Viewpoints on a Common Weed: Lythrum salicaria

by Sarah Eisenberg

Introduction
In a thought-provoking essay titled *The American Extra Pharmacopoeia*, David Winston (2000) lays out the limitations of a shrinking materia medica in contemporary western herbal practice. He goes on to propose that a number of "adventurous, hardy" plants, including introduced species that are commonly viewed as "invasives" for their ability to crowd out native habitat, offer unexplored opportunities to expand our repertory. He further suggests the harvesting of such plants for medicinal use as an alternative to "unsound chemical treatment" aimed at ridding habitats of invasives (pp. 40-41). This paper explores the potential and practicalities of pursuing such a strategy by reviewing the literature on *Lythrum salicaria*, Linne (purple loosestrife), one of the plants mentioned in Winston’s essay.

**Lythrum salicaria: invasive character and impact**
*Lythrum* was introduced to the United States from Eurasia in the early 1800s as a perennial ornamental. The plant spread widely through North American wetlands via ship ballast and wool (Hager 2004; Blossey 2002). It is now found in monocropic stands in all states with the exception of Florida, Alaska, and Hawaii (Blossey). Nearly 200 years after its introduction, President Bill Clinton issued an executive order creating the federal Invasive Species Council, recognizing the economic, ecological, and human health costs of invasive species, authorizing the development of a federal plan to prevent their introduction and control their spread (Alliance 2003).

In the absence of natural controls occurring in a native habitat, *Lythrum* is an opportunistic invader, moving into disturbed open space where biodiversity has already been reduced (Uveges et al 2002). There it flourishes in "large nonspecific stands" (Hager 2004), establishing dense mats of substrate, with mature root stocks weighing in at greater than 1 kg (Blossey). These growth patterns shift the local ecosystem: water level and moisture are reduced; patterns of nutrient availability, such as soil nitrogen cycling and mycorrhizal associations, are altered; light penetration drops; and erosion rates change (Alliance; Blossey). Wetland begins to dry out and fill in.

Control of *Lythrum* can be highly labor-intensive, requiring hand-pulling of the plants (Alliance). Herbicides may be applied to foliage or injected into basal bark in existing stands. Pre-emergent treatment may be applied to areas recently cleared of the invasive. Persistence in the soil varies among herbicides. All of these approaches require long-term monitoring of restored areas.

Blossey reports on a third approach, the use of pathogens and insects commonly associated with *Lythrum* in its native European habitat and with potential to act as the natural enemies missing from American eco-systems. In several instances test agents released into local ecosystems resulted in suppression of *Lythrum* through widespread defoliation. The reappearance of native plants has been observed in at least one instance. Despite these initial results, many questions remain about the outcome of introducing non-native organisms into ecosystems and the replacement ecosystems that might emerge.

An ecological flip-side: bioremediation
Several studies investigating the tolerance of *Lythrum* to specific ecosystem pollutants suggest its invasive character may offer some protective benefit by means of bioremediation.

Sara Eisenberg is a Clinical Intern in Herbal Medicine at the TAI Sophia Institute in Laurel, Maryland. She has more than thirty years’ experience as an educator, change agent, community-builder, group facilitator, and clinician in academic, organization and therapeutic ecosystems. Sara’s experience in bridging the approaches of conventional medicine and traditional healing arts includes seven years as Director of the Center for Health Enhancement at St. Joseph Medical Center in Baltimore.
Lythrum demonstrates the ability to take up Flumequine, a quinolone animal antibiotic frequently used in intensive aquaculture. (Migliore, Cozzolino et al 2000) The drug has a half-life of up to 150 days in surface sediment, and may alter an ecosystem (p. 741). Both single and multiple concentration models were used in the study. While chemical concentration in the plant is not directly related to exposure level, Lythrum could be used as a “canary in the coal mine” to track Flumequine contamination in an ecosystem and point to its potential function in bioremediation.

Uveges, Corbett et al (2002) looked at Lythrum’s ability to flourish in waste areas and roadside ditches where toxic runoff accumulates. Lythrum was found to tolerate lead up to a concentration of 2000 mg/L. The authors drew no conclusion as to whether Lythrum’s capacity for lead uptake might give the plant a competitive edge over native plants in a lead-polluted environment. Still, in regard to its survival in this situation, Lythrum improved eco-system health in one respect even while spreading as an opportunistic invader.

**Definition of drug and primary constituents**

Bruneton (1999), referring to the 1998 French Pharmacopoeia (10th Edition), lists the official drug as the flowering tops of *Lythrum salicaria* L. containing not less than 10% tannins. Also found in the drug are anthocyanins (in the flower), orientin and vitexin (flavone C-glycosides), and gallotannins.

Duke’s analysis of Lythrum’s constituents (2005) identifies 16 tannins; the tannin content is high enough that Lythrum has been used to tan leather (Grieve 1971).

**Traditional and current uses**

Lythrum is described as odorless, with an astringent taste that becomes mucilaginous and soothing as it is chewed, and viscous as a decoction (Christopher 1974; Remington, Wood et al 1918; Felter & Lloyd 1898).

Winston reports a history of common use in Europe for the dried, flowering *Lythrum*. Dioscorides is said to have recommended it for dysentery, as an anti-hemorrhagic and vulnerary, and for moderating menstrual flow (Cadavid & Calleja 1980), uses that are consistent with the presence of the significant amounts of tannins that have been identified in *Lythrum spp.* (Duke). Bruneton includes *Lythrum* in his review of traditional phytotherapies of tannin-containing drugs. He cites its use for "subjective symptoms of venous insufficiency," hemorrhoids (both oral and topical use), mild diarrhea, and locally for pain associated with mouth or throat conditions.

Felter and Lloyd catalog *Lythrum* as a demulcent and astringent decoction for colicrectis, summer complaints of children and diarrhoeas; locally for chronic ophthalmic ulcers and skin conditions; and as a wash or poultice for leucorrhea, gleet (gonorrhreal discharge), and chronic gonorrhea. The Dispensatory of the United States of America (Remington, Wood et al 1918) similarly cited its use in diarrhoea and chronic dysentery. Grieve (p. 497) reports its uses with fever and liver conditions, and as “a warm gargle or drink [to cure] quinsy or a scrofulous throat.”

Maude Grieve states (p. 497): "It has been stated to be superior to Eyebright for preserving the sight and curing sore eyes, the distilled water being applied for hurts and blows on the eyes and even in blindness if the crystalline humour is not destroyed." *Eyebright* spp. (eyebright) is on the United Plant Savers’ at-risk list, (Gladstar 2000). Sara Katz (2000, p. 103) recommends using only cultivated resources if they can be found. *Lythrum* might well be added to the list for topical use in particular eye problems.

The uses described for *Lythrum* are echoed in ethnobotanical reports (Duke), with a unique local use in an Iroquois decoction "for fever and sickness caused by the dead” (Morrison).

In the U.S. as late as the 1970s Dr Christopher (1974, p. 91) praised *Lythrum* highly in his chapter on alteratives as "one of the most useful alterative and astringent herbs... Its healing influence extends to the mucous, secretory, vascular, and nervous systems. Its astringent action is potent but not drying, as it promotes secretions of the mucous membranes and leaves them moist. It has special affinity for the liver, kidneys, bladder and biliary systems. Its astringent and tonic properties are valuable for interstitial problems, wherein it promotes secretions of the mucous membranes and strengthens the muscular fibers.” He lists actions of *Lythrum* as an alterative, anti spasmodic, diuretic, diaphoretic, astringent febrifuge, tonic, demulcent, and cholagogue.

Winston has brought forward the traditional uses, adding to his list certain distinctly contemporary

A summary of contemporary research

Hypoglycemic activity: Lamela, Cadavid et al (1985) report a folk medicine use for hypoglycemic activity of Lythrum at a daily dose of 4-5g fluid extract. During the 1980s several related inquiries were carried out to study this activity of the plant. Plants for these studies came from the same location on a Spanish riverbank.

Cadavid & Calleja carried out a preliminary study on the effects of various Lythrum extracts on fasting male and female normoglycemic rabbits and glucose-induced hyperglycemic animals. They reported the greatest hypoglycemic activity with extracts of the stem, followed by the flower and then the leaf, with the root as inactive. Four hours after oral administration maximum hypoglycemia was evident in the normoglycemic rabbits. Increased insulin was found to occur with the drops in blood glucose, suggesting “that the active principles of the plant may act by provoking the liberation of insulin” (p. 563).

Lamela, Cadavid et al evaluated the hypoglycemic activity of various Lythrum stem and flower extracts on normoglycemic rats, looking at serum insulin and blood lipids, and at in vitro lipid metabolism and isolated islets of Langerhans. Effer extracts from stems were shown to be the most effective hypoglycemic agents. At the point of maximum hypoglycemia the following additional effects were noted: 30% decrease in triglycerides, 80% increase in free fatty acids, and no significant change in total cholesterol. The authors conclude that among other things the extracts seemed to act directly on adipose tissue in vitro.

Lamela, Cadavid et al (1986) followed with further murine studies of the effects of stem and flower effer extracts in glucose and epinephrine-induced hyperglycemia. They found the hypoglycemic effect peaked 30 minutes after glucose-loading, the time when control group levels were highest. Peak results at four hours post administration. In another diabetic-induced rat population, animals receiving the extract showed significant enzyme variations relative to diabetic controls. The elevations in serum enzyme activity represent the metabolic ‘lesions’ that characterize diabetic state.” (p. 159).

Hypoglycemic activity: Lamela, Cadavid et al (1985) report a folk medicine use for hypoglycemic activity of Lythrum at a daily dose of 4-5g fluid extract. During the 1980s several related inquiries were carried out to study this activity of the plant. Plants for these studies came from the same location on a Spanish riverbank.

Antioxidant activity: Coban, Citoglu et al (2003) tested Lythrum extract in vitro for radical scavenging activity against super oxide anion and lipid peroxidation. The extract showed anti-oxidant activity, but lower than other plant extracts in the study (Centranthus longifloris, Plantago major, and Juglan regia). Results showed...
Concentration-dependent inhibition of lipid peroxidation. Duke's analysis cites anthocyanins and chlorogenic acid among the phytochemicals found in Lythrum with potential to affect oxidation, peroxidation and inflammatory process.

Antimicrobial activity: Cadavid & Calleja cite a 1954 study by Vincent and Segouac demonstrating Lythrum's activity against Staphylococcus and dysenteric Bacillus.

In a more recent study Rauha, Wolfender et al (2004) included Lythrum as one of 13 phenolic substances and 29 extracts investigated for their activity on selected bacteria and fungi. Lythrum extracts showed the highest activity among the tested agents against Candida albicans. Plant material of Lythrum was air-dried herb obtained from a private individual and extracted in methanol. The authors suggest conducting further investigation into the antimicrobial use of Lythrum, Filipendula ulmaria (meadowsweet), Berula palustris (white birch), and others as food preservatives.

Interactions with pharmaceuticals: Laitinin, Tammela et al (2004) investigated the effects of various food supplements and food fractions on drug absorption in vitro. They used a Lythrum extract prepared according to Rauha, Wolfender et al (2004). Lythrum's potential effects on drug absorption alongside extracts of Linum usitatissimum L. (flax seed), Prunus syravus L. (plum), Betula pubescens (white birch), and others as food preservatives. Duke's analysis cites anthocyanins and concentration-dependent inhibition of lipid peroxidation. Duke's analysis cites anthocyanins and chlorogenic acid among the phytochemicals found in Lythrum with potential to affect oxidation, peroxidation and inflammatory process.

In vitro results reported above should not be overstated, given that tannins in general are noted for their potential to affect the absorption of other substances (Mills & Bone (2000)).

Conclusion: potential and practicalities

Land development, with its ecological disturbances that invite Lythrum's proliferation, will continue to put more plants at risk (Winston). At the same time, conventional pharmacological approaches to researching plant efficacy will continue to put more widely used plants at risk of a scientific "ax" for medicinal use.

Traditional uses reported for Lythrum have been consistent over history and may be consistent with the plant's key constituent profile. With Euphrasia's stature as an endangered plant not suitable for ethical wild-crafting, and the difficulties of cultivating it (Katz), there could be a niche use for Lythrum in the 21st century. Similarly, with non-insulin dependent diabetes (NIDDM) and metabolic syndrome capturing medical attention and popular headlines as current major threats to public health in the US, "new" potential plant sources such as Lythrum that demonstrates hypoglycemic activity should be investigated.

While the official drug for most traditional uses consists of the flowering tops, Cadavid and Calleja's preliminary findings on the hypoglycemic effect of Lythrum stems suggest that wildcrafters may have an opportunity to harvest two herbal medicines from the same plant. There may also be a future for Lythrum medicinal use as an antifungal specific to Candida albicans.

Key to a rigorous assessment of Lythrum's potential is a thorough comparison with other medicinals: are the niches suggested above real and useful? Might there be other applications or extrapolations for this plant with its useful and uncommon combination of astringency and demulcency? How might its anthocyanin activity stack up in comparison with that of other herbs, such as Vaccinium, already widely used?

A second key in pursuing rigorous assessment is assuring the safety of the plant material by differentiating between clean and contaminated stands of Lythrum. One can hope that in its prolific spread, significant contaminant-free areas can be identified. It would be unfortunate to find that Lythrum medicinal value is at-risk while the plant itself remains an ecological nuisance.
If we are both fortunate and smart, we may learn to simultaneously tend to our health and the health of the land. Taking advantage of harvesting opportunities in clean environments, embracing an opportunity to build the extra pharmacopoeia, and welcoming Lythrum’s bioremediating presence in polluted ecosystems, we may build a sustainable materia medica, a sustainable future.

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