

Research Material

European Barberry *Berberis vulgaris*

Barberry is a thorned, deciduous shrub growing up to 3 meters (10 feet) in height common to most areas of Central and Southern Europe and the Northeastern regions of the United States. It grows well in dry, sunny locations, flowers in mid-spring to early summer and produces a fruit (*Fructis berberidis*) that can be harvested in early autumn or fall.

The leaves of the barberry plant are spatula shaped with numerous spiny teeth arising from the axils of thorns on short bushy shoots. Barberry has yellow, unpleasant smelling flowers that form hanging clusters, which form into long scarlet colored berries with a sour taste (41) (60).

TRADITIONAL USE

In folk medicine, european barberry root bark has been used for various conditions including liver dysfunction, gallbladder disease, diarrhea, indigestion and urinary tract diseases (2) (3) (5). It has been applied in many cultures to treat malaria, and leishmaniasis (3) (5) (10).

American Indians used barberry to improve appetite, a function that was soon picked up by early American settlers. It was also reportedly used for treating stomach problems such as ulcers and heartburn (2), and is listed in the American Medical Ethnobotany Reference Dictionary as being effective in reducing fever (27).

Duke's Handbook of Medicinal Herbs lists barberry as being antihelicobacter, fungicidal and antiparasitic. It reports indications of barberry against staphylococcus, streptococcus and yeast, and claims that it is superior in bactericidal properties to chloramphenicol, a commonly prescribed antibiotic drug (36).

The constituents berberine, columbamine, and oxyacanthine show evidence of antibacterial activity, with some suggestion that berberine sulfate might be amebicidal and trypanocidal (2) (4). Research indicates that berberine is specifically effective against cholera, giardia, shigella, salmonella and *E. coli* (35).

The German Commission E Monographs list barberry not only as useful for treating liver diseases, but also as a stimulant for the circulatory and respiratory systems (1). Barberry is claimed also to have anti-viral activities, and as a treatment for chronic candidiasis, indigestion and parasites (43).

Laboratory studies have shown that berberine has some activity against *E. histolytica* in mice (10).

Barberry is generally considered safe when consumed orally and appropriately for medicinal purposes, but due to its moderately toxic properties cannot be recommended for consumption in quantities over 500 mg. Barberry has been classified as unsafe to take during pregnancy due to its uterine stimulant properties. Due to the lack of reliable studies on the use of barberry during periods of lactation it is not recommended for use while breastfeeding (3).

Black Walnut *Juglans nigra*

Black walnut is often applied to treating cases of diphtheria, leukemia and syphilis, and to kill and expel intestinal worms (3).

The chief known constituent of black walnut is juglone, which has demonstrated both antibacterial and antifungal properties (24) (37). James Duke lists juglone as being antiparasitic, antiviral and a fungicide (32), while Martindale claims some efficiency of juglans in treating lymphatic disorders such as scrofula (33).

TRADITIONAL USE

Black walnut has been used in folk medicine as an astringent, laxative and a vermifuge. It is used to expel tapeworms and other internal and external parasites (37). The American Medical Ethnobotany Reference Dictionary claims that the juice from black walnut hull is effective against ringworm (27), but some warnings have been issued regarding the topical use of this herb (see below). Black walnut is traditionally regarded as being antiparasitic and a vermifuge (kills worms) (36) (72).

Black walnut is listed as safe for short term oral use (typical oral dose is 1,000 mg three times daily with water), but is regarded as possibly unsafe for topical application. Due to the lack of reliable studies on the use of black walnut during periods of pregnancy or lactation it is not recommended for use during these times (3).

Clove *Syzygium aromaticum*

Cloves' many medicinal uses have been most famously applied to toothache, and for mouth and throat inflammation (3). More than just a counterirritant though, the German Commission E Monographs list cloves as having antiseptic, antibacterial, antifungal and antiviral properties (1) (5).

What is behind cloves' various properties? One of the main constituents of clove oil (eugenol) exhibits broad antimicrobial activities against both Gram-positive, Gram-negative and acid-fast bacteria, as well as fungi (4) (18). Cloves are well known also for their antiemetic (relieves nausea and vomiting) and carminative properties (4) (6) (7) (18).

TRADITIONAL USE

The oldest apparent medicinal use of cloves was in China, where it is reported that they were taken for various ailments as early as 240BC. Cloves were taken over the centuries for diarrhea, most liver, stomach and bowel ailments, and as a stimulant for the nerves (26).

Traditionally cloves have been used to treat flatulence, nausea and vomiting (3) (24). In tropical Asia cloves have been given to treat such diverse infections as malaria, cholera and tuberculosis, as well as scabies (35). Traditional uses in America include treating worms, viruses, candida, various bacterial and protozoan infections (36).

Laboratory tests on cloves identify eugenol as being the possible reason for the antimicrobial actions, and confirm cloves' effectiveness in inhibiting food-borne pathogens as well as other bacteria and fungi (17). The volatile oil of cloves (about 85-92% eugenol)

was highly active against a range of test microorganisms, being classified as bactericidal in nature (64).

Cloves are generally regarded as safe when taken orally and appropriately for medicinal uses, and as a short-term topical application. Cloves are regarded as unsafe when inhaled, and clove cigarettes contain properties more damaging than many tobacco varieties. It is generally accepted that cloves are safe to use while pregnant or breastfeeding in quantities commonly found in foods.

Echinacea *Echinacea purpurea*

Echinacea is a plant that bears single pink or purple flowers from its tall stems, with a central cone that often appears purplish-brown in color. This accounts for its alternate name in some cultures, the “Purple Cone Flower”. Although there are several species of the echinacea plant, only 3 are used for medicinal purposes (*Echinacea augustifolia*, *Echinacea pallida*, and *Echinacea purpurea*) (73).

Echinacea is used for a range of benefits, including as an antiviral, an immune stimulant, and to relieve urinary tract infections and yeast-related disorders. Extracts from *Echinacea purpurea* add to the body’s resistance to bacterial and viral infection (3) (9) and have shown indirect antiviral activity (4).

The success of echinacea as a supportive therapy for colds and other respiratory infections is well documented (1) (5) (8) (24). This comes as no surprise, as echinacea is an immune stimulant, a fact established by numerous scientific studies (2) (4) (7) (8). Some effects of echinacea include an increase of the number of white blood cells and spleen cells, elevations in body temperature and reproduction of T-helper cells (5).

TRADITIONAL USE

Historically echinacea has been taken for septicemia, migraines, streptococcus infections, syphilis, typhoid, malaria and diphtheria. Often echinacea is included with in combination with other herbs to treat or prevent colds and other upper respiratory infections (2) (3).

Echinacea arrives to us from the tribal medicine of the North American Indians, and by the 19th Century had become the most widely used plant drug in the United States (18). It was used in various forms for many ailments throughout the Americas, including as an aphrodisiac, to relieve headache and stomach pains, improve appetite and ease nausea and fevers. Echinacea root was chewed to treat colds and sore throats (23). It is further listed as an antibacterial, candidicide and trichomonicide in James Duke’s Handbook of Medicinal Herbs (36).

A double-blind, placebo-controlled study indicated that 450 mg/day of *Echinacea purpurea* root extract significantly relieved the severity and duration of flu symptoms (4).

A total of 26 controlled clinical trials in Germany were conducted on the immunomodulatory activity of echinacea preparations prior to 1994. After reviewing the 34 test treatment groups, 22 were considered to have given results indicating echinacea’s positive effects on the immune system, particularly with regard to upper respiratory infections (9).

Lab studies in mice have shown that arabino-galactins from *Echinacea purpurea* provide protection against certain test microorganisms. The test results showed a 100% preventative effect against lethal *Candida albicans* infections and “very good preventative

effect” against lethal *Listeria* and *Leishmania* infections (10). Both *in vivo* and *in vitro* immunostimulant activity in mice has been documented for echinacea (12).

Echinacea is considered generally safe when taken orally for periods of no longer than 8 consecutive weeks of daily use. Due to the insufficient reliable evidence on the use of echinacea while pregnant or breastfeeding it cannot be recommended for use during these times.

Garlic *Allium sativum*

Garlic is taken orally to reduce high blood pressure, prevent heart disease and arteriosclerosis, treat earaches, stimulate both the immune and circulatory systems and prevent cancer. Other applications include treating diabetes, arthritis, colds and flu, fighting stress and fatigue and maintaining healthy liver function (3).

Various official monographs list garlic as being both antibacterial and antimycotic (suppresses the growth of certain fungi) (1) (4) (8). Consequently garlic is administered to treat *Helicobacter pylori* infections (3) (12), and to inhibit the growth of *Candida albicans*, particularly in cases of recurrent yeast infections (11).

Parasitic worms are also apparently susceptible to garlic. The World Health Organization “Monographs on Selected Medicinal Plants” reports garlic has having been used to treat roundworm (*Ascaris strongyloides*) and hookworm (*Ancylostoma caninum* and *Necator americanus*) infestations, listing allicin as the active anthelmintic constituent (8).

The United States Department of Agriculture lists garlic as being a viricide on its Medicinal Plant Database (47).

What accounts for the antibacterial action of garlic?

The garlic bulb contains an amino acid derivative called alliin, which is in fact odorless and contains no antibacterial properties. However when the garlic bulb is crushed or ground, alliin comes into contact with an enzyme (alliinase) that converts the alliin into allicin. Allicin is the reason for garlic’s distinctive odor, and is a potent antibacterial agent (2).

TRADITIONAL USE

The use of garlic in history goes back thousands of years, with Hippocrates, Galen, Pliny the Elder, and Dioscorides all reporting its use for various conditions, including parasites, low energy, and respiratory and digestive disorders. Garlic’s reputation in Western medicine was established in 1858 when Louis Pasteur confirmed its antibacterial properties (11).

Traditional Chinese medicine has used garlic since at least A.D. 510 (11), and is still using it for amoebic and bacterial dysentery, tuberculosis, scalp ringworm and vaginal trichomoniasis.

Other folk medicine cultures have traditionally used garlic for treating colds and flu, fever, coughs, headache, hemorrhoids asthma, arteriosclerosis, low blood pressure, both hypoglycemia and hyperglycemia, cancer and as an aphrodisiac (amongst other things) (3) (4). Garlic has also been used to treat pinworms (4).

The antiparasitic nature of garlic is demonstrated in the uses to which it has been applied in folk medicines around the world. For example, it has been traditionally used to treat parasitic worms in such diverse cultures as East Asia, India, Italy, North America, Peru, Saudi Arabia, Tunisia and the West Indies. Traditional practitioners in Greece have long used garlic extracts to protect against amoebic infections (14).

Laboratory tests (both in test tubes and in animals) have demonstrated that fresh garlic has antimicrobial activities (including antibacterial, antiviral, antifungal, antiprotozoal, and antiparasitic) (3) (12) (14).

Particular activity against *B. subtilis*, *E. coli*, *P. mirabilis*, *Salmonella typhi*, methicillin-resistant *Staph aureus*, *Staph faecalis*, *salmonella enteritidis*, and *V. cholerae* have been noted (3) (12).

Bacteria shown to be susceptible to garlic in the test tube include species from *Staphylococcus*, *Escherichia*, *Proteus*, *Salmonella*, *Providencia*, *Citrobacter*, *Klebsiella*, *Hafnia*, *Aeromonas*, *Vibrio* and *Bacillus* genera (12). Human trials as well as in vitro studies have shown that garlic consumption is active against *Mycobacterium tuberculosis* (14).

An epidemiological study in China among 214 people from the Shandong province suggested that garlic consumption may have a protective effect against *H. pylori* infection and the development and progression of precancerous gastric lesions (13).

Fungi demonstrated to be susceptible to garlic in lab tests include the genera *Microsporum*, *Epidermophyton*, *Trichophyton*, *Rhodotorula*, *Torulopsis*, *Trichosporon*, *Cryptococcus neoformans*, and *Candida*, including *Candida albicans*. It is reported that garlic is more effective against pathogenic yeasts than nystatin, especially *Candida albicans* (3) (12) (14) (16).

Essential garlic oils were active on *Entamoeba histolytica* in clinical trials, confirming its potential for antiamoebic activity (14).

Antiprotozoan activity has also been demonstrated in lab tests against *Paramecium caudatum* (14).

Garlic has also shown itself in lab tests to have several immune-enhancing effects (12).

Fresh garlic, garlic extracts, oil and oleoresin have been generally recognized as safe when consumed in amounts commonly found in food. Garlic has been used for medicinal purposes in clinical studies lasting up to 4 years without reports of significant toxicity. It is possibly unsafe when consumed in large amounts, with the American Herbal Products Association Botanical Safety Handbook claiming that high doses could be dangerous or even fatal for children. There are, however, no reported cases of significant adverse reactions or mortality in children associated with the ingestion of garlic (3).

There are no published reports of garlic adversely affecting pregnancy, although it would be wise to avoid consuming large amounts during these times. (Theoretically large amounts of garlic might act as an abortifacient causing uterine contractions.) There is a lack of reliable information dealing with the use of garlic while breastfeeding, but it has been generally accepted that consuming it in amounts commonly found in food would be safe (3).

Gentian *Gentiana macrophylla*

Gentian is a tall, attractive perennial plant native to the mountainous areas of central and southern Europe. It may grow up to 140 cm (55 in) high with a single stem (no branches) from which long bluish-green leaves emanate in opposite pairs. On the upper section of the plant these turn into saucer-shaped subtending leaves from which the long stemmed flowers appear. In early autumn or fall the root of the gentian plant is dug up and dried (35) (41).

The most common medicinal uses for gentian include treating digestive disorders such as loss of appetite, fullness and flatulence. It is however used for a variety of other purposes, such as reducing fever, eradicating parasitic worms and as a general tonic (roborant) (1) (2) (3).

Root extracts of gentian have antifungal activity, are anti-inflammatory, and have immunostimulating activities (12).

Gentian is regarded as safe when consumed orally in amounts commonly found in foods or in typical therapeutic amounts.

Gentian cannot be recommended for use during pregnancy due to its potential as a mutagen. Due to a lack of reliable information on the effects of lactation, gentian should be avoided while breastfeeding.

Milk Thistle *Silybum marinarum*

Milk Thistle is also known as Holy Thistle, Lady's Thistle, Marian Thistle, Mary Thistle, Our Lady's Thistle, St. Mary Thistle, Silybum and Silymarin.

Milk thistle (or St. Mary Thistle) fruit is one of the most encouraging traditional herbs to be handed down to modern scientific medicine. The milk thistle plant grows wild throughout much of Europe, being native to the Mediterranean and thriving in sunny locations. Milk thistle has distinctive white markings on its leaves, traditionally believed to be caused by the Virgin Mary's milk (thus the name). The flowerheads are picked while in full bloom in early summer (35).

The fruit and seed of the milk thistle plant are commonly applied to treating gallbladder and liver conditions (1), as a liver protectant, for treating hepatic cirrhosis and chronic hepatitis, and diseases of the spleen (3) (5) (12) (38).

The British Herbal Pharmacopoeia has listed milk thistle fruit as having a liver protecting action (7). Thus this herb is used in conditions when the liver is under stress or when toxicity is present, such as times of infection, excess alcohol, or during periods of chemotherapy (35).

TRADITIONAL USE

Milk thistle has been used for many centuries in Europe as a remedy for depression and liver problems (35). Historically milk thistle has also been used for treating malaria, uterine disorders and to stimulate menstruation (3).

Duke's Handbook of Medicinal Herbs lists both antioxidant and antiviral properties for milk thistle, as well as the liver protecting functions otherwise well established (36).

Studies in animals have shown that milk thistle can exert a protective effect on the liver against various toxins. Other studies and some human trials suggest that milk thistle can actually help the liver in regenerating and producing new liver cells (18). Thus this herb has been endorsed by German health authorities as a supporting treatment for inflammatory liver conditions and cirrhosis (2).

Other animal studies have demonstrated milk thistle's power as an antioxidant and a liver protector (12) (24).

Milk thistle fruit is generally accepted as safe when consumed in moderate amounts. Due to the lack of reliable information regarding the use of milk thistle during pregnancy or while breastfeeding, it is recommended that you avoid using it during these times.

Olive Leaf *Olea europaea*

The olive tree is a small evergreen tree native to the Mediterranean. The tree grows green to blue-black edible fruit, and also from which can be processed an edible oil. The oil and the leaves are both processed for therapeutic purposes (69).

Olive leaf is commonly used for treating conditions caused by, or associated with, a virus, retrovirus, bacterium or protozoan. Hence its applications include conditions such as colds and influenza, meningitis, Epstein-Barr Virus, encephalitis, herpes, shingles, HIV/AIDS, chronic fatigue, hepatitis B, pneumonia, tuberculosis, gonorrhoea, malaria, dengue, and assorted infections (3).

Olive leaf has been used in traditional medicine to reduce fever, blood sugar, blood pressure, and as a diuretic (24). In 1854, the Pharmaceutical Journal contained an article outlining its use to counter cases of fever and malaria (68).

Olive leaf is listed in Duke's Handbook of Medicinal Herbs as antibacterial, antioxidant and a hypoglycemic, with indications against such diverse conditions as malaria, lymphatic disorders and schistosomiasis (36).

Because the olive leaf is well known to be resistant in nature to both microbial and insect attack, many studies have focused on the antimicrobial properties of its chief constituents. Laboratory studies have found that oleuropein and hydroxytyrosol, constituents in olive leaf, have a high antimicrobial activity against both Gram-negative and Gram-positive bacteria. These results suggest that olive leaf can be considered a potential source of antimicrobial agents for treating intestinal and respiratory tract infections in humans (19).

Oleuropein has both bacteriostatic and antioxidant activity (3).

In animal experiments olive leaf has demonstrated itself to reduce fever, blood pressure and blood sugar levels (1), and to normalize irregular heartbeat (5). During the course of the 1960's research at Upjohn showed that constituents of olive leaf also has antiviral

properties. Further related research has confirmed olive leaves efficacy in countering bacteria and parasitic protozoa also (68).

Typical administrations of olive leaf extract include up to 500 mg doses 4 times per day over a limited period (68). Due to the lack of reliable information, olive leaf should be avoided while pregnant or breastfeeding (3).

Pau D'Arco *Tabebuia avellanedae*

Pau d'arco is a large canopy tree native to tropical rainforests in Central and South America. It grows to about 30 meters in height and can measure 2-3 meters in diameter at its base. The common name pau d'arco is applied to a number of species of the *Tabebuia* genus, but the preferred species employed in herbal medicine is *Tabebuia avellanedae* (31) (35).

Pau d'arco is taken for Candida yeast infections, various viral infections and parasitic infections. It also has anti-inflammatory and cleansing properties, and stimulates the immune system (35). Pau d'arco is a potent antioxidant (70).

Lapachol, a chief constituent of the wood and bark of the pau d'arco tree, has anti-inflammatory, antimalarial, antibacterial, antifungal, antiparasitic, and immunomodulatory activity (3), many of which have been backed up by results from animal and other laboratory studies (2).

Lapachol shows antibacterial/antiparasitic activity against Gram-positive and acid-fast bacteria, fungi and viruses, with a strong activity against the *Brucella* species. Naphthoquinones in pau d'arco, are highly effective against *Candida albicans* and *Trichophyton mentagrophytes*. Pau d'arco also actively inhibits the growth of several dangerous viruses, including Herpes types 1 & 11 (70).

In folk medicine pau d'arco has been taken to treat diabetes, ulcers, liver ailments, cystitis, prostatitis, ringworm, gonorrhea, syphilis, candida and as a general tonic (3). Natives from Central and South America reportedly used pau d'arco bark to treat cancer, leishmaniasis, leukemia, lupus and infectious diseases (21) (31).

In North American herbal medicine pau d'arco is considered to be antifungal, antiviral, anticancerous, and antibacterial. It is used for fevers, colds, flu, lupus, arthritis and circulatory problems. It is commonly included in herbal preparations throughout the United States for treating Hodgkin's disease, Parkinson's disease and candida yeast infections (31).

Duke's Handbook of Biologically Active Phytochemicals lists lapachol as being antimalarial, bactericidal and fungicidal (32).

Pau d'arco should be used with caution as significant evaluation of the safety of this herb in typical doses has not been conducted. Daily doses greater than 1.5 grams of lapachol have been associated with the most risk. Due to the lack of available data, pau d'arco should not be taken during periods of pregnancy or breastfeeding (3).

Pumpkin Seed *Curcubita pepo*

Pumpkins are thought to be originally native to North America, but are now found worldwide. They are an annual creeping plant with twining stems, lobed leaves, yellow flowers and large orange fruit. Pumpkins are harvested in autumn or fall (35).

Pumpkin seeds contain a fixed oil that is mostly linoleic acid (43-56%) and oleic acid (24-38%). Other constituents include protein, sterols, curcubitin, vitamin E, beta-carotene and minerals (including iron, zinc and selenium) (35).

Pumpkin seed is taken orally for bladder irritations and intestinal worms (3). It is thought to be a particularly safe and effective deworming agent, particularly in children for whom aggressive and toxic preparations are inappropriate (35).

Traditionally pumpkin seed has been taken to expel intestinal worms (24) with particular effectiveness noted against both tapeworms and roundworms (2) (18). Early settlers in North America mixed ground pumpkin seeds with water, milk or honey to provide a remedy for worms (35).

The United States Pharmacopoeia listed pumpkin seeds as an official medicine for eliminating parasites from 1863 until 1936, and this use for curcubita was practiced by eclectic physicians at the end of the 19th century. Traditional uses within the United States also included treating bacterial infections of the kidneys and urinary tract infections (3) (25).

Laboratory studies have demonstrated that curcubitin, a chief constituent in pumpkin seed, has antiparasitic activity. Human trials in China show that pumpkin seed is helpful to people suffering from schistosomiasis, a severe parasitic disease. Other human studies in China and Russia have demonstrated the effectiveness of pumpkin seed against tapeworm infestations (25).

Generally pumpkin seed is regarded as safe when taken appropriately. Due to the lack of reliable evidence on the effect of pumpkin seed on pregnancy and lactation, it should be avoided during these times (3).

Thyme *Thymus vulgaris*

Key constituents of thyme include thymol, carvacrol and flavonoids, often attributed with the antibacterial, antifatulent and antiworming properties of the herb. Thyme is also used to suppress coughing, ease chest congestion and stimulate production of saliva (3).

Thymol is considered to be antihelmintic (antiworm) with particular effectiveness against hookworm, and together with carvacrol is both antibacterial and antifungal (3) (4) (12).

The German Commission E Monographs list thyme as being bronchoantispasmodic, expectorant and antibacterial (1).

Traditionally it is the thyme leaf and flowering tops that have been used therapeutically. In folk medicine thyme is used to stimulate the appetite, suppress coughing, and relieve digestive disorders such as chronic gastritis, diarrhea in children and flatulence. It is also used to expel parasitic worms (3) (4) (24), particularly in children (35).

The overall antiseptic and tonic properties of thyme suit it well as a general boost for the immune system during times of chronic infection, and is still commonly used to remedy respiratory ailments (35).

Laboratory studies demonstrate that thymol has antifungal activity against a number of species, including *Cryptococcus neoformans*, *Aspergillus*, *Saprolegnia*, and *Zygorhynchus* species. Further studies confirm the antibacterial actions of this constituent, with demonstrated activity against *Salmonella typhimurium*, *Staphylococcus aureus*, *Escherichia coli* and other bacterial species (8). As an antibiotic, thymol is 25 times as effective as phenol, but less toxic (8) (18) (63).

Research in Scotland during the 1990's suggests that thyme and its volatile oil may counter the effects of aging. Subsequent studies have confirmed thyme's antioxidant properties, and how it helps the body maintain higher levels of essential fatty acids within the brain (35).

Thyme is generally regarded as safe when used in normal amounts, and has a Generally Recognized as Safe (GRAS) status in the US. Typical dosages of thyme include up to 4 grams of dried herb equivalent three times per day (3) (40).

Due to the lack of reliable information regarding large amounts of Thyme it should be limited to a moderate intake, particularly during pregnancy and breastfeeding (3).

Wormwood *Artemisia annua*

Wormwood is a hardy perennial herb native to Europe but now found throughout the world. The wormwood bush can grow to a height of 2 meters, and produces a number of bushy stems that are covered with fine, silky grey-green hairs. Wormwood produces small yellow-green flowers from Summer through to early autumn or fall (26).

Orally wormwood is taken for loss of appetite, indigestion and gastrointestinal problems (1) (7). It is often used in conjunction with other herbs to deal with gallbladder disorders and flatulence (3).

The constituents of wormwood include absinthin, anabsinthin (both bitter compounds), and a volatile oil that is 70% thujone (3).

Habitual large doses of wormwood can cause a range of undesirable effects. These may include restlessness, insomnia, nightmares, vomiting, abdominal pains, dizziness, tremors, convulsions and urinary tract dysfunction.

Thujone's toxicity can cause various effects as the amount of wormwood consumed increases, including seizures, delirium and hallucinations in extreme cases. Some researchers believe that thujone's mind altering effects are similar to THC in marijuana (3).

There are some beneficial uses of this wormwood constituent however, as thujone shows promise as an antioxidant. It also appears to have moderate antimicrobial and antifungal properties (28).

Without doubt the most famous therapeutic use of wormwood is the expulsion of parasitic worms. Many reference works continue to list wormwood as an effective vermifuge, and some also list it for its antibacterial and antifungal actions (4) (5) (18) (27) (36).

Historically wormwood has been used as a parasitic worm killer, an aphrodisiac, tonic and to induce perspiration (3). Other traditional applications include regulating menstruation and reducing fever (5). Duke's handbook of Medicinal Herbs lists antibacterial and antifungal properties for wormwood (36).

In times past wormwood was thought to counteract poison. It was also strewn about chambers to repel moths, fleas and other insects. When rumors of plague breaking out in London hit the streets in 1760, merchants reported running out of wormwood due to the huge public demand (26).

The use of wormwood in beverages dates back many centuries, perhaps as far back as the Saracens. Various methods of consumption have been used throughout history, including mixing the essential oil with beer or adding wormwood seeds to the distillation of whisky (26).

Most famous however is the mixing of the wormwood drug absinthol with anise to produce the intoxicating beverage known as absinthe. Overuse of this drink had devastating effects in Europe in the 18th century, with overindulgence known to have brought about paralysis (26).

Wormwood is employed today in the making of vermouth, and accounts for this drink's characteristic bitter flavor (26).

It appears that wormwood may also have certain antimalarial properties, with animal tests confirming that alcohol extracts of the dried leaves have considerable antimalarial potential (30), with the wormwood species *Artemisia annua* showing far greater antimalarial potential than extracts from over 30 other species in lab tests (74).

Wormwood is generally regarded as safe when used appropriately and for short durations. Wormwood should not be taken in large amounts or long-term.

This herb has been declared unsafe for use during pregnancy due to its uterine and menstrual stimulating effects. Due to the lack of sufficient reliable information, wormwood should not be used while breastfeeding.

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