

Spasmolytic Botanicals

Relaxing Smooth Muscle with Herbs

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Abstract

Western herbs that relax smooth muscle and the conditions these herbs are used to treat are reviewed in this article. Carminatives, such as the STW-5 formula, *Angelica archangelica* (garden angelica), *Matricaria recutita* (chamomile), *Carum carvi* (caraway), *Melissa officinalis* (lemonbalm), *Mentha x piperita* (peppermint), and *Foeniculum vulgare* (fennel), are discussed.

The stronger gastrointestinal (GI) spasmolytics *Atropa belladonna* (belladonna) and *Garrya flavescens* (silk tassel) are also mentioned. Gallbladder amphoterics *Fumaria officinalis* (fumitory) and *Fumaria indica* (pitpapra) are reviewed along with the pure gallbladder spasmolytic *Dioscorea villosa* (wild yam).

Bronchodilators and relaxing expectorants are covered. These include *Thymus vulgaris* (thyme), *Ephedra sinica* (*ma huang*), *Eriodictyon angustifolia* (narrowleaf *yerba santa*), *E. californica* (*yerba santa*), *Hyssopus officinalis* (hyssop), *Prunus serotina* (black cherry), and *Lobelia inflata* (lobelia).

Uterine spasmolytics discussed include fennel, *Zingiber officinale* (ginger), *Viburnum opulus* (cramp bark) and *V. prunifolium* (black haw). Vasodilating herbs mentioned include *Salvia miltiorrhiza* (*dan shen*), black haw, *Crataegus laevigata* (hawthorn), *C. curvisepala* (Iranian hawthorn), and *Marrubium vulgare* (horehound). Spasmolytic herbs helpful for relieving acute renal colic mentioned include *Ammi visnaga* (khella), lobelia, *Piscidia piscipula* (Jamaica dogwood), gelsemium, Western pasque flower, and *Hyoscyamus niger* (henbane).

Introduction

Numerous herbs relax smooth-muscle cells in the body. Clinically, this makes these herbs valuable for addressing a wide range of conditions, given the number of organs with smooth muscle in them. Conditions that can respond to herbal treatment include esophageal, gastric, intestinal, or colon spasms; gallbladder hyperactivity; spasmodic cough; bronchospasm; uterine cramps; hypertension (caused by vasoconstriction); and

ureteral spasms (see Summary of Uses for Spasmolytic Herbs). Many mechanisms have been investigated for these herbs. This article reviews a range of spasmolytic herbs in common clinical use (see General Smooth-Muscle Relaxing Herbs Ranked by Potency and see Selected Carminative Herbs).

Carminatives and Gut Spasmolytics

Spasmolytics that inhibit gastrointestinal (GI) smooth muscle are known as carminatives (see Selected Carminative Herbs). They are commonly confused with bitter herbs, which have the exact opposite effect on smooth muscle in the gut, stimulating it. Bitters and carminatives are diametrically opposed but can be combined clinically, usually to lessen the potency of strong bitter herbs and offset their flavor to some extent.¹

The herbal formula known as STW-5 combines *Iberis amara* (bitter candytuft) herb, *Angelica archangelica* (garden angelica) root, *Matricaria recutita* (chamomile) flower, *Carum carvi* (caraway) fruit, *Silybum marianum* (milk thistle) fruit, *Melissa officinalis* (lemonbalm) leaf, *Mentha x piperita* (peppermint) leaf, *Chelidonium majus* (greater celandine) herb, and *Glycyrrhiza glabra* (licorice) root. In vitro, this formula inhibited histamine-induced contractions of guinea pig intestines.² Garden angelica and chamomile were the most active components of the formula. This formula has carminatives as its primary components that balance the potent bitter candytuft. A meta-analysis of clinical trials on this formula for the spasm-related condition functional dyspepsia showed that the formula was superior to placebo and equivalent to cisapride (a prokinetic drug), although the latter result was based on a single trial.³

Mentha spp. (mints) are among the most widely used carminatives in the Western world. Peppermint, a hybrid of *M. aquatica* (water mint) and *M. spicata* (spearmint), is perhaps the most commonly used of all the mints as a beverage tea, a flavoring agent, and medicine. Numerous human clinical trials conducted on oral use of steam-distilled volatile oil of peppermint confirm that it relaxes intestinal smooth muscle.⁴

Summary of Uses for Spasmolytic Herbs

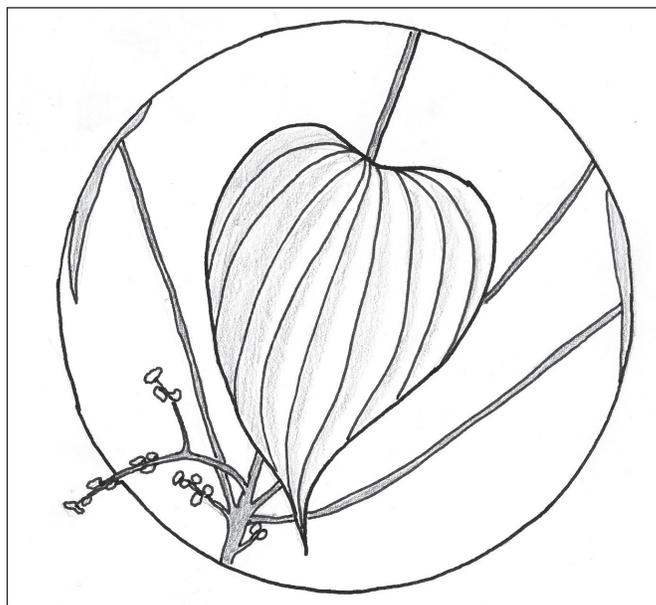
- Esophageal spasm
- Functional dyspepsia
- Irritable bowel syndrome (particularly diarrhea-predominant subtype)
- Spastic constipation
- Biliary dyskinesia
- Mild gallbladder spasm/biliary colic
- Spasmodic cough
- Bronchospasm from asthma, chronic obstructive pulmonary disease, or infection
- Dysmenorrhea
- Hypertension with vasoconstriction
- Acute renal colic
- Bladder spasms

Based on in vitro work, peppermint oil seems most likely to function as a calcium-channel antagonist.⁵ Peppermint tea inhibited rabbit duodenal smooth muscle in vitro by noncholinergic, nonsympatholytic actions.⁶ In vitro, an ethanol extract of peppermint was the most potent spasmolytic in guinea pig intestines, compared to chamomile, caraway, *Citrus aurantium* (bitter orange) peel, *Rosmarinus officinalis* (rosemary) leaf, and *Foeniculum vulgare* (fennel) fruit when acetylcholine was the spasmogen.⁷ *M. longifolia* (wild mint) leaf (native to South Asia) tea and petroleum spirit extract have also been shown to be calcium-channel blockers in vitro.⁸

Peppermint has shown benefit for a number of conditions characterized by excess smooth-muscle activity in the gut. Peppermint oil combined with the equally spasmolytic caraway steam-distilled volatile oil were just as effective as cispripide for relieving symptoms of functional dyspepsia in one double-blinded, randomized clinical trial.⁹ A meta-analysis of clinical trials of peppermint oil (often enteric-coated to ensure delivery to the intestines and colon) for addressing irritable bowel syndrome (IBS) confirmed the efficacy of this treatment compared to placebo, although the quality of the trials was generally low.¹⁰

Carminatives are also frequently used with cathartic laxatives to reduce excessive colon spasms. In one clinical trial, a combination of *Senna angustifolia* (senna), a cathartic laxative, together with *Pimpinella anisum* (anise) and fennel as carminatives as well as *Sambucus nigra* (elder) fruit, was effective with good safety for short-term treatment for chronic constipation in Brazil.¹¹

A much stronger spasmolytic for use in the gut is *Atropa belladonna* (belladonna) leaf or root, a classic source of atropine that is a racemic mixture of (-)- and (+)-hyoscyamine.¹² This anticholinergic plant strongly inhibits GI smooth muscle as well as decreasing secretions in the gut. Belladonna is not generally grouped with the carminative herbs though it produces a



Dioscorea villosa (wild yam). Drawing © 2011 by Kathy Abascal, BS, JD, RH (AHG).

somewhat similar action, because most carminatives are more gentle and far safer. Hyoscyamine is sufficiently potent to relieve the pain even of peptic ulcers according to clinical trials, whereas most carminatives would not be sufficiently strong.¹³ Slight dry mouth and eyes are common side-effects of belladonna, but blurred vision, confusion, or any more-serious symptoms are grounds for discontinuation to prevent worse effects of overdose, including death.¹⁴ A typical dose of belladonna tincture is 8–10 drops three times per day.

Garrya flavescens (silk tassel) leaf is a milder anticholinergic herb native to the Sonoran desert.¹⁵ The plant's spasmolytic activity has not been investigated since the 1950s.¹⁶ Silk tassel also produces spasmolytic activity in the gallbladder. This herb is much less likely to cause adverse effects than belladonna. A typical dose of *Garrya* tincture is 1–2 mL, three times per day.

Gallbladder Spasms

Biliary dyskinesia is a condition in which gallbladder function is irregular and often decreased, although this is frequently the result of the gallbladder being in chronic spasm.¹ The European herb *Fumaria officinalis* (fumitory) is traditionally used to correct poor gallbladder function.¹⁷ We have previously written about fumitory as an herb incidentally noted to address gastroesophageal reflux (GERD) in patients simultaneously being treated for gallbladder dysfunction.¹⁸ A relative from India, *F. indica* (*pitpapra*) has been shown to be a calcium-channel blocking spasmolytic and a spasmogenic agent in atropinized guinea pig ileum.¹⁹ This tends to confirm the amphoteric nature of fumitory on the gallbladder and indicate that the mechanism of action is not a simple spasmolytic action. A typical dose of tincture is 3–5 mL, three times per day, with meals.

Peppermint oil (90 mg) inhibited gallbladder contractions significantly in one small human trial.²⁰ There are precious



Valeriana spp. (valerian) root

few other studies on the ability of herbs to inhibit gallbladder spasms.

Clinically, *Dioscorea villosa* (wild yam) root is a fairly specific gallbladder spasmolytic. There is no research on this herb as a spasmolytic, but it has been observed to be clinically helpful. A typical dose of tincture is 3–5 mL, three times per day, with meals. More-frequent dosing may be necessary in patients with acute biliary colic, although total biliary obstruction should be ruled out in all such cases.

Cough and Bronchospasm

Many times, particularly after resolution of many of the symptoms of pulmonary infections as well as particular infections such as pertussis, patients develop spasmodic coughs that cause pain, interfere with sleep, and do nothing to promote healing. In such cases, spasmolytic herbs with bronchiolar affinity can be helpful. In addition, these herbs tend to be helpful for treating and preventing acute asthmatic bronchospasms. The current authors have previously reviewed several of these in this publication.²¹ Use caution in giving spasmolytics to patients with productive coughs as this could aggravate underlying disease processes.

Thymus vulgaris (thyme) leaf is of Mediterranean origin with a strong traditional history of use for treating spasmodic cough and asthma. Aqueous extracts of thyme, terpenoids including thymol and carvacrol, and flavonoids from thyme are antispas-

General Smooth-Muscle Relaxing Herbs Ranked by Potency

Very Potent (roughly from strongest to mildest)

- *Hyoscyamus niger* (henbane) herb
- *Datura stramonium* (jimson weed) leaf
- *Pulsatilla occidentalis* (western pasque flower) herb
- *Gelsemium sempervirens* (gelsemium) root
- *Atropa belladonna* (belladonna) leaf

Moderately potent (roughly from strongest to mildest)

- *Ammi visnaga* (*khella*) fruit
- *Piscidia piscipula* (Jamaica dogwood) bark
- *Garrya flavescens* (silk tassel) bark or leaf
- *Thymus vulgaris* (thyme) leaf
- *Ephedra sinica* (*ma huang*) stem (bronchiole/bladder-specific)
- *Salvia miltiorrhiza* (*dan shen*) root (vascular-specific)
- *Valeriana* spp. (valerian) root

Gentle (in no particular order)

- All carminatives*
- *Piper methysticum* (kava) root
- *Viburnum opulus* (cramp bark) bark
- *Viburnum prunifolium* (black haw) bark
- *Dioscorea villosa* (wild yam) root
- *Fumaria officinalis* (fumitory) herb
- *Eriodictyon* spp. (*yerba santa*) leaf
- *Hyssopus officinalis* (hyssop) herb
- *Prunus serotina* (black cherry) bark
- *Zingiber officinale* (ginger) rhizome
- *Crataegus* spp. (hawthorn) leaf, flower, fruit
- *Marrubium vulgare* (horehound) leaf

*See box with Selected Carminative Herbs.

modic in tracheal smooth muscle in vitro.^{22,23} A combination of dry extracts of thyme and *Primula veris* (primrose), an astringent herb, was superior to placebo for reducing coughing episodes in patients with acute bronchitis in one double-blinded, randomized trial.²⁴ Fluid extracts of the same two herbs were also effective, compared to placebo, for reducing coughing episodes in patients with acute bronchitis in a double-blinded, randomized trial.²⁵ The usual dose of a tincture of thyme is 1–3 mL several times a day for acute cough. Optionally, 1–3 drops of steam-distilled volatile oil could be substituted but should probably be avoided in small children or in pregnant women.

Ephedra sinica (*ma huang*) stem is a well-known bronchodilating herb with a long tradition of use in Chinese medi-

Selected Carminative Herbs

Eurasian natives

- *Angelica archangelica* (garden angelica) fruit or root
- *Carum carvi* (caraway) fruit and volatile oil
- *Foeniculum vulgare* (fennel) fruit and volatile oil
- *Heracleum mantegazzianum* (hog parsnip) fruit or root (low-dose)
- *Matricaria recutita* (chamomile) flower (can become bitter if heated for long enough)
- *Melissa officinalis* (lemonbalm) leaf
- *Mentha x piperita* (peppermint) leaf and volatile oil
- *Mentha pulegium* (pennyroyal) flowering top
- *Mentha spicata* (spearmint) leaf and volatile oil
- *Nepeta cataria* (catnip) leaf

North American natives

- *Angelica arguta* (sharptooth angelica) root
- *Dyssodia papposa* (pagu ) flowering top
- *Hedemora pulegioides* (pennyroyal) flowering top
- *Heracleum lanatum* (cow parsnip) root or fruit (low-dose)
- *Hyptis emoryi* (desert lavender) leaf
- *Mentha arvensis* (pol o) leaf
- *Monarda menthaefolia* (horsemint) leaf
- *Osmorrhiza occidentalis* (western sweet cicely) root
- *Satureja douglasii* (yerba buena) leaf

cine for what would be called asthma in Western terms.²⁶ Its alkaloid (–)-ephedrine has been shown to be antitussive in mice.²⁷ The whole herb relaxed tracheal smooth muscle in vitro.²⁸ Ephedra acts as an α - and β -adrenergic agonist on bronchial smooth muscle as well as having other antiallergic actions that may benefit patients who have asthma.²⁹ The dose of *ma huang* tincture is 0.5–1 mL every 15 minutes (up to 4 doses) for mild acute asthma or every 2–4 hours for spasmodic coughs. However, this herb is not appropriate for pregnant women or those who are lactating. Ephedra is illegal in the United States to use for weight loss but not for other purposes, particularly when prescribed by practitioners. Some states have even more stringent regulation. Do not exceed stated doses.

Some other traditional so-called relaxing expectorants include *Eriodictyon angustifolia* (narrowleaf *yerba santa*) and *E. californica* (*yerba santa*) leaf, *Hyssopus officinalis* (hyssop) herb, *Prunus serotina* (black cherry) bark, and *Lobelia inflata* (lobelia) herb. These have not been the subject of modern research. All but lobelia are quite mild clinically and require robust, frequent dosing (1 tsp every 2–4 hours) to produce any effect except in

very mild cases. The usual dose of lobelia tincture or extract is 0.5–1 mL every 2–4 hours, although even this dose can cause nausea or vomiting in sensitive people.

Dysmenorrhea

Uterine cramping related to normal menstruation (known as primary dysmenorrhea) is common and can range from mild to debilitating. In the mildest situations, this normal phenomenon does not require any medication, but when cramping begins to interfere with daily activities, many women look for relief. Herbal medicines can help significantly and, in many cases, avoid the need, for nonsteroidal anti-inflammatory drugs (NSAIDs) and their attendant adverse effects. In more-severe cases, secondary causes of pain and cramping (such as uterine leiomyoma or endometriosis) should also be considered.

Although fennel is generally considered predominantly a carminative active in the GI tract, this herb produces spasmolytic activity in other smooth muscles in the body. In one trial, fennel steam-distilled volatile oil 2% (25 drops every 4 hours) was compared to the NSAID mefenamic acid (250 mg every 6 hours) or no therapy over three menstrual cycles.³⁰ Fennel oil was superior to no treatment but somewhat less effective than mefenamic acid for reducing severity of menstrual cramps on days 2 and 3 of menses but not on any other day. Fennel oil was very safe in this study.

Zingiber officinale (ginger) rhizome is a well-known, effective antiemetic that can, depending on the patient, dose, and extract, act as a carminative or GI stimulant. This herb has been assessed in a double-blind trial for women with primary dysmenorrhea.³¹ A dose of 250 mg of ginger, four times per day, was compared to mefenamic acid (250 mg) or ibuprofen (400 mg) four times per day. All subjects took the medicine for 3 days from the start of menses. All three treatments were equally effective for reducing dysmenorrhea without adverse effects. The inflammation-modulating effects of ginger may also explain some of its benefits for dysmenorrhea.³²

Viburnum opulus (cramp bark) and *V. prunifolium* (black haw) traditional treatments for dysmenorrhea. For black haw, the bark and leaf are used.

Hypertension

Systemic vasoconstriction is a frequent component contributing to hypertension. Vasorelaxants are commonly included in traditional herbal treatments for hypertensive patients.

Salvia miltiorrhiza (*dan shen*) root is used in Chinese medicine as a Blood regulator, which somewhat translates into a vasodilator in Western medical terms. Dihydrotanshinone is a diterpenoid quinone from *dan shen* that partly acts as a calcium-channel blocker to dilate blood vessels.³³ Aqueous extracts of the herb were also effective in vitro for dilating vessels, and this action was largely the result of calcium-channel blockade and, to a lesser extent, of potassium-channel opening.³⁴

A combination of *dan shen* and *Pueraria lobata* (*ge gen*) spray-dried water extracts (6 g per day) improved flow-mediated vasodilation and reduced carotid intima-media thickness in patients with coronary artery disease significantly better than placebo.³⁵ A meta-analysis of trials on this same formula for treating unstable angina pectoris concluded that the formula is beneficial, although most of the studies were of low methodological rigor.³⁶

Chinese patients who had already suffered a transient ischemic attack (TIA) or ischemic stroke and had conventional therapy were assigned to one of two groups. One group was instructed to take a combination of tablets of aqueous extracts (extracts dried and pressed into tablets) of *dan shen*, *Panax notoginseng* (*sanqi* ginseng), and *Dryobalanops camphor* (*bang pian*). The dose was 250 mg three times per day. The other group received no additional treatment. The study duration was for 1 year.³⁷ At the end of this period, recurrence of TIA or stroke was significantly (~ 50%) less in the herb group, compared to the no-additional-treatment group, although overall mortality was no different. There was no difference in rates of intracranial hemorrhage. Several other trials have shown that *dan shen* can help relieve symptoms of neurologic deficits after acute ischemic stroke, although these trials were all methodologically very weak.³⁸

Black haw is another traditional spasmolytic for relieving high blood pressure (BP). Various tinctures of black haw were tested in vitro as vasorelaxants, and it was found that 30% ethanol extracts were five times more potent than 60% ethanol ex-

Black haw is another traditional spasmolytic for relieving high blood pressure.

tracts.³⁹ Human trials are not available. Typical doses of black haw tincture are 3–5 mL, three times per day, by itself, or less in combination formulas with other agents.

Crataegus laevigata (hawthorn) leaf, flower and fruit extracts have been shown to reduce blood pressure in at least two randomized, controlled trials.^{40,41} One of these trials was in patients with diabetes mellitus who were not already responding to hypotensive medications (although these patients continued taking the medications). A double-blinded trial of *C. curvisepala* (Iranian hawthorn) flower tincture found it significantly more effective than placebo for lowering BP.⁴² Animal studies have shown repeatedly that hawthorn extracts can dilate coronary and other peripheral blood vessels.^{43,44} A typical dose of hawthorn tincture or glycerite is 3–5 mL, three times per day.

Marrubium vulgare (horehound) is more traditionally considered a relaxing expectorant, although it has also been shown to relax blood vessels in spontaneously hypertensive rats.⁴⁵ It is not clear if this is truly relevant to humans clinically or not.

Acute Renal Colic

The pain of passing a kidney stone is largely the result of spasm in the ureters. Though this movement can potentially break stones up and move them out of the ureters, the pain this causes is generally too intense for people to withstand. Spasmolytic herbs have been clinically effective for controlling ureteral spasm in such cases while using diuretic herbs to push sufficiently small stones through the ureters more slowly and tolerably. There are, unfortunately, few studies on this process, but the current authors have had success with it in practice.

Previously one of the current authors (E.Y.) and Selena Heron, ND, have discussed this subject in this publication in more depth.⁴⁶ Some of the more potent spasmolytic herbs that have been reliably effective in this realm include *Ammi visnaga* (khella) fruit, which is also strong enough to use for angina pectoris and acute asthma, lobelia, *Piscidia piscipula* (Jamaica dogwood) bark, gelsemium, and Western pasque flower. *Hyoscyamus niger* (henbane) herb is also useful; it is an even stronger anticholinergic antispasmodic like belladonna but with an affinity for the genitourinary tract. Typical doses of *khella* tincture are 1–3 mL, three times per day, or more often, as needed. Typical doses of henbane 1:5 tincture are 3–5 drops, three times per day, or as needed until a slight dry mouth or dry eyes develop.

Conclusion

Spasmolytic herbs have a long history and wide range of useful applications in medicine. Many examples that have proven effective in clinical trials have been discussed here. Sometimes, these herbs are not sufficient, particularly in more-severe conditions, but do represent an effective and potentially cheaper, safer approach than pharmaceuticals for patients with milder spasmodic conditions. ■

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