areas, and by the roadside. Look out for fallen branches in these locations or arrange with the appropriate authority to collect prunings and gather fallen leaves.

Wild cherry trees can be found along the perimeter of agricultural land, in woodland, and along railway embankments. If the tree is large and mature, and if there is an abundance of trees in the area, cutting twigs will do no harm.

Wild plum trees are often found in hedges, sometimes planted as windbreaks. In Great Britain, wild damson fruits (*Prunus insititia*) were used to provide dyes for the Luton straw hat industry and for the Manchester cotton mills.

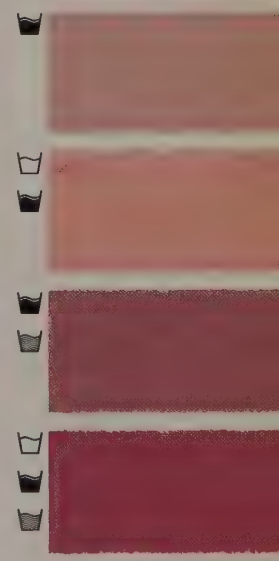
Harvest the leaves from late spring to early fall and use them fresh or dried in the dye pot. Bark can be stripped from pruned twigs and branches with a sharp knife.

Dyeing procedure

Process the leaves and bark as described in Dyeing Techniques (see pp.46–48).

To experiment with a dye bath made from dark-colored cherry, plum, or damson fruits, crush the fruits well and then simmer them in a little water until you get a strongly colored liquid. Fruit dyes often yield better colors on vegetable fibers if they are applied without much heat, or in a cool dye bath.

LEAVES (PLUM)



BARK (CHERRY)

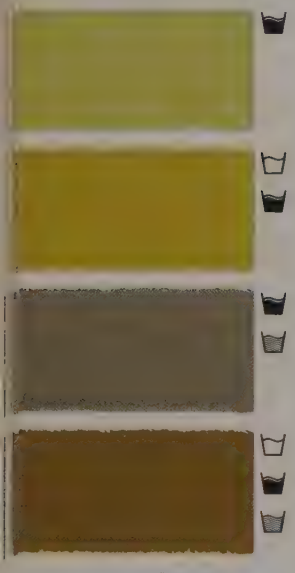
Range	Most temperate regions worldwide.
Availability	Gather from nature.
Planting time	Not applicable.
Growing habit	Not applicable.
Harvesting time	Leaves: late spring to early fall. Bark: all year.
Dyestuff	Leaves, bark.
Dyeing instructions	Leaves: mordant needed especially for vegetable fibers. Use equal weights of dyestuff and fibers for leaves. Bark: no mordant necessary. Use half the weight of dyestuff to fibers for strong colors from bark.

Prunus spinosa

Blackthorn

The small damson-like fruits of blackthorn, known as sloes, are used to make preserves, wine, and to flavor gin. Harvested in fall when they are fully ripe, the sloes can be used as a fresh or dried dyestuff to produce muted shades of gray and purple, while shoots yield a greeny-yellow dye.

FRUITS



LEAFY SHOOTS

Blackthorn is a hedgerow shrub or bushy tree, with dark green leaves and masses of snowy white blossoms that cover the branches in spring. Although the fruits, which appear in fall, resemble damsons, they cannot be picked and eaten from the tree as they are very bitter.

Cultivation and harvest

Blackthorn grows abundantly throughout Great Britain and it is naturalized in some parts of North America. It has sharp thorns and hardwood much valued for walking sticks.

The fruits (sloes) are harvested in the fall, when black and ripe and can be used fresh or dried. Twigs and slender branches can be cut without damaging these vigorous trees. Harvest the leafy shoots and twigs at any time during the growing season. Chop the fresh plant materials into pieces and soak them to extract the color.

The bark and blossoms can also be used as a dyestuff. Blackthorn bark gives similar colors to those from cherry bark (*Prunus* species, see p.111). Strip bark either from the main trunk of a felled bush or from larger branches. Gather the blossoms in spring when fully mature, and use them fresh to yield strong yellow colors on all fibers.

Dyeing procedure

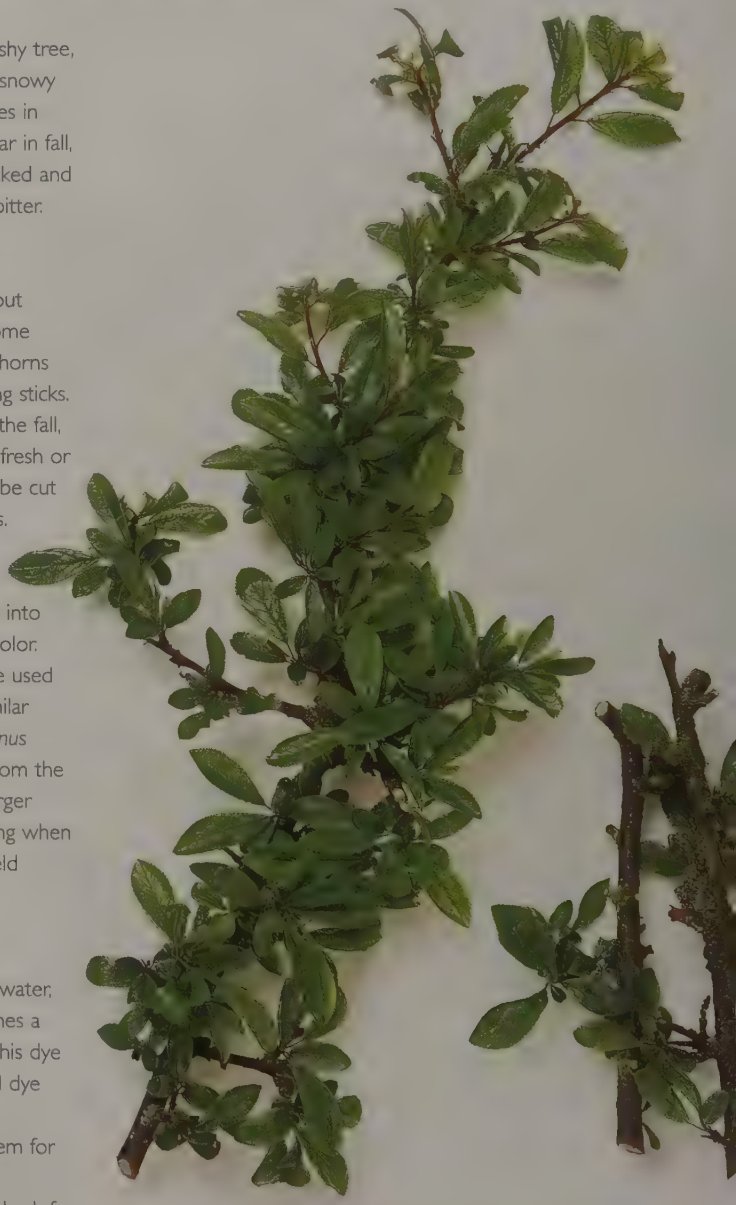
Crush the fruits and cover them with water, then gently heat until the liquid becomes a rich, purply-red. Vegetable fibers take this dye best and it should be applied in a cool dye bath or with moderate heat only.

To use the leafy shoots, simmer them for one hour to extract the dye color.

To experiment with bark, soak the bark for one week, then simmer for several hours. Leave to cool overnight, then strain off the dye liquid and use this as your dye bath.

To prepare a dye bath from blossoms, simmer the blossoms for several hours until the liquid is a deep reddish-gold.

Use the dye liquids from all plant parts on both animal and vegetable fibers as described in Dyeing Techniques (pp.49–52).



Range	Europe and North Africa to west Asia.
Availability	Gather from nature.
Planting time	Not applicable.
Growing habit	Not applicable.
Harvesting time	Fruits: fall. Leafy shoots, bark: all year. Blossoms: spring.
Dyestuff	Fruits, leafy shoots, bark, blossoms.
Dyeing instructions	Mordant recommended. Use equal weights of dyestuff and fibers for fruits, leafy shoots, bark, and blossom. Fruits produce prettier colors on vegetable fibers.

Pteridium aquilinum

Bracken, Brake

Bracken gives variable results in the dye pot, sometimes producing golden yellows and olive-greens, and sometimes browns. It is easy to gather and relatively simple to achieve successful results, which makes it an ideal choice for the newcomer to dyeing with plant materials.

Bracken is a type of fern, and these perennial, flowerless plants reproduce by means of spores, not seeds. The spores appear on the underside of the leaves from late summer to late fall and are dispersed by wind or passing animals. Today's ferns are among the most primitive plants on earth. In fossil form, they date back more than three million years.

Bracken has been used as bedding for humans and animals, as lining for baskets of fruit and fish, and as protective wrapping for slate and earthenware. The ashes from burnt bracken were sometimes used in soap making and the bleaching of linen. However, many people regard bracken as a nuisance, especially when it invades agricultural land. It is also considered toxic to animals.

LEAFY FRONDS

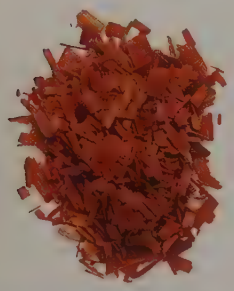
Cultivation and harvest

Bracken is a common fern in woodlands, heaths, and on hillsides, often covering large areas with its green leafy fronds. Bracken is tough, so when harvesting it for the dye pot, wear protective gloves and take a sharp knife or pruning shears to cut it.

Dyeing procedure

The young and mature leafy fronds can be used whole in the dye pot, either fresh or dried. A dye bath made from young fronds will generally give yellow shades. They should be gathered when they are about 6in (15cm) high and simmered for 30 minutes to one hour. Strain off the dye liquid and use it as generally described for leaves in Dyeing Techniques (see pp.46–48). Older fronds should be treated in the same way as young fronds and will produce a range of greeny-yellow or olive-green shades.

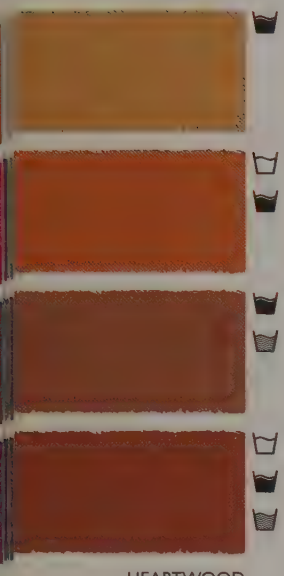
Range	Most temperate regions.
Availability	Gather from nature.
Planting time	Not applicable.
Growing habit	Not applicable.
Harvesting time	Young fronds: spring. Mature fronds: summer to fall.
Dyestuff	Leafy fronds.
Dyeing instructions	Mordant recommended on all fibers. Use equal weights of dyestuff and fibers for both young and mature fronds.



Pterocarpus santalinus

Sanderswood, Saunderswood

Sanderswood is one of a group of dyes known as the "insoluble redwoods," which were used for dyeing wool attractive shades of pinky-brown. Recipes for these dyes frequently appear in master dyers' recipe books but now only sanderswood is sold commercially as a dyestuff.



HEARTWOOD

Sanderswood belongs to the pea family and is a small tree that grows up to 33ft (10m) in height. The dyestuff is available in the form of wood chips or powder, prepared from the heartwood of mature trees. It contains a red dye, which is not soluble in water, and an attractive rusty-brown dye, which can be extracted in hot water.

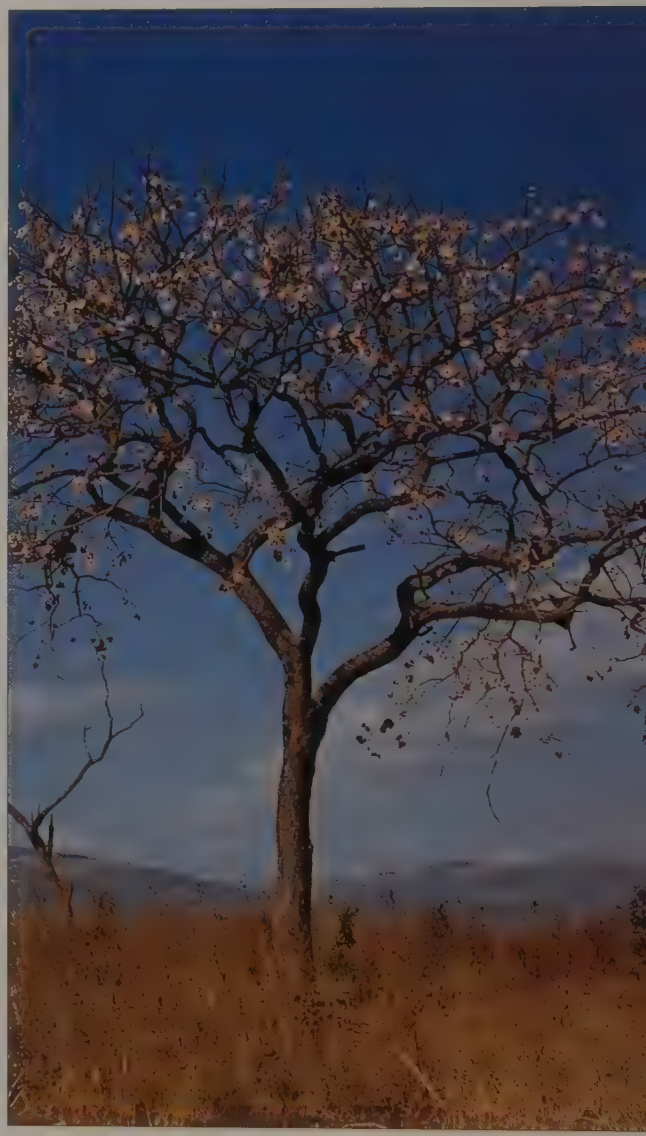
Other "insoluble redwood" dyes include barwood, from *Pterocarpus soyauxii* (African Padauk), native to Africa, and camwood from *Baphia nitida*, a large tree found growing on the west coast of Africa. In some parts of Africa powdered camwood is pressed into blocks and applied as a cosmetic. Neither is now available commercially as a dyestuff.

In the past, the "insoluble redwoods" were soaked in rubbing alcohol as this yielded more dye color than simmering the wood in water. Rubbing alcohol is not recommended for use by craft dyers as it is highly flammable.

"Insoluble redwoods" were also applied with other dyestuff to give compound colors, especially browns, or as the base for other dyes. Their use continued until the early part of the 20th century when synthetic dyes replaced natural dye sources.

Dyeing procedure

Sanderswood is usually supplied by specialist dyestuff suppliers either as a powder or as wood chips. Simmer the powder or wood chips in water for about 45 minutes to one hour to dissolve the dye color. Stronger colors often result if the dyestuff is left in the dye bath with the fibers. As the powder or wood chips can be difficult to remove from the fibers, try straining the dye liquid through a coffee filter to remove the particles before dyeing. Alternatively, once the wood chips have simmered, strain off the dye liquid, tie the wood chips in a muslin bag, and add this to the dye bath. Stir the fibers in the dye pot or the color result may be uneven. Simmer the fibers in the dye solution for about 45 minutes. Let them cool in the dye bath.



Range	East Indies, Sri Lanka, and the Coramandel Coast.
Availability	Purchase from specialist suppliers.
Planting time	Not applicable.
Growing habit	Not applicable.
Harvesting time	Not applicable.
Dyestuff	Heartwood (powder or wood chips).
Dyeing instructions	Mordant recommended. Use equal weights of dyestuff and fibers. A copper modifier gives attractive shades of claret-brown.

Punica granatum

Pomegranate

The edible pomegranate fruit yields an ocher-yellow dye and the skins are rich in tannin, which improves colorfastness. The pomegranate dye lacks brilliance so it is often mixed with turmeric root to make the color brighter. In India and Southeast Asia it is used as a mordant and a dye.

OUTER SKINS OR WHOLE FRUITS

The pomegranate is a very attractive small tree or shrub that grows to about 20ft (6m) high. It has numerous slender branches, some with sharp thorns, and beautiful green leaves. Its brilliant scarlet flowers are produced in the summer at the tips of the branches. The fruits, which ripen from early fall onward, can be 3–4in (8–10cm) in diameter. They have a characteristic hard leathery skin and are crowned by a "toothed" calyx tube. For centuries pomegranate skin has been recorded as a dye in most parts of the world where the trees grow. It was used without a mordant for yellow and beige colors, with an alum mordant for bright, golden yellows, and with an iron mordant for gray and black.

Cultivation and harvest

Although pomegranate fruits rarely ripen in colder climates, the tree is worth growing for its beauty alone. Those who cannot grow the fruits in their climate, can buy them from fruit sellers throughout the year or purchase the dried dyestuff from specialist suppliers.

Dyeing procedure

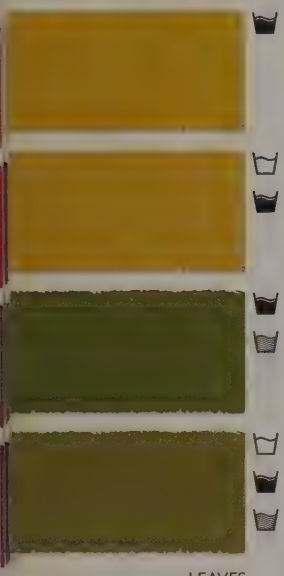
Pomegranate fruits can be used fresh or dried. To dry the outer skin or the whole fruit, leave the skin or fruit in a warm dry place. Before extracting the dye color, crush the fresh or dried outer skin or whole fruit into small pieces. This can be done by hitting it sharply with a hammer but it may be wise to put it into a strong plastic bag first, so the pieces do not fly around. Once crushed, simmer the skins or whole fruit for about 45 minutes to one hour, then strain off the solution for your dye bath. Simmer the fibers in the dye bath for about 30 minutes and then leave them to soak in the dye bath overnight. Alternatively, heat the dye bath to simmering point, turn off the heat, and leave the fibers to soak in the liquid for one or two days.

Range	Southern Europe, the Middle East, India, Southeast Asia, West Indies, and North Africa.
Availability	Purchase from specialist supplier or as a foodstuff.
Planting time	Not applicable.
Growing habit	Not applicable.
Harvesting time	Not applicable.
Dyestuff	Outer skins or whole fruits.
Dyeing instructions	No mordant required. Use at least half the weight of dyestuff to fibers. Using an iron modifier will give greeny-brown shades.

Pyrus communis

Pear

Pears are hardy, deciduous trees that bear blossoms in spring and fruits in late summer and fall. Pear tree bark gives pinky shades in a cool dye bath and pinky-browns when simmered. The leaves yield yellows and olive-greens and can be mixed with other fruit tree leaves.



LEAVES

BARK

Pyrus communis is a native of temperate Europe and western Asia as far as the Himalayas, and is the parent of modern European and North American cultivated varieties of pear.

Cultivation and harvest

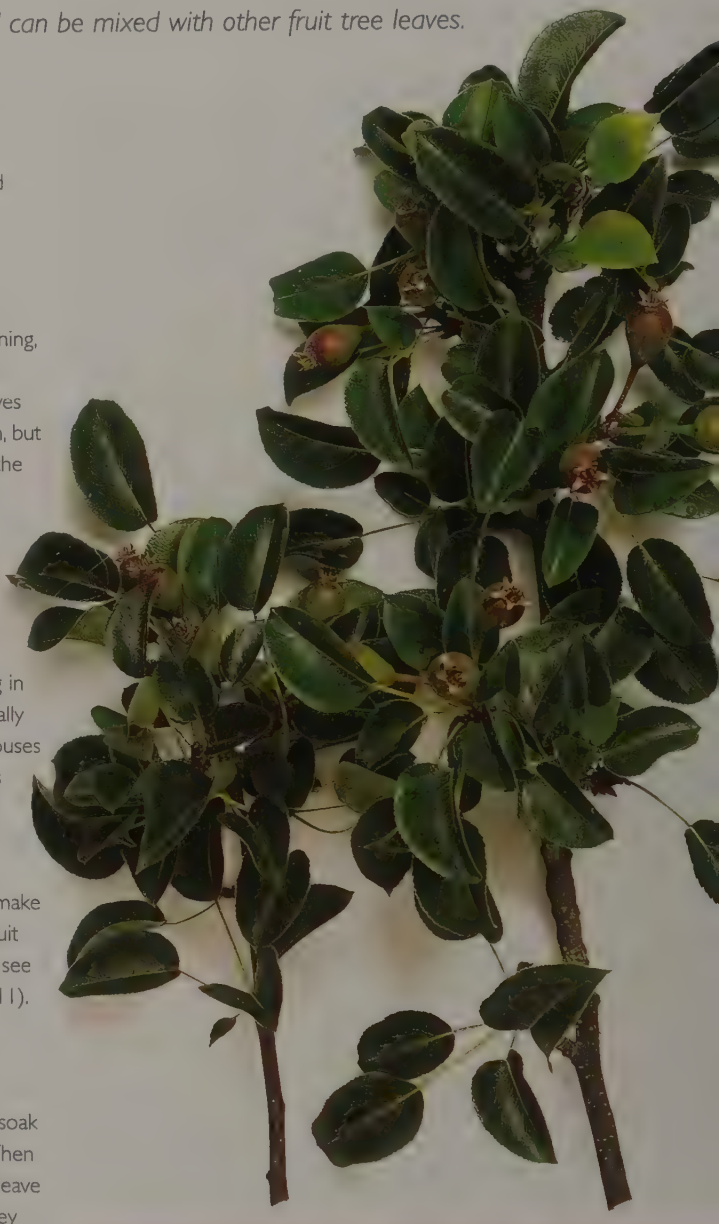
Established pear trees growing in fruit orchards and gardens usually require pruning, so this is when dyers should gather fresh leaves and bark for the dye pot. Pear leaves produce the best colors when used fresh, but bark can be used fresh or dried. During the growing season, only a few leaves should be picked from each branch. Otherwise, pick fall leaves just before they drop, or gather up the fallen leaves. Bark can be stripped from pruned branches with a sharp knife.

Pear trees are difficult to find growing in the wild, although old trees can occasionally be found by the sides of roads, where houses and gardens once stood, or in rural areas previously occupied by fruit orchards.

Dyeing procedure

If there are not sufficient pear leaves to make a dye bath, mix pear leaves with other fruit tree leaves, such as apple (*Malus* species, see p.107) or cherry (*Prunus* species, see p.111). Process the fruit tree leaves as generally described in Dyeing Techniques (see pp.46–48).

To extract dye color from pear bark, soak the pieces of bark for one or two days. Then add the fibers to the soaking water and leave the fibers to steep with the bark until they have absorbed enough color. Remove the fibers and then simmer the bark gently for one hour or so to extract more color. Let the solution cool a little, then add more fibers and let them soak in the liquid for another one or two days. This all-in-one method works well.

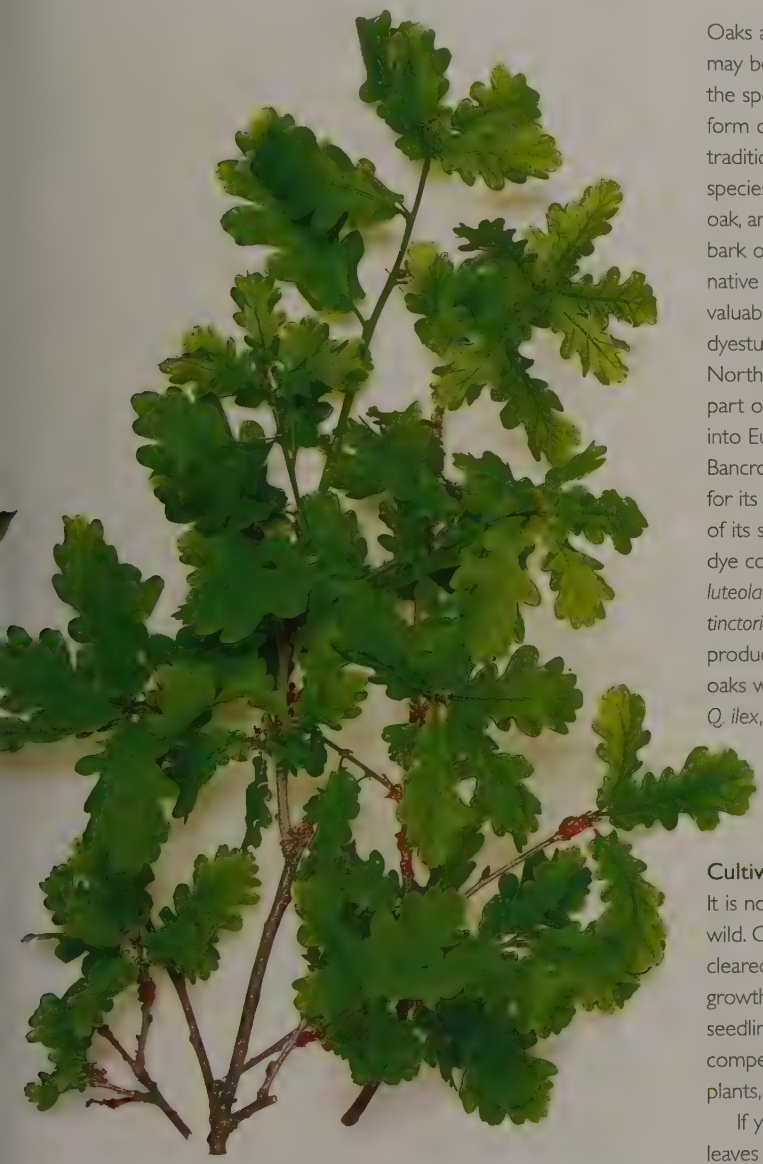


Range	Europe and west Asia, and temperate regions.
Availability	Gather from nature.
Planting time	Not applicable.
Growing habit	Not applicable.
Harvesting time	Leaves: late spring to fall. Bark: all year.
Dyestuff	Leaves, bark.
Dyeing instructions	Leaves: mordant required (especially on vegetable fibers). Use equal weights of dyestuff and fibers for leaves. Bark: no mordant required. Use at least half the weight of dyestuff to fibers for bark.

Quercus species

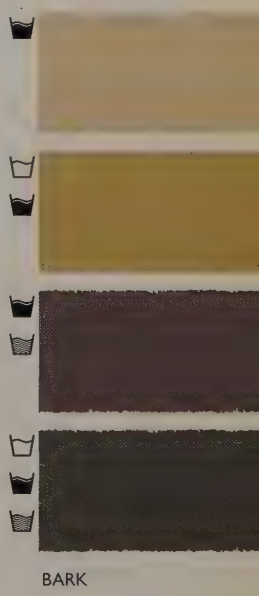
Oak

All parts of the oak contain tannin, and oak leaves, bark, and acorns also produce ocher, beige, and gray dye colors. The tannin from oak bark was extracted and used for centuries to tan hides. It is the oak galls that contain the most tannin, and are used as a mordant on vegetable fibers.



Range	Northern temperate regions, high altitudes in Tropics.
Availability	Gather from nature or grow from seedlings.
Planting time	Spring or fall.
Growing habit	Plant 24in (60cm) apart for a hedge.
Harvesting time	Bark, oak galls: all year. Leaves: spring to fall. Acorns: fall.
Dyestuff	Bark, leaves, oak galls, acorns.
Dyeing instructions	No mordant needed. Use equal weights of dyestuff and fibers for bark, leaves, oak galls, and acorns. Using small amounts of iron modifier gives attractive grays.

Oaks are generally hardy, long-lived trees and may be evergreen or deciduous, depending on the species. They all produce their seeds in the form of acorns. The oak is Great Britain's traditional tree and there are two native species *Quercus robur*, the English or common oak, and *Q. petraea*, the sessile oak. The inner bark of the black or yellow oak, *Q. velutina*, native to North America, is the source of a valuable yellow dye, known as quercitron. This dyestuff was widely used commercially in North America and Europe until the early part of the 20th century. It was introduced into Europe in 1785 by the dyer Edward Bancroft and was highly regarded, not only for its coloring properties, but also because of its strength. It produced considerably more dye color by weight than either weld (*Reseda luteola*, see p.119) or fustic (*Chlorophora tinctoria*, see p.82), so less was required to produce similar shades of yellow. Two other oaks worthy of mention are *Q. coccifera* and *Q. ilex*, or holm oak, which are native to Mediterranean coastal areas and the host trees for kermes insects, the source of a red dye (see p.15).



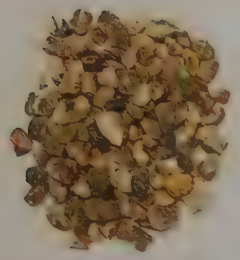
BARK

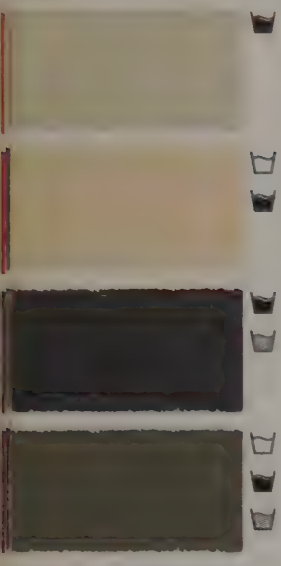
LEAVES

Cultivation and harvest

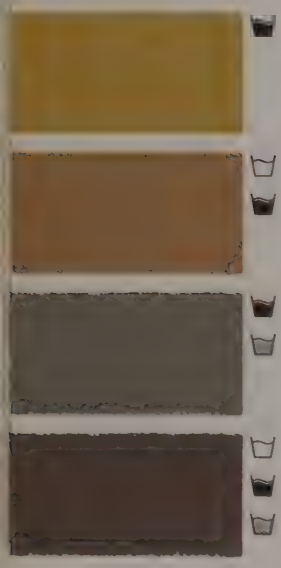
It is not difficult to locate an oak tree in the wild. Oaks colonize hedgerows and waysides, cleared woodlands, and neglected pastures. Its growth is slow and steady, but the tough seedlings tolerate a wide range of soils and compete vigorously with grass, herbaceous plants, and thorn bushes.

If you want to plant oaks to produce leaves and bark for dyeing in two or three years time, the best method is to plant an oak hedge. Oaks will grow in any well-drained garden soil and will tolerate partial shade. The evergreen *Q. ilex*, available as seedlings from some nurseries, makes a good screen in areas where winters are not too severe. Set the seedlings at 24in (60cm) intervals for hedging. After planting, remove the growing points to encourage growth. An annual mulch of compost, leaf-mold or well-rotted manure will





OAK GALLS



ACORNS

help to establish them. Allow your hedge to become well grown before you start to harvest any leaves or twigs for dyeing.

When gathering oak from nature, look out for fallen branches. Only remove bark from fallen trees and then soak the bark in water until it is soft enough to break up into pieces. Small amounts of leaves can be gathered from living branches but it is better to collect them from fallen branches. Oak leaves harvested in spring or summer yield brighter colors if used fresh. Leaves gathered in the fall can be used fresh or dried to produce brown shades.

Harvesting oak galls

The oak also produces another valuable dyeing ingredient, the so-called oak gall. This small swelling occurs when the wasp deposits her eggs inside an oak shoot. This "foreign body" stimulates the tree to grow plant tissue around the gall wasp larvae and the plant tissue develops into a nut-like gall. Oak galls do not affect the general health of established oak trees and they are extremely valuable to dyers because of their high tannin content; they are used as part of the mordanting process for vegetable fibers. A solution made from oak galls mixed with iron produces a black dye that was used in the 19th century as writing ink. If possible, harvest oak galls before they turn brown and hard, as this is when the tannin content is highest.

Harvest acorns for the dye pot in the fall when they are fully ripe. Prepare the acorns before processing them further by crushing them and leaving them to soak for a few days.

Dyeing procedure

To extract dye color from oak bark, soak the bark for at least one week. If the soaking water is strongly colored, strain off the dye liquid and apply it to the fibers without heat. If the soaking liquid is not strongly colored, simmer the bark for one or two hours to extract more color before immersing the fibers in the dye liquid with or without heat.

To extract color from oak leaves, use one or two methods depending on the time of year the leaves were gathered. To make a dye bath from fresh spring or summer oak leaves, simmer the leaves for about 45 minutes to one hour. Strain off the dye solution and simmer the fibers in the dye pot until they have absorbed a good, strong color. Leave the fibers to soak in the dye bath overnight.

To process fall leaves, pour boiling water over the leaves to make a dye bath and allow to soak overnight. Then simmer the leaves for about one hour, strain off the dye solution and use as described above for fresh spring or summer leaves.

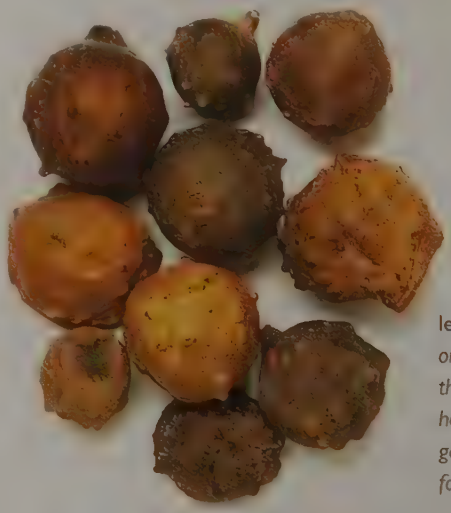
To use oak galls, first crush them, and then soak them in water until they are soft. To extract the tannin, simmer the oak galls for about one hour, and then strain off the solution. They can often be simmered again to extract more tannin.

The tannin solution is applied as part of the mordanting process for vegetable fibers (see pp.40–41). It can also be used to dye fibers dark gray or almost black, either by adding iron to the dye liquid or by using an iron modifier after dyeing. To darken the color, leave the fibers to soak in the dye bath or iron solution overnight.

In medieval times, this method of adding iron to the oak gall dye liquid or using an iron modifier after dyeing was a common way of producing a black color on wool fibers. However, some dyers, keen to save both time and expense, added iron filings to oak gall dye liquids, instead of using ferrous sulfate or iron liquor (see p.42), and this had a harmful effect on the wool, making it feel harsh to the touch and weakening the fibers.

To use acorns, crush the acorns well and soak them for several days, before gently simmering for one or two hours to make the dye solution. Strain off the dye liquid and apply it with gentle heat only, as excess heat can dull the colors.

An iron modifier gives gray or almost black shades with acorn dye, especially on alum-mordanted vegetable fibers.



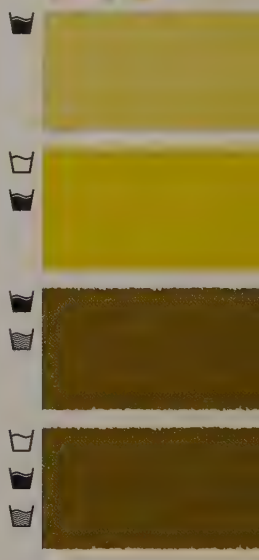
left *Oak galls occur on oak shoots where the gall wasp has laid her eggs. The galls are gathered and crushed for use in the dye pot.*

Reseda luteola

Weld, Dyer's rocket

Weld is one of the oldest yellow dye plants and produces some of the most light- and washfast yellow shades, especially when used with a copper mordant or modifier. It was a popular dye plant from Roman times until fustic and quercitron were introduced into Europe from the Americas.

Range	Europe and temperate regions.
Availability	Gather from nature or grow from seed.
Planting time	Sow seeds in spring.
Growing habit	Allow 12in (30cm) per plant. Grows to 6ft (1.8m) tall.
Harvesting time	Summer.
Dyestuff	Plant tops.
Dyeing instructions	Alum or copper mordant recommended. Copper mordant produces the fastest shades. Use equal weights of dyestuff and fibers.



PLANT TOPS

Weld was imported into North America from England in the 18th century, where it was cultivated as a dyestuff. However, the decline in use of weld as a dye was due to the fact that it had less tinctorial power than fustic or quercitron (the inner bark of black oak, see p.117). Weight for weight, weld produced less dye color than either of these plants, and more dye plant material was needed to get similar depths of color.

Cultivation and harvest

Weld favors an open site and freshly turned ground. To harvest weld, cut off the stems just above the lowest two or three side shoots. These shoots then grow and produce flowering stalks and seeds for the next crop.

Weld is easy to cultivate from seed and forms flat rosettes of leaves in its first year and flowering stalks in the second. It has a long taproot and does not react well to being transplanted. For this reason, sow seeds outdoors in spring in their growing positions and when they are large enough to handle, thin them out to 8–10in (20–25cm) apart. The flowering spikes produce seeds inside green pods and these can be sown the following spring. The tall plant tops are harvested for the dye pot when they are in flower. Slice the stems into pieces and use them fresh or dried.

Dyeing procedure

To extract dye color, pour boiling water over the chopped up plant tops and leave them to soak overnight. Pour off the dye liquid and use it for your dye bath or, if the dye liquid is not strong enough, simmer the plant tops first for about one hour. Excess heat can dull colors so do not allow the liquid to boil. Strain off the dye solution, allow it to cool, and then add the fibers. Leave them to steep for a few hours. For stronger colors, simmer the fibers in the dye bath for 45 minutes before steeping.

The plant parts can be reheated to make a second dye bath. Simmer them for one hour to extract any remaining color, then pour off the liquid and use it as before.

Rhamnus species

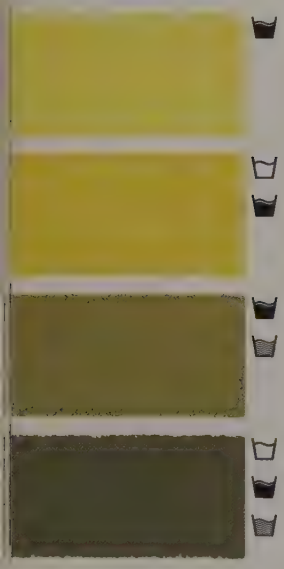
Buckthorn

Buckthorn berries were used as a yellow dye for centuries and the yellow component of the green in many old silks and calico prints came from the superior Persian buckthorn berries. In North America, they were used by professional dyers in the 18th and 19th centuries.

BARK

Several species of *Rhamnus* can be used for dyeing. *Rhamnus catharticus* is a tall, spiny shrub found mainly on chalky ground in Europe, in hedgerows, and on fens and scrubs. It is naturalized in North America. The buckthorn berries generally sold as a dyestuff are usually called Persian berries. They are the mature or immature berries of *R. infectorius*, also known as *R. saxatilis*. This is an evergreen shrub, native to Italy, Spain, southern France, and parts of the Middle East. The dye pigment known as sap-green was made from the concentrated juice of the ripe berries of *R. infectorius*.

Although the berries are the most highly prized plant part, buckthorn bark is also a strong dye and gives colors ranging from yellows to deep rusts, depending on the quantities used.



BERRIES

Cultivation and harvest

Buckthorn berries may be harvested as either unripe green berries in early summer, or when black and ripe in the fall. The unripe, immature berries give clear yellows and the mature berries give deeper, more mustard tones.

Dyeing procedure

To extract the dye color from berries, pour boiling water over them and leave them to soften. Then crush the berries against the sides of the pan and simmer them for about 45 minutes to extract the color. Strain off the dye liquid and simmer the fibers in it for about 30 minutes or as long as necessary for a good strong color. The berries can often be simmered again to make a further dye bath.

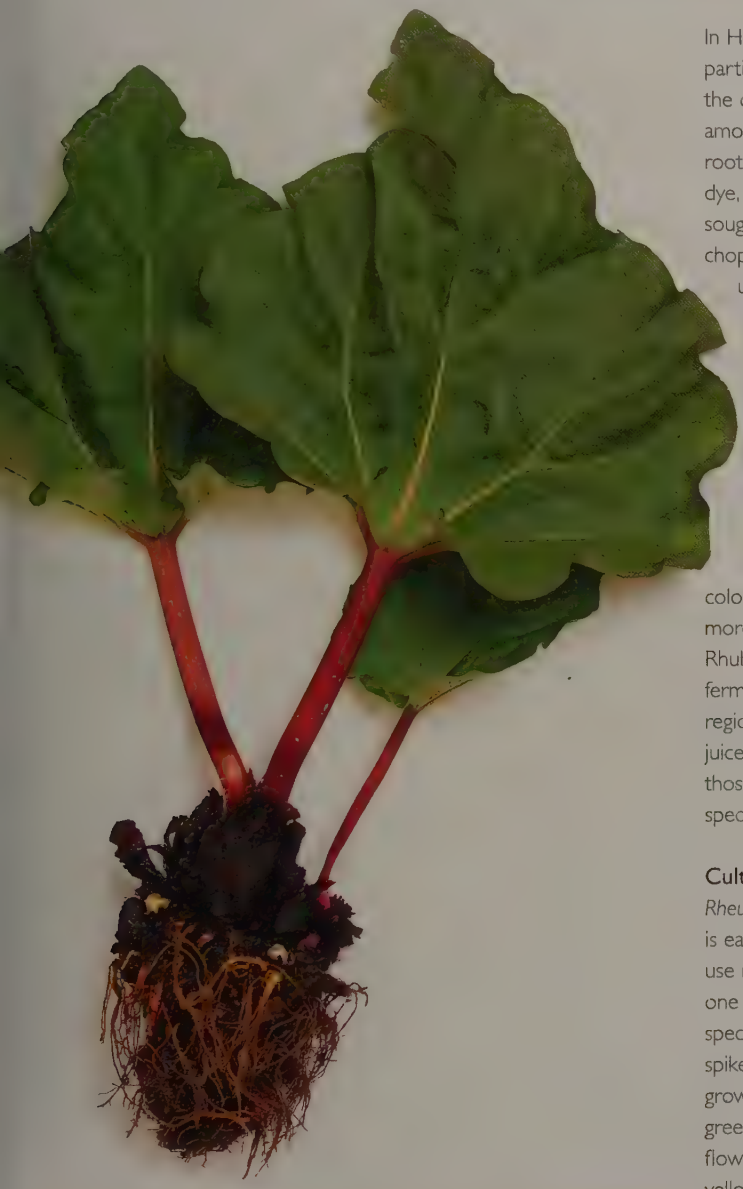
To process buckthorn bark, pour boiling water over the chopped bark and leave it to steep overnight. Then strain off the dye solution and use this as a dye bath. Simmer the bark for a second dye bath, or dry the bark and store for later use. The dye from the bark can also be applied without heat. Add the fibers to the dye solution and leave them to steep for 2 or 3 days.

Range	Europe, the Middle East, and North America.
Availability	Gather from nature or buy from specialist supplier.
Planting time	Not applicable.
Growing habit	Not applicable.
Harvesting time	Bark: all year. Berries: early summer to fall.
Dyestuff	Bark, berries (mature or immature).
Dyeing instructions	Bark: no mordant required. Berries: mordant recommended. Use half the weight of dyestuff to fibers for bark and berries.

Rheum species

Rhubarb

The rhubarb plant is one of the most useful to dyers. Its leaves, which contain the poison oxalic acid, can be used as a good source of dye and also as a natural mordant. Its roots yield a range of yellow, gold, and orange dye colors, and its leaves give greeny-yellow shades.



Range	Asia and most temperate regions.
Availability	Grow from seed or purchase as foodstuff.
Planting time	Sow seeds in early spring.
Growing habit	*R. rhaponticum*: allow 2–4ft (60cm–1.2m) per plant. Grows to 24–36in (60–90cm) tall.
Harvesting time	Leaves: late spring to summer. Roots: all year.
Dyestuff	Leaves, roots.
Dyeing instructions	No mordant required. Use equal weights of dyestuff and fibers for leaves. Use half the weight for roots.

ROOTS

In Himalayan regions, species of rhubarb are particularly valued for their contribution to the dye pot. In parts of Tibet and Ladakh, and among Tibetan refugees in Nepal, rhubarb root is the most common source of yellow dye, and species of rhubarb have long been sought after locally. The roots are dried, chopped up, and ground into powder before use, and give strong, fast shades of yellow, gold, and orange.

Traditionally, washing soda is added to the dye bath and, after dyeing, the yarns are laid out in the sun to dry and become shades of rosy and bluish-pink. The leaves are used to produce paler yellow and greeny-yellow colors but rhubarb leaves' most common use is as a base or fixative for other dye colors, especially in areas where chemical mordants are difficult to obtain (see p.39). Rhubarb leaves are also used to aid fermentation in indigo vats in Himalayan regions, and a solution of rhubarb leaves and juice is added to other dye baths, particularly those made from walnut husks (*Juglans* species, see p.102), to vary the shades.

Cultivation and harvest

Rheum rhaponticum, common garden rhubarb, is easy to grow, but dyers who do not wish to use rhubarb for eating may prefer to grow one of the ornamental varieties, which are spectacular foliage plants with erect flowering spikes. *R. alexandrae*, native to China and Tibet, grows to 3ft (90cm) tall, and has glossy mid-green leaves on short stalks. The spring-flowering spikes have overlapping, papery, pale yellow bracts that look like drooping tongues. *R. palmatum*, native to China, grows to a height of 8ft (2.4m) and has purple-red leaves. These fade to green after the plant has flowered in early summer, when deep-pink or red bead-like flowers grow in panicles up to 3ft (90cm) long. The root of *R. palmatum* was widely used medicinally as a purgative.

Both ornamental species can be raised from seed sown outdoors in spring. When the

seedlings are strong enough, move them to a nursery bed and transplant them to their permanent positions in winter of the following year. They like a sunny position and will grow in garden soil, although they flower more freely in rich moist soils. After flowering, cut down the spikes. Lift and divide older plants in winter. They are generally trouble-free.

R. rhaponticum can also be raised from seed sown indoors in spring in 2in (5cm) deep drills. Thin the seedlings to 9in (23cm) apart when the first leaf appears and plant them out the following spring. However, plants grown from seed are sometimes inferior and the stems cannot be pulled for several years.

The best way to grow *R. rhaponticum* is to purchase crowns and plant them firmly in spring with the top bud 2in (5cm) below the surface of the soil. A few weeks before planting, dig the ground well, and work in some well-rotted manure or compost. Rhubarb grows in garden soil and produces healthy stems over several years before the plants need dividing. Remove any flowering stems and keep the bed weed-free. Mulch the crowns when the plants die down.

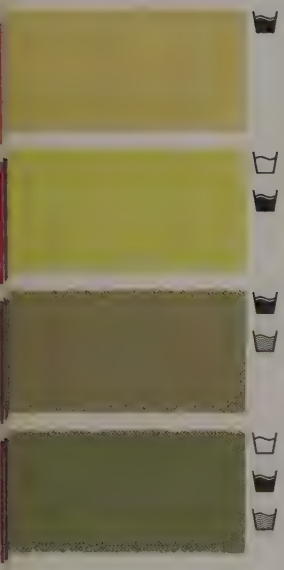
Rhubarb leaves are ready for harvest in late spring. They are best used fresh in the dye pot but may also be dried. Harvest the roots when dividing the plants. Keep a few roots for dyeing and replant the rest. Use the roots fresh or dried in the dye pot but chop them up when they are fresh as they will be too tough to cut up when dried.

Dyeing procedure

To extract the dye color from the leaves, simmer them for 30 minutes to one hour in a covered pan, then strain off the dye liquid carefully and dispose of the poisonous leaves safely as described in Dyeing Techniques (see p.44). Simmer the fibers for 30 minutes or so in the covered dye bath. Leave them to soak overnight, then rinse carefully, wearing rubber gloves. Rhubarb leaf solution can also be used as a color modifier.

Rhubarb root is not poisonous and is safe to handle. Simmer the chopped root for about 30 minutes to extract the color. Then strain off the liquid. For clear yellow colors, heat the dye bath to just below simmering point, then leave the fibers to steep overnight. For more mustardy shades, simmer the dye bath for about 30 minutes.

An alkaline modifier will turn the dye liquid bright red and fibers treated in the modified dye bath become a coral-red shade. An iron modifier produces lovely olive-greens.



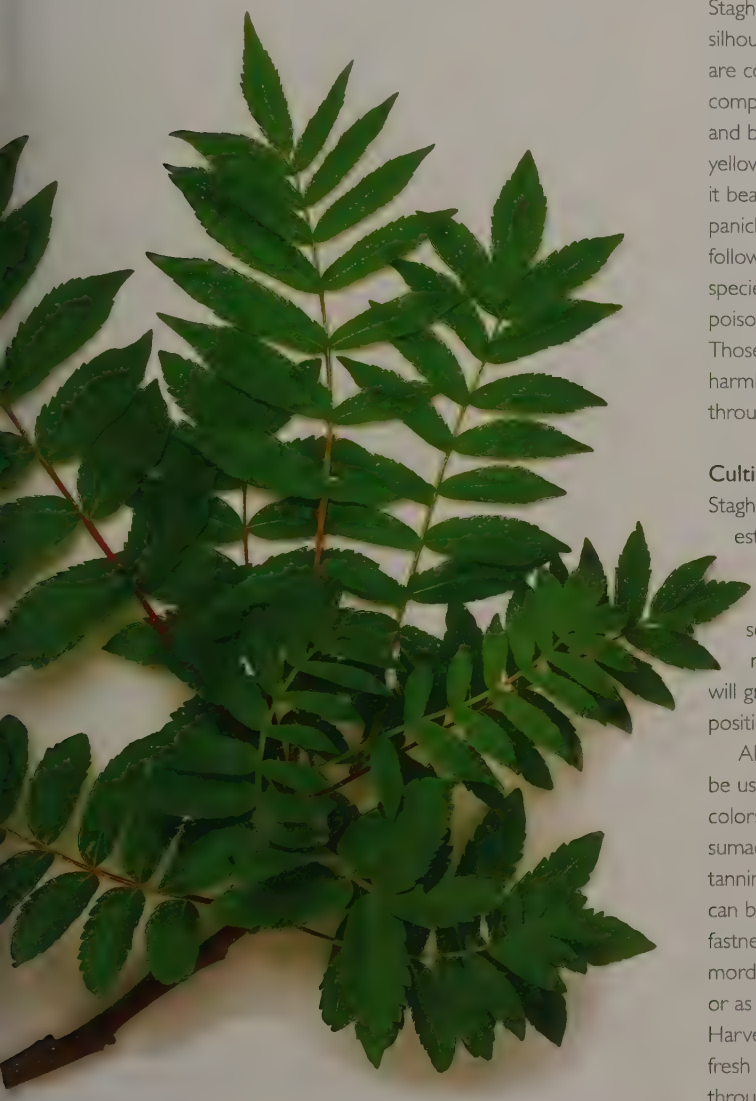
LEAVES

right R. palmatum, *is an ornamental variety of rhubarb with spectacular purple-red foliage. The leaves and roots can be used for dyeing as an alternative to* R. rhaponticum, *or common garden rhubarb.*

Rhus typhina

Staghorn sumac

Sumac trees and shrubs grow in North America, Europe, Asia, and Africa. All parts of Rhus typhina, *except the root, can be used for dyeing. The tannin-rich leaves yield shades of tan and are used for mordanting vegetable fibers. The bark gives shades of rust and orange.*



Range	North America and temperate regions.
Availability	Grow from seedlings or gather from nature.
Planting time	Fall to spring.
Growing habit	Allow 10–12ft (3–4m) per tree. Grows to 10–20ft (3–6m) tall.
Harvesting time	Bark: all year. Leaves: summer.
Dyestuff	Leaves, bark.
Dyeing instructions	No mordant needed. Alum mordant with staghorn sumac bark gives vivid orange on animal fibers. Use equal weights of dyestuff and fibers for strong colors from leaves and bark.

Staghorn sumac is easy to recognize. In silhouette, the branches look like antlers and are covered with downy hairs like velvet. Its compound leaves grow up to 2ft (60cm) long and become glowing shades of orange-red, yellow, and purple in early fall. In early summer it bears tiny, hairy red flowers in dense, conical panicles around 8in (20cm) long and these are followed by clusters of crimson berries. Some species of sumac are poisonous and all the poisonous species have white or gray berries. Those with red berries, like *R. typhina,* are harmless. *R. typhina* is vigorous and abundant throughout North America.

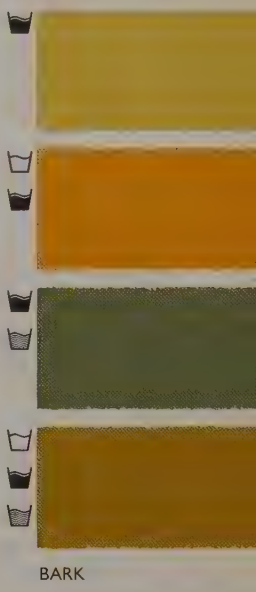
Cultivation and harvest

Staghorn sumac is easy to grow and once established it puts out suckers. These suckers can be dug up in the fall to make new plants. Alternatively, buy seedlings and plant them between fall and mid-spring. Staghorn sumac is hardy and will grow in any garden soil. It prefers a sunny position and tolerates drought and poor soil.

All parts of *R. typhina,* except the root, can be used for dyeing and produce variable colors in the dye pot. However, staghorn sumac is particularly valuable as a source of tannin. All plant parts are rich in tannin and can be added to other dye baths to improve fastness. The leaves are especially useful for mordanting vegetable fibers, either used alone or as part of the alum-mordanting process. Harvest the leaves in summer and use them fresh or dried. Harvest other plant parts throughout the year and use them fresh or dried in the dye pot.

Dyeing procedure

Extract the dye color from the plant materials as generally described in Dyeing Techniques (see pp.46–48). Process the plant parts for as long as possible to extract the maximum dye color possible. Dye baths made from a mixture of bark and leaves often give interesting shades, especially if applied with only moderate heat.



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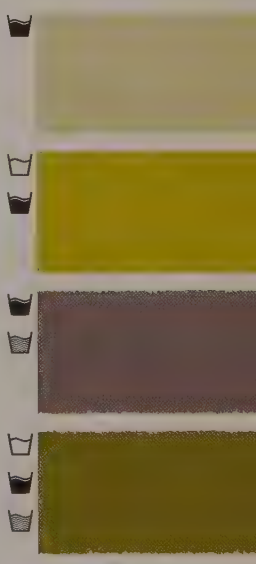
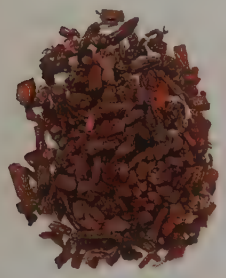


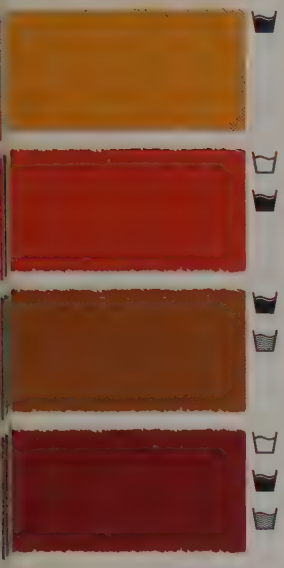
LEAVES



Rubia tinctorum

Madder

Madder's leafy tops sprawl untidily over the ground and their clusters of tiny yellow-green flowers are insignificant. Yet, to the dyer, madder is a miracle of color because its roots contain alizarin, one of the most valuable red dye pigments ever known.



ROOTS

Madder is one of the most ancient dyes and its existence can be traced as far back as the Indus civilization of around 3,000 BCE. Madder was cultivated throughout Europe and the Middle East, and the finest quality dyestuff came from Turkey, Holland, and France.

Cultivation and harvest

Madder is easy to grow from seed, although it is a good idea to buy one or two established plants since you cannot harvest roots for at least two years after sowing seeds.

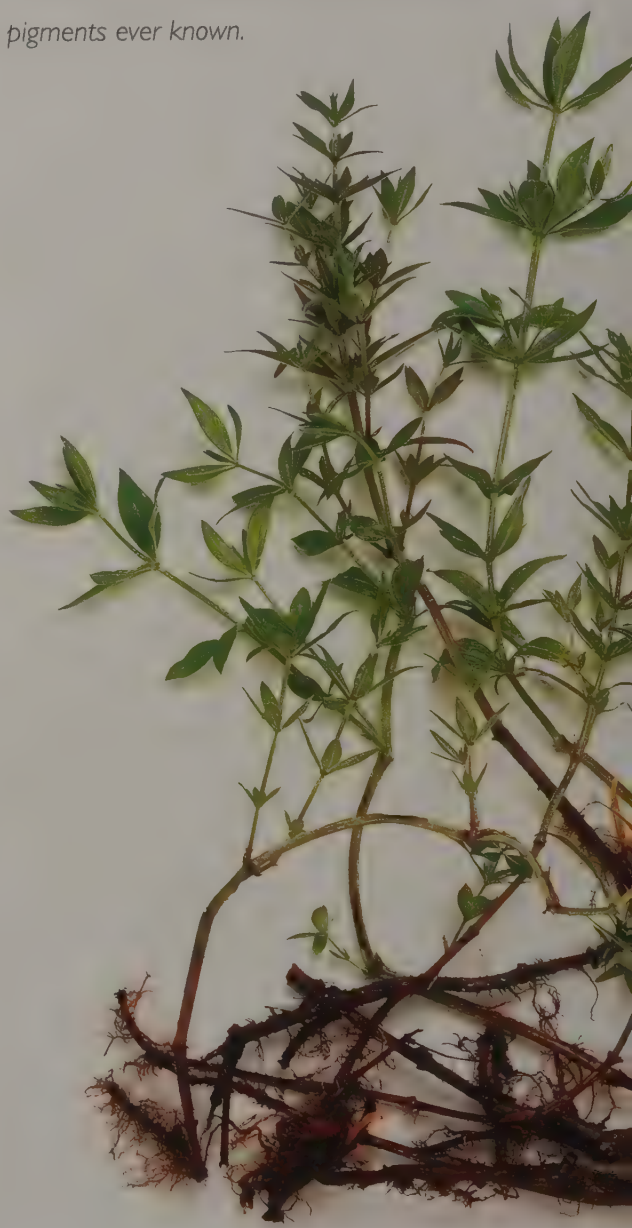
Madder prefers full sun, but will tolerate some shade and cold spells. It will grow in most well-drained, fertile garden soils, but the addition of lime encourages the roots to produce more dye pigment. Before you plant madder, dig over the ground and add some compost and manure. Madder is not subject to pests or diseases and, once established, it requires little care.

Sow seeds in early spring several weeks before the last frost and transplant the seedlings to their permanent positions when they are 6in (15cm) high. Set the plants 24in (60cm) apart and keep the bed weed-free. When the plant tops are about 12–18in (30–45cm) long, bend them over and cover the leaf joints in soil. This encourages the plants to grow more roots.

In their second or third year, madder plants flower and produce green berries that turn black when mature. These berries contain seeds that can be dried, stored, and sown. Madder seeds often self-sow, so each spring the seedlings can be dug up and put into pots to give as gifts to other dyers.

The plant tops can be used in the dye pot and will produce pretty coral-pink and tan shades. To harvest the plant tops, wait until they have died down and look straw-like, then cut them off and use them straight away in the dye pot, or dry them out and store them for later use.

If collecting madder plant seeds, leave the plant tops to dry out and gather up the seeds before using the plant tops in the dye bath.



Range	The Middle East, south-central Asia, and Europe.
Availability	Grow from seed or purchase from specialist suppliers.
Planting time	Sow seeds in early spring.
Growing habit	Allow 24in (60cm) per plant. Grows to 4ft (1.2m) tall.
Harvesting time	Roots: spring or fall, when plants are two years old. Plant tops: late fall to winter.
Dyestuff	Roots, plant tops, purchased dyestuff.
Dyeing instructions	Alum mordant recommended for true reds. Use equal weights of dyestuff and fibers for strong colors.

old. To harvest madder roots, dig up a few plants in the spring or fall, making sure to dig deeply enough to find all the roots. The roots are about the thickness of pencils and bright orange-red in color. At this point the plants can be divided and some can be replanted.

Harvesting madder roots

Wash the harvested roots well to remove not only the soil, but also some of the less desirable yellow and brown pigments, which can dull dye colors. Purchased madder root dyestuff can also be rinsed before use for this reason. Chop up the madder roots and then spread them out on a mesh tray or rack and dry them thoroughly until they are brown, woody, and shrivelled. Store the dried roots in a cool, dry place in paper sacks. If they become moldy, they may still be used, but the dye color may be duller. Madder roots can also be used fresh. Rinse, and chop them up first, to release their full potential.

Dyeing procedure

To process the fresh or dried plant tops for dyeing, cut them up into small pieces and simmer gently for about one hour. Let the solution cool, then add the fibers and either leave them to steep or apply gentle heat until you achieve a suitable depth of color.

Madder root can also be simmered gently to extract the dye color but once the fibers have been added, the temperature should be kept well below a simmer to achieve clear reds. Simmering or boiling the dye bath will turn red colors browner and duller.

The best color results are often achieved if the pieces of madder root are left in the dye pot during the dyeing process.

When planning a madder dyeing session, have plenty of fibers ready to be dyed, and aim for a range of red to orange shades from one dye bath. Then, take the largest dye pot, put in the chopped madder root, and fill up the pot with warm water. Add the first batch of fibers to be dyed and leave them to steep in the dye pot for at least one or two days. Keep checking the color and when it seems deep enough, remove half of the fibers from the pot but leave the rest of the fibers to soak for another day or so for even deeper shades. When the color is really rich and deep, remove all the remaining fibers from the pot and add another batch. This new batch of fibers can be processed in the same way without heat or gentle heat can be applied straight away to speed up the results. The dye bath can be heated and cooled several times until a suitable color is achieved. Usually, the same madder dye bath can be reused two or three times on different batches of fibers for a series of different shades.

Modifying the color results

If the resulting dye colors are too orange in tone, add an alkaline modifier (see p.59) to make them pinker. An acidic modifier (see p.58) will brighten the colors and make them yellower. An iron modifier (see p.59) gives browns with madder, while copper used as a modifier (see p.59) or mordant usually produces salmon-pink shades.

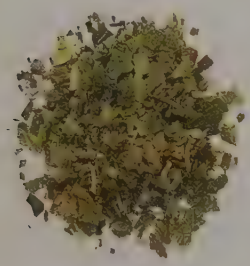
When the madder dye bath looks as if it may not yield any more color, add one tablespoon of citric acid granules (see p.28) to the dye solution to make it more acidic, stir it in well and add a batch of unmordanted fibers. Simmer the fibers in the dye bath for 30 minutes or so to obtain bright orange and tangerine shades.

Madder also produces a rich, aubergine purple, one of the traditional colors used in Middle Eastern carpets and kilims. To achieve this deep aubergine color, the fibers are first mordanted in iron before being added to the madder dye bath and then an alkaline modifier is used after dyeing.

Clear madder reds

To achieve clear reds from madder root the dye liquid must be sufficiently alkaline (see p.28). Dyers in hard water areas will usually have alkaline water but dyers in soft water areas may have to increase the alkalinity of the water (see p.28) to realize true madder reds. It is also important to remove the yellow and brown pigments, which will dull the color. To do this, pour boiling water over the madder pieces and leave them to steep for about 2 minutes. Then pour off this liquid and repeat the process. The poured-off liquid can be discarded or retained to make a further dye bath for orange-brown shades. Then return the madder pieces to the dye pot. Simmer them gently for 15 to 20 minutes and strain off the liquid. This liquid should be allowed to cool to below simmering point before adding the fibers. Keep the dyeing temperature well below a simmer and allow the fibres to steep for as long as necessary to achieve the desired depth of color.

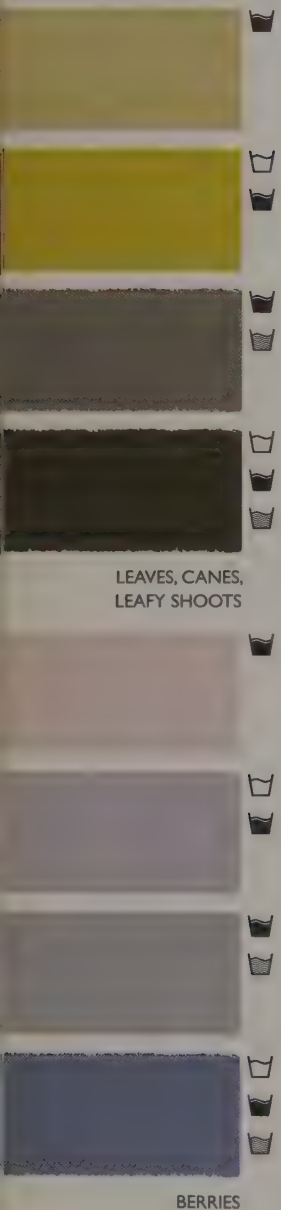
PLANT TOPS



Rubus fruticosus

Blackberry

The berries, leaves, and fruiting canes of cultivated and wild blackberries all yield dye colors. Fall leaves and old blackberry canes give attractive shades of fawn, gray, and yellowy-green. The berries give pretty lilac shades on vegetable fibers, although these fade to gray in time.



LEAVES, CANES, LEAFY SHOOTS

BERRIES

The blackberry is a hardy, woody shrub, usually with thorns, that grows freely in the wild and is frequently cultivated for its fruits.

Cultivation and harvest

Cultivated blackberries are easy to grow. Buy blackberry canes at a garden center and plant them out between winter and spring. The canes need support and are best grown on wires, against walls, or up supporting posts. They prefer a well-drained, slightly acidic, lime-free soil that retains moisture and favor sun or partial shade. Keep them well watered during dry summer spells, before the berries ripen. After fruiting, cut out the old blackberry canes that have borne fruit.

Cultivated and wild blackberries grow so vigorously that canes and shoots can be harvested without damaging the plant. Use the old fruiting canes and leaves for the dye pot. If you have a good harvest of fruit, sacrifice some for the dye bath, otherwise collect berries from the wild.

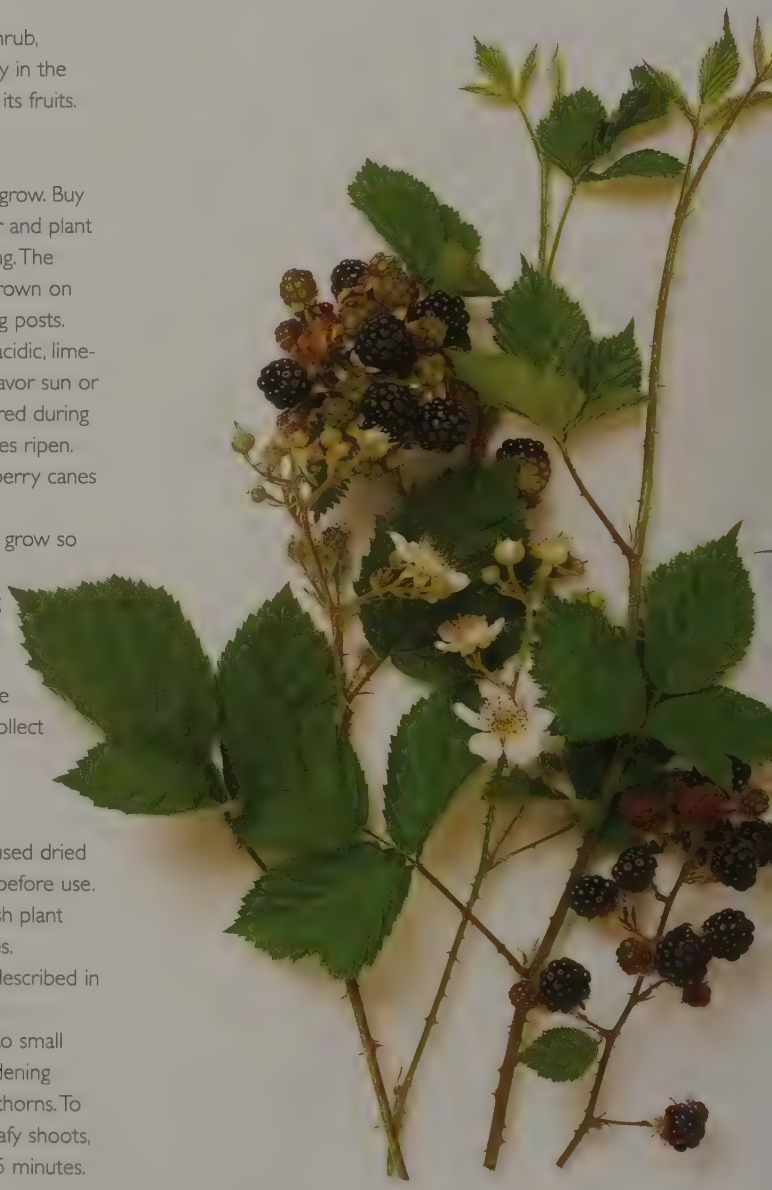
Dyeing procedure

All parts of the blackberry can be used dried and the berries can also be frozen before use. However, dye baths made from fresh plant materials usually give brighter shades.

Process the leaves as generally described in Dyeing Techniques (see pp.46–48).

Cut up the canes and shoots into small pieces before processing. Wear gardening gloves to protect your hands from thorns. To make a dye bath from canes and leafy shoots, simmer the plant parts for about 45 minutes. They give similar shades to leaves.

For berries, crush and then simmer them for about 30 minutes to extract the dye color. Strain off the dye liquid. When dyeing vegetable fibers, use only gentle heat for about one hour or so. Vegetable fibers also benefit from steeping overnight or longer in the dye liquid. When dyeing animal fibers, simmer them in the dye bath for 45 minutes. Leave to steep in the dye bath overnight.

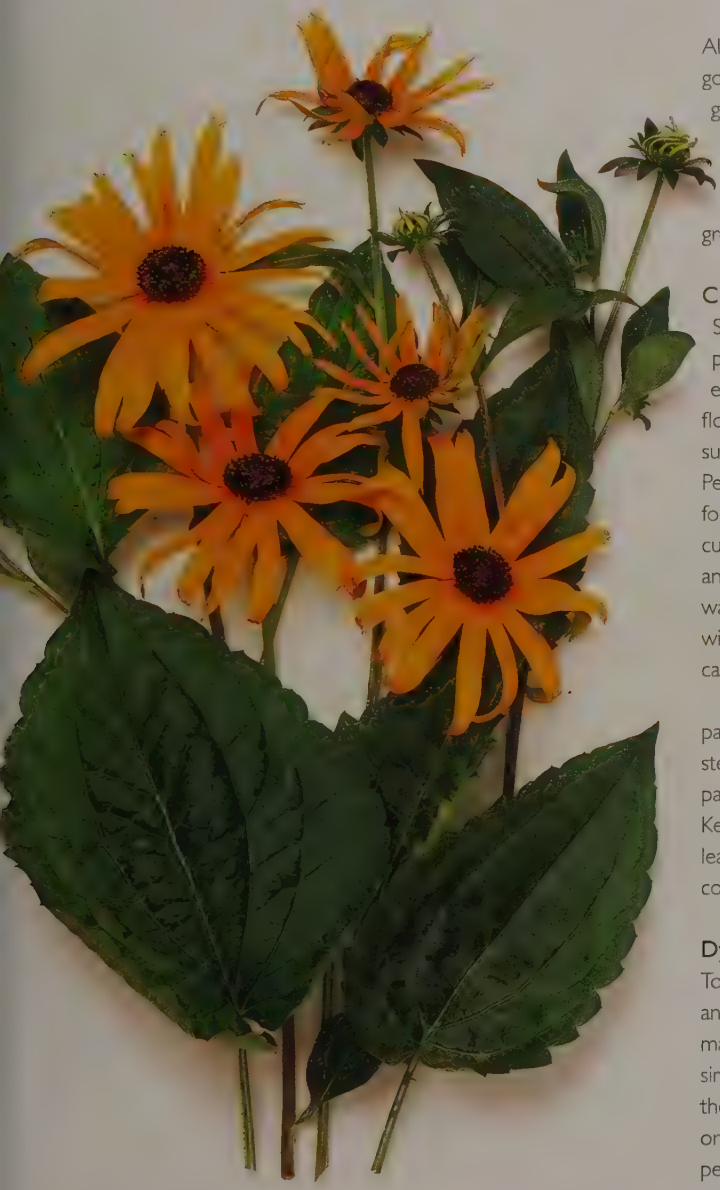


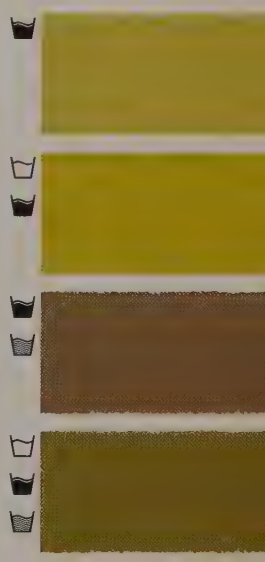
Range	Most temperate regions.
Availability	Grow from purchased canes or gather from nature.
Planting time	Plant canes from winter to spring.
Growing habit	Varies according to growing method.
Harvesting time	Leaves, canes, leafy shoots: spring to fall. Berries: fall.
Dyestuff	Leaves, canes, leafy shoots, berries.
Dyeing instructions	No mordant necessary but alum mordant increases fastness. Use equal weights of dyestuffs and fibers for all plant parts.

Rudbeckia species

Rudbeckia, Coneflower, Black-eyed Susan

These attractive daisy-like flowers provide a good source of olive-green and gold colors for the dye pot. They flower throughout the summer so there is always a plentiful supply of material but the flowers, leaves, and stems need to be processed for several days in order to achieve good results.





FLOWERS

LEAVES, STEMS

All species of *Rudbeckia* have bright yellow, gold, or rust daisy-like flowers with black or green central cones. Some perennial species of *Rudbeckia* grow as wild flowers in parts of North America. In Great Britain they are raised from seed, often as annuals, or grown from purchased plants.

Cultivation and harvest

Sow the seeds indoors in early spring and pot the seedlings when they are large enough to handle. Plant them out into their flowering sites in late spring. Annual varieties, such as *R. bicolor*, will flower the same year. Perennial species will not flower until the following year. Rudbeckia grows in any well-cultivated, well-drained garden soil and prefers an open, sunny position. Keep the plants well watered during dry weather to prevent wilting. Once established, perennial species can be propagated by division in spring or fall.

Harvest the flowers as soon as they are past their prime and cut off the leaves and stems when they no longer have any buds. All parts of the plant can be used fresh or dried. Keep the flower heads separate from the leaves and stems, since they give different colors in the dye pot.

Dyeing procedure

To extract the dye color from flowers, leaves, and stems, pour boiling water over the plant materials and let them soak overnight. Then simmer them for one or two hours and let them steep in the dye liquid for another day or so. The plant materials need a long soaking period to produce olive-green and gold dye colors. If you process them quickly, you will achieve only tan shades.

When the plant material has been processed fully, strain off the dye solution, add the fibers, and simmer for one hour or more. Turn off the heat and let the fibers soak in the dye pot overnight, or longer for stronger colors. Acidic or alkaline modifiers will not alter the colors. Iron or copper modifiers, however, deepen shades.

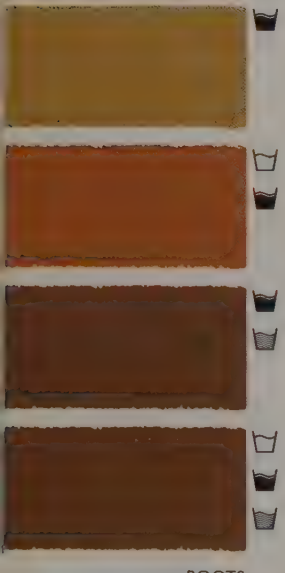
Range	North America and most temperate regions.
Availability	Grow from seed.
Planting time	Sow seeds in early spring.
Growing habit	Allow 12–36in (30–90cm) per plant. Grows to 24–36in (60–90cm) tall.
Harvesting time	Summer to fall.
Dyestuff	Flowers, leaves, stems.
Dyeing instructions	Mordant recommended. Use at least equal weights of dyestuff and fibers for all plant parts.

Rumex species

Dock, Sorrel, Curled dock

All types of dock and sorrel can be harvested for the dye pot, and all produce stronger colors on animal fibers. Gather leaves or whole plant tops and use them fresh or dried, with young leaves producing brighter greeny-yellow shades. The roots of mature plants yield deep earthy colors.

LEAVES



ROOTS

Various species of *Rumex* grow wild in meadows and fields, along roadsides, and on wasteland in both rural and urban areas. The most common *Rumex* species in North America is *R. crispus*, or curled dock, and it is classified as a weed. The leaves of *Rumex obtusifolius*, broadleaved dock, are often used as a remedy for nettle stings. The leaves were also used to wrap butter and keep it fresh. Juice from the leaves of *R. acetosa*, broad-leaved sorrel, can remove rust stains from silver as well as ink and mold stains from linen.

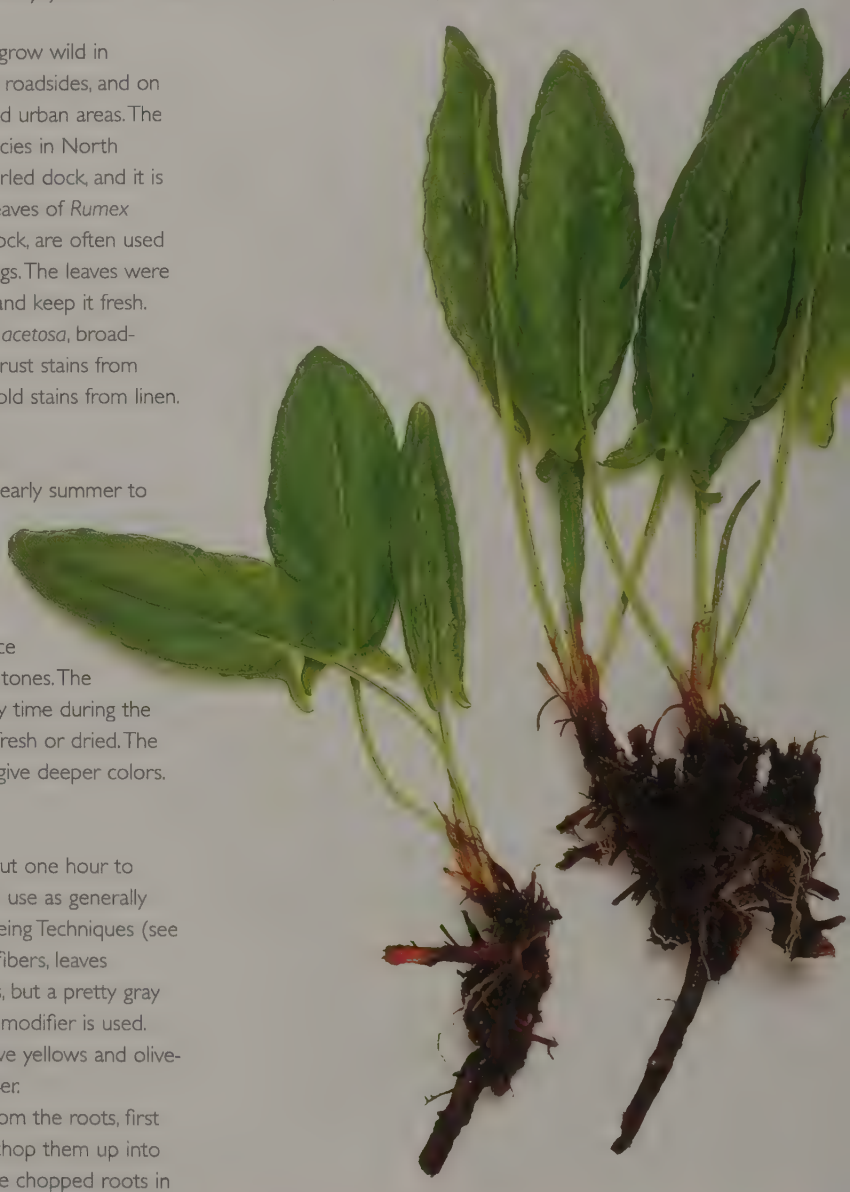
Cultivation and harvest

Gather leaves throughout early summer to early fall and use them fresh or dried in the dye pot. Young leaves tend to give yellower shades, and older leaves usually produce browner, mustard-colored tones. The roots can be dug up at any time during the growing period and used fresh or dried. The roots from mature plants give deeper colors.

Dyeing procedure

Simmer the leaves for about one hour to make a dye bath, and then use as generally described for leaves in Dyeing Techniques (see pp. 46–48). On vegetable fibers, leaves produce pale beige shades, but a pretty gray can be achieved if an iron modifier is used. On animal fibers, leaves give yellows and olive-greens with an iron modifier.

To extract dye color from the roots, first clean the roots and then chop them up into small pieces. Next, soak the chopped roots in water for one day before boiling them for several hours. Apply the dye liquid to fibers as generally described in Dyeing Techniques (see pp.49–52). The dye extracted from roots produces warm rusty-brown shades on wool, but much paler tan colors on vegetable fibers. Wool fibers dyed with dock roots and modified with iron give deeper brown shades. On vegetable fibers, an iron modifier gives either gray or gray-black.



Range	Europe and North America.
Availability	Gather from nature.
Planting time	Not applicable.
Growing habit	Not applicable.
Harvesting time	Leaves: early summer to early fall. Roots: all year.
Dyestuff	Leaves, roots.
Dyeing instructions	No mordant is necessary for animal fibers but alum mordant is required for vegetable fibers. Use equal weights of dyestuff and fibers for both leaves and roots

Salix species

Willow

Willows can be found in many rural and urban areas and all species yield dye colors. The leafy stems and bark can be used fresh or dried in the dye pot to produce delicate shades of pinky-tan, gray, and yellow and, as with oak, willow bark offers a good source of tannin.

Range	Most temperate regions.
Availability	Gather from nature.
Planting time	Not applicable.
Growing habit	Not applicable.
Harvesting time	Leafy stems: late spring to early fall. Bark: all year.
Dyestuff	Leafy stems, bark.
Dyeing instructions	Leafy stems: no mordant necessary for animal fibers but an alum mordant is required for vegetable fibers. Bark: no mordant needed but alum mordant produces brighter colors. Use equal weights of dyestuff and fibers for both leafy stems and bark.

Among the most common species of willow in Great Britain are *Salix caprea*, or goat willow, and *S. cinerea*, also known as gray willow, which has silky, silver-gray catkin buds. The wood of white willow, *S. alba*, is used for making cricket bats. *S. fragilis*, or crack willow, has slender, long, green leaves and is frequently found beside lowland rivers and in damp fens and river valleys. There are many species of willow in North America, including *S. negra*, black willow, and *S. alba*, white willow. The weeping willow, sometimes grown in gardens as a specimen tree, is *S. babylonica*, which is native to China. Many species of willow are grown to be harvested for basketry.

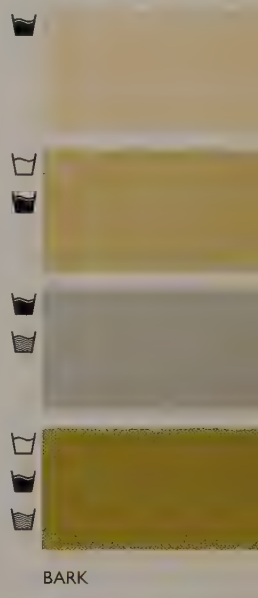
Cultivation and harvest

A few slender twigs and branches can be cut from mature willows at any time of year without damaging the tree. The bark can be stripped away from the branches with a sharp knife. Harvest leafy stems between late spring and early fall. You can separate off the leaves or cut up the whole stem for the dye pot.

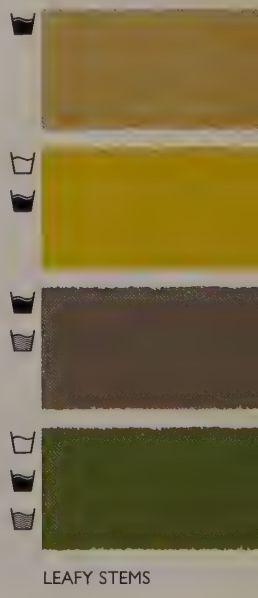
Dyeing procedure

To make a dye bath from leaves only or leafy stems, pour boiling water over them and let them steep overnight to extract the dye color. Then simmer the dye liquid for half an hour or so, strain it off, and use this for your first dye bath. Add the fibers and simmer gently for one hour, then leave to steep overnight. Simmer the plant materials again for a second dye bath and apply the dye liquid to the fibers as directed for the first dye bath. Iron used as a modifier gives various shades of gray.

Soak the bark for two or three days before simmering it gently for one hour or so to extract as much color as possible. Strain off the dye liquid into the dye bath, add the fibers, and simmer for about one hour. Leave the fibers to soak in the dye bath overnight.



BARK

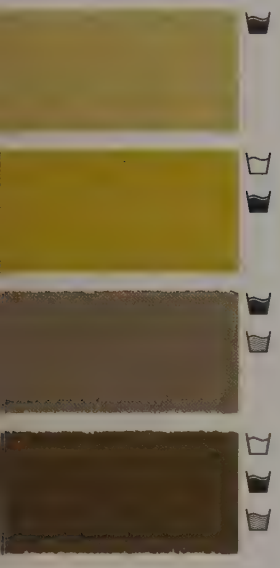


LEAFY STEMS

Sambucus species

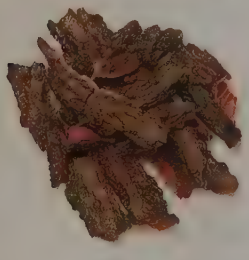
Elder, Elderberry

Elder is a common, fast-growing small tree or large bushy shrub. Its leaves, berries, and bark are all used as dye sources, although dyes from the berries fade quickly. The leaves yield colors in the yellow to green range, the bark creamy-beiges, and the berries shades of purple.



LEAVES

BARK



Elder was once regarded as a magical plant with the power to keep the devil away and the ability to charm away warts and vermin. Today, its reputation remains as varied as its myriad uses. To some it is a foul-smelling, invasive weed; to others it is the most useful of trees: a valuable source of food and, importantly for gardeners, it is the only tree that rabbits find distasteful.

Elder leaves have a rather acrid smell but early summer blossoms have a sweet, honey-like aroma. The white heartwood is as hard as ebony and was once used for carving combs and chessmen.

The evidence of elder's usefulness is compelling. Its umbels of white flowers can be dipped in batter and eaten as fritters, or made into a delicious champagne-like cordial. The berries are rich in vitamin C and are used to make jams, relishes, wine, and a drink for sore throats. Elderflower water is used as a skin cleanser and elder leaves keep flies away from cows and horses.

Cultivation and harvest

Elder grows prolifically in hedgerows, wooded areas, on chalk downs, waste grounds, and abandoned cultivated lands. Leaves, berries, and bark can be harvested without fear of damaging this vigorous tree.

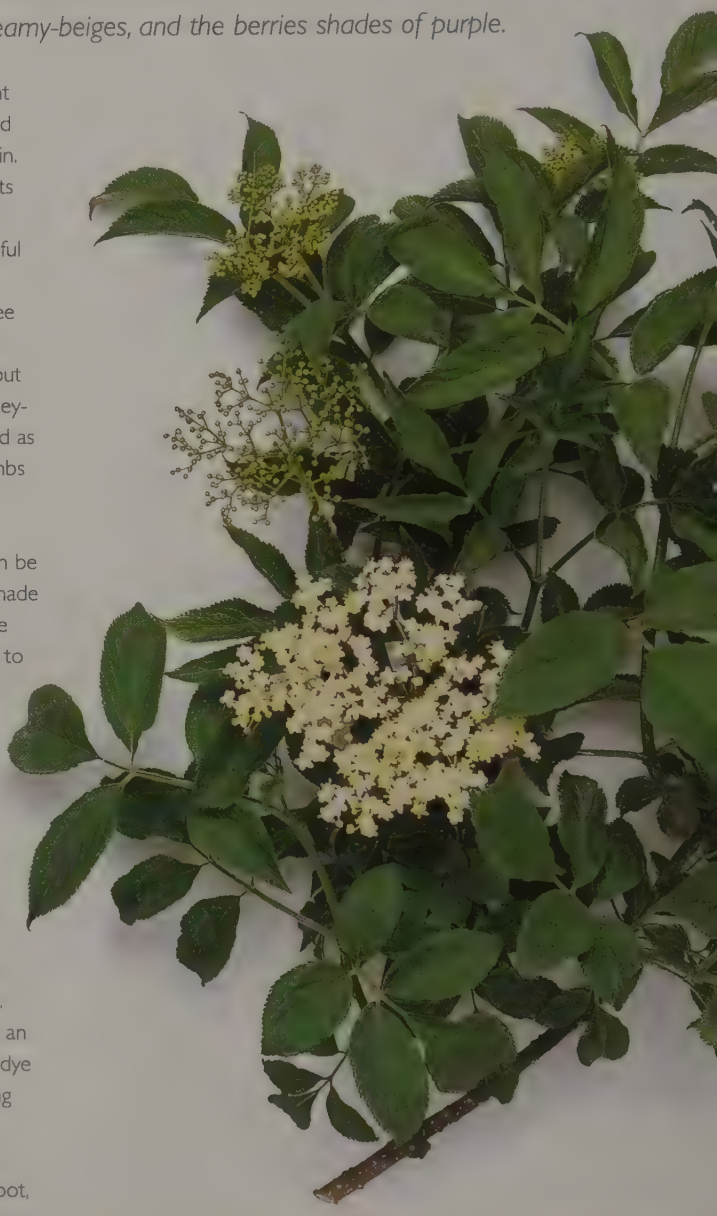
Elder trees growing in gardens provide an abundant source of plant material for the dye pot. Harvest the leaves between late spring and early fall. Although they can be used dried, the fresh leaves give brighter colors.

To harvest the elder bark for the dye pot, strip the bark from the branches at any time during the year with a sharp knife and use it fresh or dried.

The berries should be collected in the fall, when ripe and blackish purple in color. Berries can be used fresh, frozen, or dried for dyeing.

Dyeing procedure

Most dyers experiment with elder berries when they first embark on using plant dyes and the often spectacular results spur them



Range	Europe and throughout North America.
Availability	Gather from nature.
Planting time	Not applicable.
Growing habit	Not applicable.
Harvesting time	Leaves: late spring to early fall. Bark: all year. Berries: fall.
Dyestuff	Leaves, bark, berries.
Dyeing instructions	Bark: no mordant required. Leaves: alum mordant gives brighter colors. Berries: alum mordant is recommended. Use equal weights of dyestuff and fibers for leaves, bark, and berries.

on to greater things. The reputation of elder as a dye source is varied. Some dyers avoid it because of the unreliability of the colors from the berries: fresh berries give purples and sometimes reds, while dried or frozen berries give shades of reddish-brown. Others find these varied shades so pleasing that they refuse to be deterred by the fugitive nature of the colors. Some dyers use the leaves, but not the bark or berries, as they are more reliable.

Process the leaves as generally described for leaves in the Dyeing Techniques (see pp.46–48). The dye colors from leaves can vary from tans, yellows, and golds to grays and greens, depending on the harvesting time and the mordants and modifiers used. Cut the leaves up as small as possible, then pour boiling water over them and leave to steep overnight. Then simmer them for about one hour and strain off the dye liquid. Leave it to cool before adding the fibers to be dyed. Then raise the temperature gradually to simmering point and simmer for 45 minutes to one hour. Leave the fibers to soak in the dye bath overnight. Using an iron modifier with leaves produces olive-greens.

Processing elder berries

To make a dye bath from berries, crush them, then simmer for about one hour and strain off the dye liquid. If you are dyeing wool, simmer the skeins in the dye bath for about one hour, then turn off the heat and leave the wool to soak in the dye pot overnight. If you are dyeing vegetable fibers, place them in the dye solution and bring it to just below simmering point, then turn off the heat and allow the fibers to soak in the dye pot for at least one or two days.

Using color modifiers

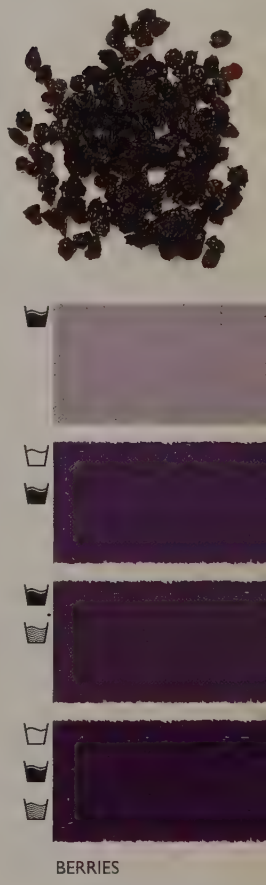
Using modifiers with berries can cause dramatic changes in color. An alkaline modifier, such as washing soda, shifts the color to green, and an acidic modifier, for example citric acid or clear vinegar, makes it redder. Both of these shades change again, unless the rinsing and washing solutions are pH neutral. Using iron as a modifier produces deep purple, almost black shades and copper makes the color greeny-gray. Some sources suggest first soaking the crushed berries for a few days in water to which two or three teaspoons of clear vinegar have been added. To fully extract the color, the berries are then boiled for one hour in the soaking liquid, which is then strained off to make the dye bath. Some dyers add salt to the elder berry dye bath and this is reported to give bluer shades. Some dyers have obtained lavender-blue shades from berries collected from trees close to busy roads. The bluest tones are produced from the elder berries coated in exhaust fumes.

Most of the colors produced from elder berries fade on exposure to light, but even the faded shades of pale lavender can be pleasing to the eye. Because of this characteristic, however, using fibers dyed with elder berries for tapestries or wall hangings is not recommended.

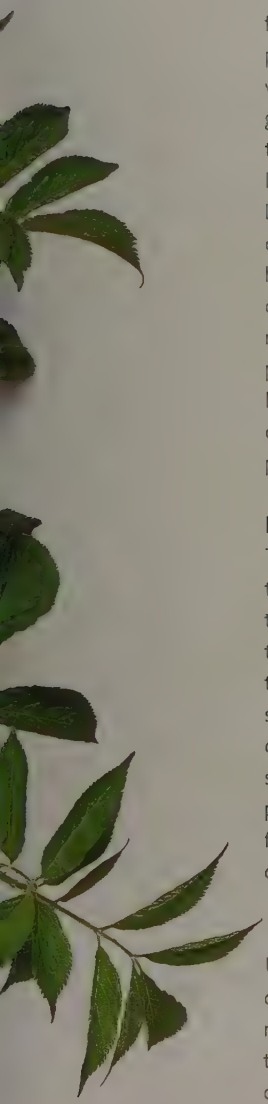
Processing elder bark

To extract the maximum dye color from elder bark, soak it in water for seven days, then simmer it for one or two hours. Strain off the dye liquid into the dye pot, then add the fibers and simmer gently for at least one hour. Take the pot off the heat, and leave the fibers to steep in the dye bath overnight to produce warm creamy-beige colors.

Using iron as a modifier produces a soft gray on animal fibers and a deep gray-black on vegetable fibers. All these shades make an attractive contrast to the colors from the leaves and berries.



BERRIES

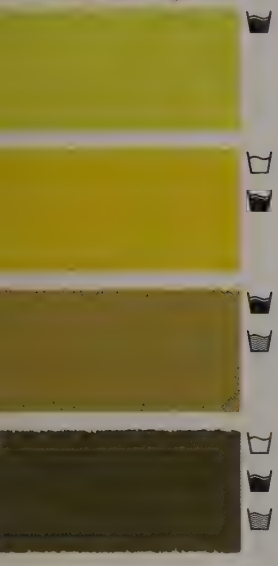


left *The frilly leaves of* Sambucus racemosa *'Sutherland Gold' and the broader leaves of* S. nigra *'Aurea' are good sources of color.*

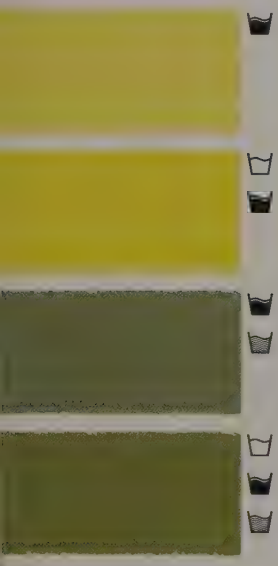
Solidago species

Goldenrod

Goldenrod is a hardy, herbaceous perennial with plumes of tiny, yellow clustered flowers, which are excellent as cut flowers. All types can be used in the dye pot. Its just-opened flower blossoms yield clear, bright yellows, while later in the year, the flowering tops give greeny-yellow dyes.



PLANT TOPS



FLOWERS

Native to North America, where it often grows wild in abundance, goldenrod has become naturalized in Great Britain and is frequently found on wastelands. It spreads by means of seeds and its root rhizomes. If not checked, some species can become invasive.

Cultivation and harvest

To grow goldenrod, either buy plants from a nursery, grow them from seed, or propagate existing plants.

Set out purchased plants from fall to spring, or sow the seeds indoors a few weeks before the last frosts and plant seedlings out when they are well grown and all danger of frost is over. Plants of the dwarf form *S. canadensis* 'Golden Baby,' which are raised from seed and sown in early spring should flower in the first season. Propagate established plants by lifting and dividing roots in fall or early spring.

Goldenrod can be grown in any garden soil and will need watering occasionally, especially in dry weather. It prefers full sun but will tolerate some shade. Generally problem-free, powdery mildew may appear on the leaves and stems.

Goldenrod gives clearer, brighter colors if used fresh, but it can also be dried for later use. Cut the flower heads when the little flowers have opened, but before they begin to fade for bright golds and yellow dyes. Toward the end of the growing season, cut off the whole plant tops for greeny-yellows.

Dyeing procedure

Simmer the plant tops or flowers for up to one hour to extract the dye color and strain off the dye solution before adding the fibers. A dye bath of flowers only produces brighter, clearer colors if the temperature is kept below a simmer. Steep the fibers as described in Dyeing Techniques (see pp.49–52) until they are the desired color, but be aware that while prolonged simmering makes the shades darker, it destroys the dye's brilliance. Iron or copper modifiers produce olive-green colors.

Range	North America and most temperate regions.
Availability	Grow from seedlings or gather from nature.
Planting time	Sow seeds or plant plantlets in early spring.
Growing habit	Allow 24in (60cm) per plant. Grows to 2–4ft (60cm–1.2m) tall.
Harvesting time	Early summer to early fall.
Dyestuff	Plant tops, flowers.
Dyeing instructions	Mordant recommended. Use equal weights of dyestuff and fibers for plant tops and flowers.

Sorbus species

Rowan, Mountain ash

Rowans have pinnate leaves and creamy-white flowers in late spring and early summer. The large clusters of orange-red berries from late summer into fall are its distinctive feature, but unfortunately this color cannot be transferred onto fibers. A dye bath made from leaves gives greeny-golds.

Range	Northern temperate regions, south to Mexico.
Availability	Gather from nature.
Planting time	Not applicable.
Growing habit	Not applicable.
Harvesting time	Leaves: early summer to fall.
Dyestuff	Leaves, leafy twigs.
Dyeing instructions	Mordant recommended for leaves only. For a mixed dye bath of leaves and twigs, alum mordant is recommended on vegetable fibers and for brighter shades on animal fibers. Use equal weights of dyestuff and fibers for all plant parts.

These ancient trees, which grow at high altitudes, were an early colonizer after the Ice Age. *Sorbus aucuparia*, European mountain ash, grows in woods, hedgerows, and scrub throughout Great Britain and is often planted on suburban streets. It is an introduced species in North America, where the native species are *S. americana* and *S. decora*. All three species are used for dyeing.

Cultivation and harvest

In the past, the protective powers of rowan wood were perceived to be extensive. Trees were planted near houses as a protection against witches, and in parts of Scotland there is still a strong taboo against cutting down a rowan. Rowan boughs were hung over stables to protect livestock and the wood was made into charms against rheumatism. Rowan berry jelly is delicious when eaten with cheese or, as was traditional, served with game and lamb. Rowan berries are a popular bird food.

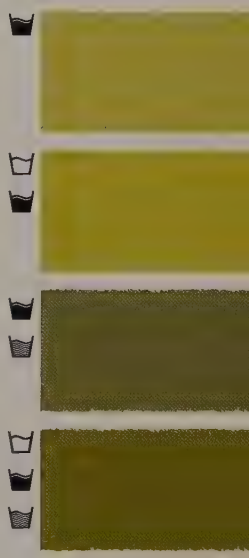
Harvest fresh leaves and leafy twigs for the dye pot between early summer and fall. Chop up the leafy twigs before processing further.

Dyeing procedure

The leaves produce soft greeny-golds. Leafy twigs give similar shades, and the tannin in the twig bark increases colorfastness.

To use the leaves and leafy twigs as a dye bath, simmer them for about one hour and soak overnight. Strain off the dye liquid, add the fibers, and simmer for 30 minutes to one hour, or until the desired color is achieved. Leave the fibers to steep in the dye bath overnight. Iron as a modifier gives pretty, soft browny-green shades on wool and a warm gray on vegetable fibers.

A dye bath made from rowan berries alone yields shades of beige and tan. Rowan berries can be added to madder root dye baths to increase the brightness of the color, especially when using madder without a mordant. For details of dyeing with madder see pp.124–125.

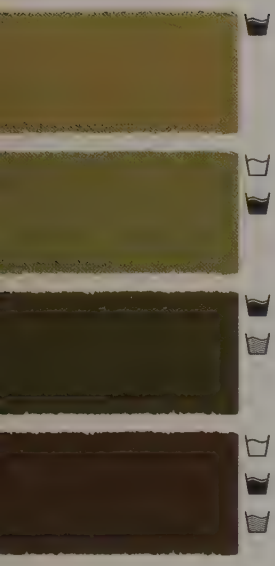


LEAVES, LEAFY TWIGS

Symphytum species

Comfrey

Comfrey is a herbaceous perennial. It has rough, hairy mid-green leaves and tubular or bell-shaped flowers, which may be pink, purple, violet, creamy-yellow, white, or blue. The fresh leaves produce soft shades of green, dried leaves give browner shades.



LEAVES

Comfrey is widely used in herbal medicines as a healing poultice for sprains, bruises, and abrasions. It contains allantoin, which provides healing in connective tissue; and it has been known to heal wounds when all other remedies have failed.

Cultivation and harvest

Comfrey is usually found growing in the wild, but some species, available from nurseries, make quite spectacular garden plants. Common comfrey, *S. officinale*, grows in damp grassland, on river banks, in ditches, on damp roadsides, and on wastelands. Russian comfrey, *Symphytum* x *uplandicum*, is a hybrid that is widely naturalized in northern Europe and was introduced into Great Britain as a fodder plant.

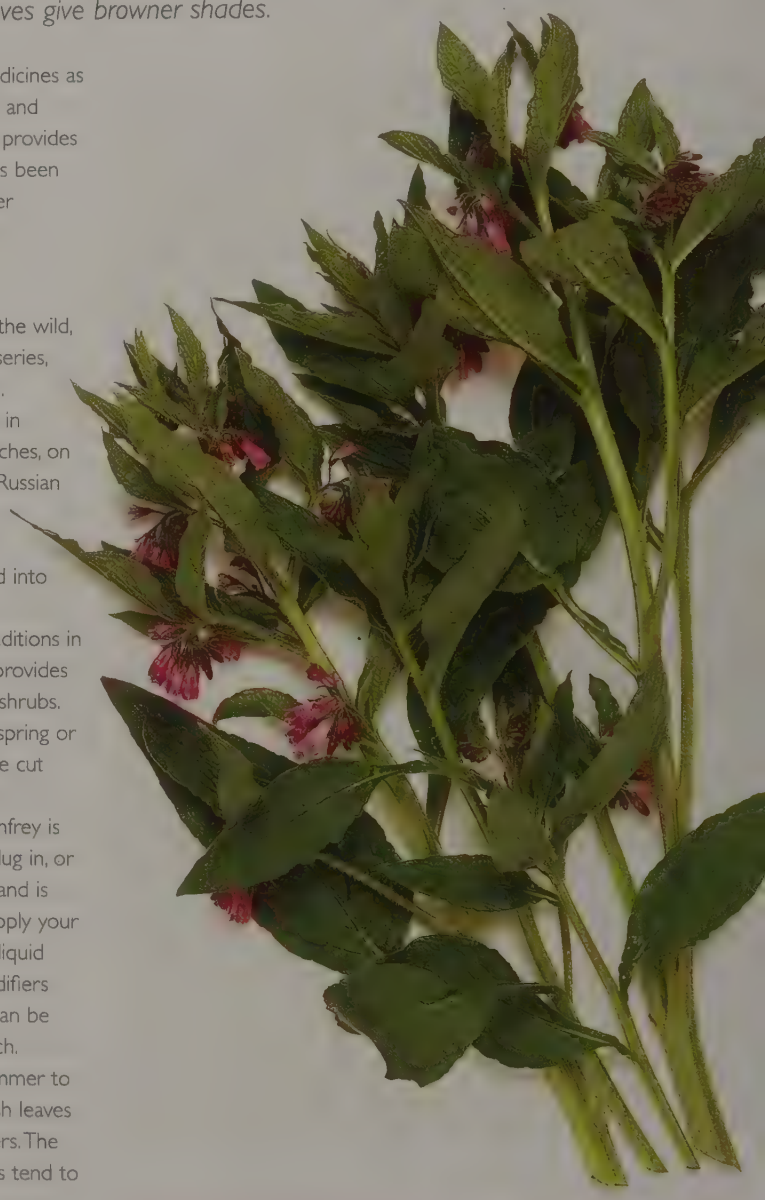
Comfrey grows best in moist conditions in sun or shade. It spreads rapidly and provides good ground cover under trees and shrubs. Plants can be dug up and divided in spring or fall. It may need staking and should be cut back after flowering.

Also used as "green manure," comfrey is either grown on the spot and then dug in, or soaked until the water turns brown, and is then administered as a liquid feed. Apply your used dye bath in the same way as a liquid feed for tomatoes, as long as no modifiers have been added to it. Used leaves can be composted or used as a garden mulch.

Harvest the leaves from early summer to fall, and use them fresh or dried. Fresh leaves give khaki green shades on wool fibers. The dye colors from dried comfrey leaves tend to be browner in tone.

Dyeing procedure

To make the dye bath, cut up the leaves. Cover with boiling water and soak overnight. Simmer the dye liquid for one or two hours and strain off the dye solution. Add the fibers to the dye pot and simmer for at least one hour, turn off the heat, and leave the fibers to soak overnight. An iron modifier gives dark green shades.

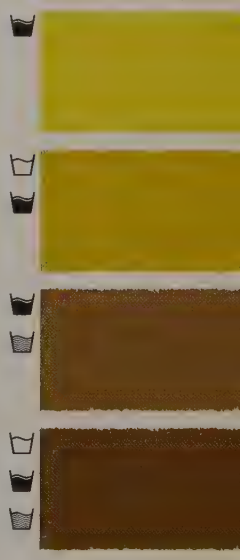


Range	Most of Europe, parts of Asia, and North America.
Availability	Grow from plantlets or gather from nature.
Planting time	Spring or fall.
Growing habit	Allow up to 36in (90cm) per plant. Grows to 4ft (1.2m) tall.
Harvesting time	Leaves: early summer to fall.
Dyestuff	Leaves.
Dyeing instructions	No mordant needed for wool, but improves fastness. Alum mordant required for vegetable fibers. Use equal weights of dyestuff and fibers.

Tagetes species

French marigold, African marigold

These familiar, popular bedding plants are very easy to grow and continue to flower throughout the summer and well into the fall. Dye shades from the flowers range from greeny-yellow and gold to orange and tan, while the plant tops usually give greeny-yellow and olive-green shades.



PLANT TOPS

FLOWERS

Range	Central America and most temperate regions.
Availability	Grow from seed.
Planting time	Sow seeds in early spring.
Growing habit	Allow 6–12in (15–30cm) per plant, depending on the variety. Grows to 24in (60cm).
Harvesting time	Plant tops: fall. Flowers: early summer to late fall.
Dyestuff	Plant tops, flowers.
Dyeing instructions	Mordant recommended. Use equal weights of dyestuff and fibers for all plant parts.

Although called French or African marigolds, all *Tagetes* species originate from Central America. Some species are small and compact; others have upright, long-stemmed blooms. Flowers range in color from cream, yellow, orange, and rusty-red to brown and maroon, and some are bicolored. The dark green, fern-like foliage has a strong aroma.

Cultivation and harvest

Sow the first set of seeds indoors several weeks before the last frost, then another a few weeks later indoors or in situ. This will produce flowers from early summer right through to late fall. Marigolds grow quickly and can be planted outside as soon as all danger of frosts is over. A few marigolds planted around tomato plants will also deter pests.

Marigolds grow in any well-cultivated site, even in poor, rather dry soils, but they should be watered during dry weather. They prefer an open, sunny situation. Remove the dead flower heads regularly, and save the seeds for next year's crop.

All parts of the plant, except the root, can be harvested for the dye pot. Pick off the flower heads regularly throughout the growing season and use them fresh or dry. In the fall, pull up the whole plants, cut off the roots, and use the plant tops, either fresh or dried, in the dye pot. Do not worry if the flowers are frostbitten: they yield attractive, deep, rich colors, especially when used with copper or iron modifiers.

Dyeing procedure

To make a dye bath from the flowers, or from the whole plant tops, simmer them for about half an hour or so to extract the color, then strain off the dye liquid into the dye pot. Simmer the fibers in the dye pot until the desired depth of color is achieved.

Flowers only will yield shades from greeny-yellow and gold to orange and tan, depending on the variety, flower color, and processing time. The plant tops produce greeny-yellow and olive-green shades.

Tanacetum vulgare

Tansy

Tansy is a strongly aromatic perennial plant that spreads by underground runners. It can be found growing in the wild on grassland and wasteland. Its leafy stems bear clusters of button-like golden yellow flowers and these or the plant tops are used in the dye pot for yellow-greens and golds.

PLANT TOPS

FLOWERS

Tansy leaves are bright green and deeply serrated, and, as well as being used for dyeing fibers, they were once used to flavor puddings, cakes, omelettes, and salads, even though they have a bitter taste. In parts of Great Britain it was customary to eat tansy pudding at Easter in remembrance of the "Bitter herbs" eaten at the Passover by the Jews. Tansy was also used as an effective insect repellent.

Cultivation and harvest

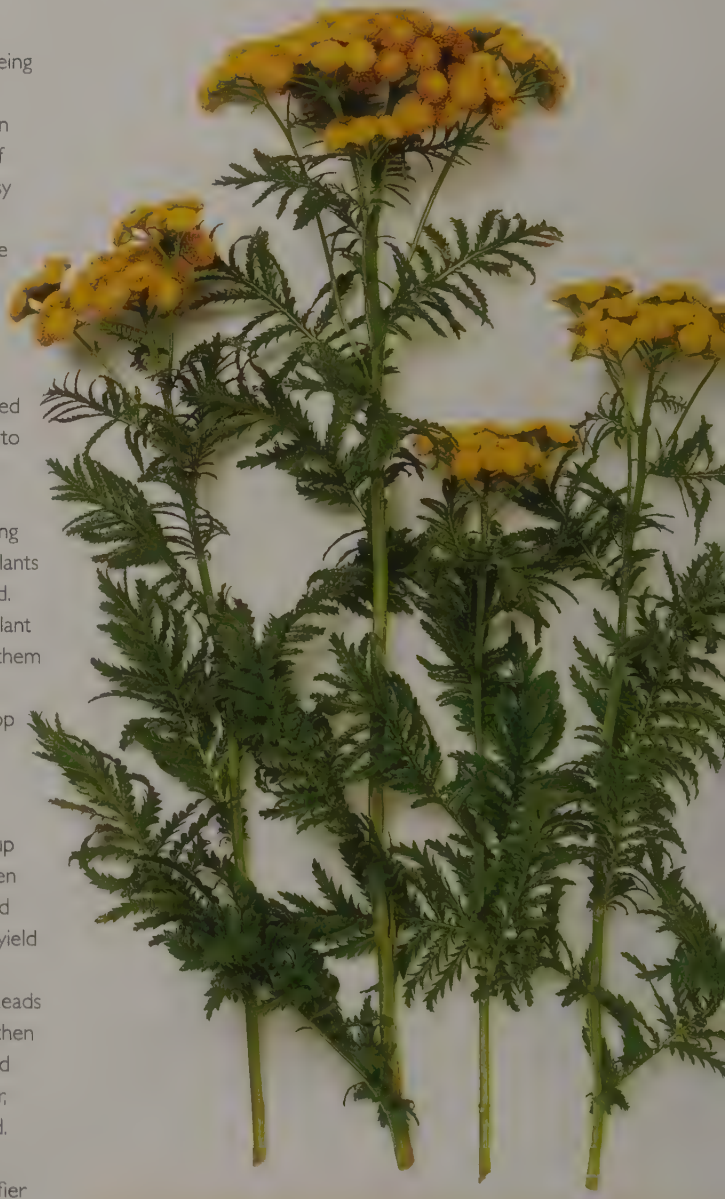
Grow tansy either from plants or from seed sown in early spring indoors, or directly into the garden when the soil has warmed up. Tansy can tolerate most conditions and spreads rapidly. To prevent it from spreading too much, dig up and discard unwanted plants in fall after they have flowered and divided. Harvest the whole plant tops when the plant is in flower from summer to fall, and use them fresh or dried. Alternatively, separate the flower heads from the rest of the plant top and use them to make a dye bath.

Dyeing procedure

To use the whole plant tops, chop them up well, simmer them for about one hour, then strain off the dye liquid. Add the fibers and simmer them for as long as necessary to yield the desired color.

To make a dye bath from the flower heads only, simmer them for about 45 minutes, then strain off the dye liquid. Add the fibers and simmer gently for 30 minutes to one hour, depending on the depth of color required.

Tansy gives varying shades of greeny-yellow, gold, and bronze. An alkaline modifier shifts the color to an olive-brown and iron used as a modifier gives olive-green.



Range	Europe, North America, and most temperate regions.
Availability	Gather plant from nature or grow from seed or purchased plantlet.
Planting time	Sow seeds or plant plantlets in early spring.
Growing habit	Allow 24in (60cm) per plant. Grows to 36in (90cm) tall.
Harvesting time	Summer to fall.
Dyestuff	Plant tops, flowers.
Dyeing instructions	Mordant recommended. Use equal weights of dyestuff and fibers for plant tops and flowers.

Taraxacum officinale

Dandelion

Dandelion is a plant most people recognize as it grows freely in the wild and in gardens. It is a cause of much frustration to natural plant dyers, many of whom try in vain to coax red or purple colors from its root. It is possible, however, to produce wonderfully bright yellows on animal fibers.

Range	Europe, North America, and most temperate regions.
Availability	Gather from nature.
Planting time	Not applicable.
Growing habit	Not applicable.
Harvesting time	Flowers and leaves: spring to fall.
Dyestuff	Flowers, leaves.
Dyeing instructions	Mordant recommended. Use equal weights of dyestuff and fibers for flowers only, or flowers and leaves. Dyes tend to produce brighter colors on animal fibers.

Dandelion has been used medicinally for centuries, as a herbal laxative and diuretic. It contains high levels of potassium and its use helps to replace the potassium removed from the body when urine production is increased.

Cultivation and harvest

Like many other edible plants, dandelion leaves were grown from early times for use in winter salads when other food was in short supply. As a culinary herb or vegetable, it is increasing in popularity again.

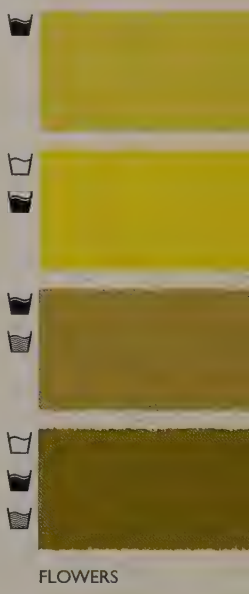
Dandelion wine has always been popular in Great Britain and large quantities of flowers were collected for this purpose. The roots can also be used to make a coffee substitute. During World War II, when real coffee was unavailable, dandelion roots were dried, roasted, and ground and used as an alternative to coffee.

Dandelion leaves and flowers give pretty shades of yellow dye. The flower heads can be picked any time when they are in bloom and are best used fresh. The leaves can be added to the flower dye bath or used separately if you can collect enough. They are also best used fresh.

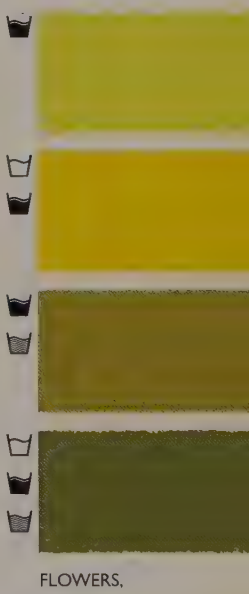
Dyeing procedure

To make a dye bath from the flower heads, boil them for about 30 minutes, then strain off the dye liquid. Add the fibers to the dye bath, bring the solution to simmering point, then reduce the heat but keep the dye bath hot for at least one hour. This should give a light, clear yellow on fibers.

To use the leaves and flowers together, simmer them for one hour, then strain off the dye liquid into the dye pot. Add the fibers and process as generally described in Dyeing Techniques (see pp.49–52) for greeny-yellow shades. If you use the leaves alone to make a dye bath, the colors on fibers may be more yellowy-green.



FLOWERS

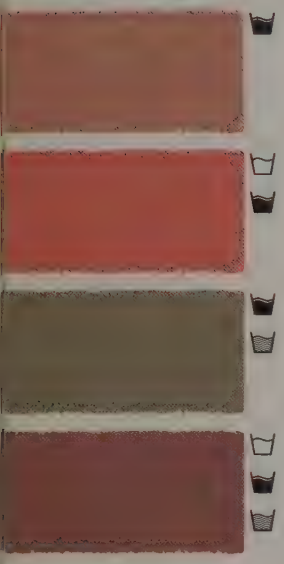


FLOWERS, LEAVES

Ulmus species

Elm

There are several species of elm tree and all can be used for dyeing. Elm bark produces lovely shades of coral-pink and rusty-orange on all fibers, while the fresh or dried leaves yield rich shades of golden yellow and pale tan on animal fibers and paler golds on vegetable fibers.



BARK

LEAVES

The elm is an ancient tree, long associated with human settlements. The foliage was cut for cattle fodder and trees were frequently planted as hedges and boundary markers. Elm timber was widely used when durability in wet conditions was required, such as for floorboards and coffins.

Since the spread of Dutch elm disease, many of these heavy, towering trees have been lost from the landscape. Fortunately, the majority of elms produce suckers from their roots and many trees have regenerated this way. The new trees can reach 20ft (6m) in height before succumbing to the disease.

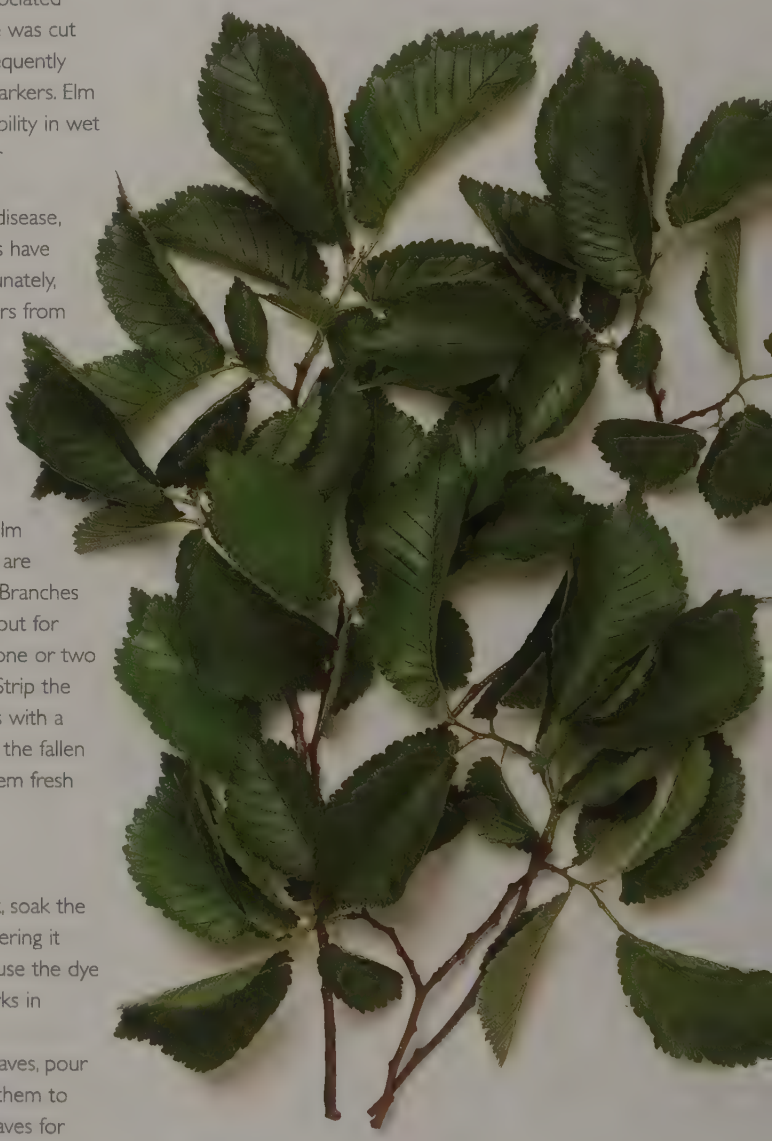
Cultivation and harvest

The destruction caused by Dutch elm disease means that leaves and bark are available from fallen or felled trees. Branches also drop from living elms, so look out for these, too, otherwise only remove one or two slender branches from living trees. Strip the bark from fallen branches and twigs with a sharp knife. Collect the leaves from the fallen branches or felled trees and use them fresh or dried in the dye pot.

Dyeing procedure

To extract dye color from elm bark, soak the bark for a week or so before simmering it gently to extract more color. Then use the dye liquid as generally described for barks in Dyeing Techniques (see pp.46–48).

To make a dye bath from the leaves, pour boiling water over them and leave them to soak overnight. Then simmer the leaves for about one hour, before straining off the dye liquid. Add the fibers to the dye bath and simmer until the desired depth of color is achieved. Elm leaves with an alum mordant give rich golden yellows on animal fibers but paler golds on vegetable fibers. On wool, elm leaves without a mordant produce pale tan.

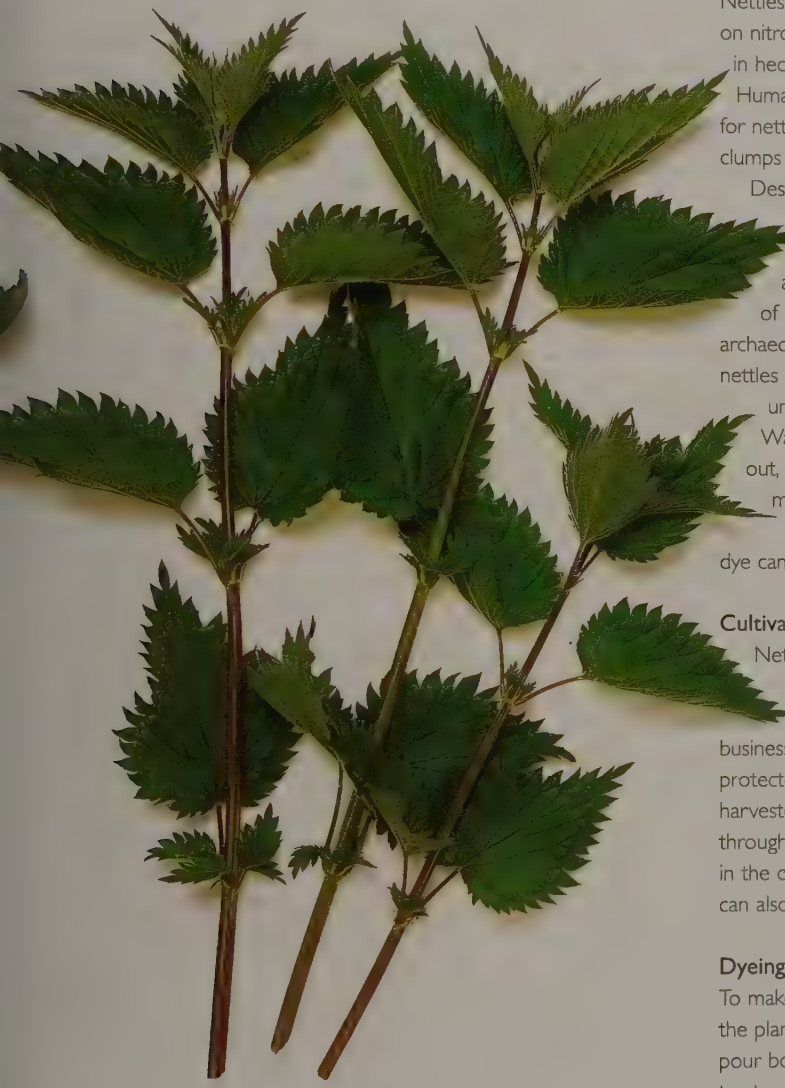


Range	Northern temperate regions.
Availability	Gather from nature.
Planting time	Not applicable.
Growing habit	Not applicable.
Harvesting time	Bark: all year. Leaves: late spring to fall.
Dyestuff	Bark, leaves.
Dyeing instructions	Bark: no mordant required. Leaves: alum mordant recommended. Use at least equal weights of dyestuff to fibers for bark and leaves.

Urtica dioica

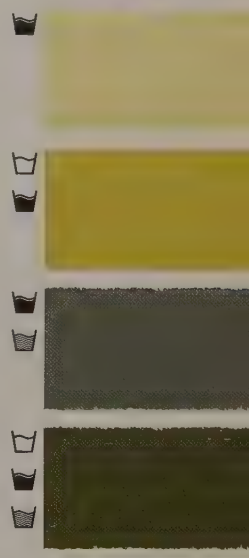
Nettle

The common stinging nettle is a coarse perennial that bears small greenish flowers in summer and is covered with stinging hairs. Nettles gathered before the plants flower produce lovely shades of yellowy-green, while those collected later in the year yield paler tans.

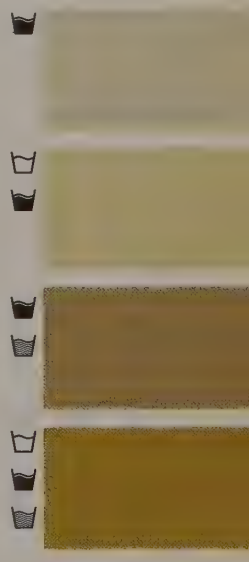


Nettles spread rampantly and grow wild on nitrogen-rich soils by the sides of roads, in hedges and woods, and near buildings. Human settlements provide ideal conditions for nettles to flourish and ancient nettle clumps mark the sites of deserted towns.

Despite its stinging hairs, nettles have been a source of food since prehistoric times. Yarns spun from nettle fiber also have a long history. Fragments of nettle cloth have been found in archaeological excavations and cloth from nettles was manufactured in Scandinavia up until the 19th century. During World War 1, when the supply of cotton ran out, nettles were used in Germany to make military clothing. A dye made from nettles was used in World War I to dye camouflage military uniforms a khaki color.



PLANT TOPS
EARLY SUMMER



PLANT TOPS
LATE SUMMER

Cultivation and harvest

Nettles have been used as a source of dye by many cultures, even though collecting them can be a painful business if hands and arms are not adequately protected. Whole nettle tops can be harvested at any time of year from spring through to fall. They give the brightest colors in the dye pot when used fresh, but nettles can also be dried for later use.

Dyeing procedure

To make a dye bath from nettles, chop up the plant tops, wearing protective gloves. Then pour boiling water over them and leave them to steep for at least one day. Simmer the nettles for 30 to 45 minutes, and strain off the dye liquid into the dye pot. Apply the dye liquid to the fibers as generally described in Dyeing Techniques (see pp.49–52).

Copper used as a modifier gives a greener shade, and an iron modifier produces grayish-green on animal fibers and dark green-black on vegetable fibers. The discarded leaves can be used as a garden mulch.

Range	Europe, North America, and all temperate regions.
Availability	Gather from nature.
Planting time	Not applicable.
Growing habit	Not applicable.
Harvesting time	Spring to fall.
Dyestuff	Plant tops.
Dyeing instructions	Use of a mordant is recommended. Use equal weights of dyestuff and fibers for plant tops (regardless of when they were harvested).

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Page numbers in *italic* refer to illustrations

Acknowledgments

Jenny Dean would like to thank all those at Mitchell Beazley who have worked on the production of *Wild Color*, also Matthew Ward for his photography and most especially Colin Walton, who designed the book with such painstaking attention to detail and whose photographs enhance the plant pages.

This book is dedicated with love to my husband Roger, and our children Joe and Jessica, and to the memory of my parents, Fred and Dorothy Jackson.

Mitchell Beazley would like to thank James Morley of the Centre of Economic Botany at the Royal Botanic Gardens, Kew, for his help. Shepherds Bookbinders Ltd, 76 Rochester Row, London SW1 for loan of a natural hide. Hilary Bird for compiling the index; Polly Boyd for proof reading; Jenny Faithfull for researching additional plant photographs.

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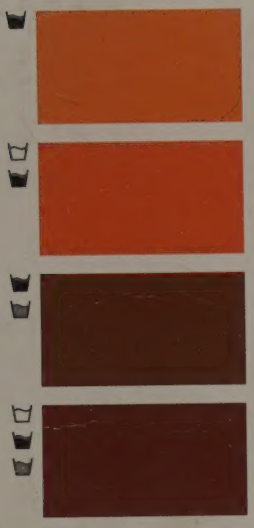

A practical and inspiring guide to creating and using natural dyes from plants, *Wild Color, Revised and Updated Edition*, offers the latest information on current environmentally friendly dyeing techniques and more than 65 species of plants and natural dyestuffs.

This comprehensive book outlines all the necessary equipment, how to select fibers and plant parts, choose the right methods for mordanting and dyeing, test color modifiers and the fastness of dyed colors, and obtain a range of gorgeous colors from every plant, from alder to woad, shown in more than 250 swatches.

Wild Color, Revised and Updated Edition, is the all-in-one resource for fiber enthusiasts, including knitters, sewers, and weavers; gardeners who are interested in new uses for traditional dye plants; and eco-conscious DIYers who want authoritative information about the natural dyeing process and the plants that are essential to it.

JENNY DEAN has worked with natural dyes for more than 30 years. She is the author of several books and numerous articles on natural dyeing, and also conducts lectures, workshops, and courses on the subject. A collection of her dyed samples can be found at the Royal Institute for Cultural Heritage in Brussels, Belgium.

Consultant, **Karen Diadick Casselman** has taught dyeing techniques throughout the U.S. and internationally. Her dyed pieces are included in the collections of the Smithsonian Institution and other museums.

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Cover photographs: front: Matthew Ward; back: Colin Walton (top); Matthew Ward

9 780823 058792