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Mile-a-minute Weed, (Polygonum perfoliatum L.), an Invasive Vine in Natural and Disturbed Sites

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ABSTRACT

Polygonum perfoliatum L. (Polygonaceae) or mile-a-minute weed, from eastern Asia, has been spreading through wild and disturbed areas of the mid-Atlantic United States. It has a wide ecological amplitude and is found on stream banks, moist thickets, roadsides, nurseries, wood-piles, clearings, and ditches. *Polygonum perfoliatum* presents serious problems for reforestation because it thrives where forests are clear-cut. A southward direction of spread indicates that the species will probably proliferate in at least some southern states. Mechanical control is not likely to be completely effective because seeds are often left behind. No appropriate biocontrols are known. The plant poses a threat to natural and restored ecosystems because of its capacity to grow rapidly and overgrow other species. It is expected to cover large areas unless it is controlled.

INTRODUCTION

Polygonum perfoliatum is a native of eastern Asia that was first collected in the United States in 1890 (Cusick and Ortt 1987, Hickman and Hickman 1977). Agriculturalists, biologists, and others have indicated concern over the invasive nature of this plant. Hill et al. (1981) note that in the mid-Atlantic United States, it is a "widespread roadside and nursery weed" that reaches "noxious densities" and invades "orchards and estuaries". N.L. Hartwig, an expert on *P. perfoliatum* in the United States, contends that it is "a definite possibility that this weed could spread from coast to coast" (Wall Street Journal 1991). Hartwig also says: "If we ignore its presence, we may be creating conditions for full-fledged spread and infestation" (Rosellini 1991). This report is a review of the scientific literature concerning the plant.

Common names of *P. perfoliatum* include mile-a-minute, minute weed, tearthumb, and devil's tail tearthumb, alluding to the plant's rapid growth and to its tearing prickles. In Japan, the common name is ishimakawa (Cusick and Ortt 1987). Synonyms include *Tracaulon perfoliatum* (L.) Greene and *Persicaria perfoliata* (L.) Gross (Cusick and Ortt 1987).

DISTRIBUTION

Polygonum perfoliatum is native to a wide area of eastern Asia including Japan and the Philippines (Cusick and Ortt 1987); and Korea, China, the Malay Peninsula, India, and Bangladesh (Khan and Hassan 1978). It has more recently been recorded in western Asia, i.e., Turkey (Guener 1984). Records from these areas suggest that the plant originates in high-altitude temperate rather than subtropical or tropical locations (W.L. Mountain, pers. comm. 1996).

The first American record of the species is from the Gray Herbarium at Harvard University, dated 1890, from boat ballast near Portland, Oregon (Hickman and Hickman 1977). It was reported from British Columbia, Canada, in 1954 (Hill et al. 1981) but this was apparently the last report of *P. perfoliatum* from western North America. Collections from York County, Pennsylvania, including a 1946 collection from an orchard, probably originated as seed contaminants from rhododendron nursery stock imported from eastern Asia in the 1930s (Hill et al. 1981).

Polygonum perfoliatum spread into other states over the last 25 years, and was reported from Maryland (Riefner and Windler 1979), West Virginia (Duppstadt 1981), Virginia (Bradley 1983), the District of Columbia (Cusick 1986), and southern Delaware (Hartwig, pers. comm. 1992). It has recently been reported in 22 counties in Pennsylvania; 15 counties in Maryland; Delaware; two counties in West Virginia; at least one in Ohio; two in New York State; four in New Jersey; five counties in Virginia; and in District of Columbia (W.L. Mountain and Pennsylvania Department of Agriculture, pers. comm. 1995). In these areas, the plant has increased dramatically. Reed (1979b) observed that in Baltimore County, Maryland, many roadside embankments were "solid" with the species, perhaps because of dispersal by roadside mowers. Reports from the literature suggest, therefore, that this exotic species has not only become established but has begun to replace extant vegetation and is probably extending its range southward and westward.

DESCRIPTION AND IDENTIFICATION

Mile-a-minute weed is a prickly annual vine, easily identified by deltoid leaves, backward-bending barbs on the stem, and iridescent blue fruits (Hill et al. 1981). It is seldom found as single individuals but becomes locally abundant in dense populations. Stems are elongated, branched, and green, becoming woody and redbrown toward the base. Spikes of 1–2 mm length arm the stems, petioles, and primary and secondary leaf veins (Figure 1). Leaves are perfect triangles, 2.5–7.5 cm in length and width and appear thinly membranous and pale green (Figure 2; Mountain 1989). The leaf apices are acute and the bases truncate. Sheaths at the nodes are saucer-shaped and completely encircle the stem, hence the specific epithet, *perfoliatum*.

The perianth is 3–4 mm long. The persistent calyx thickens around the developing achene to produce an iridescent blue fruit resembling a berry, ca. 5 mm in diameter (Hill et al. 1981), which at maturity contains a single black shiny seedlike achene, about 3 mm in diameter (Mountain 1989).

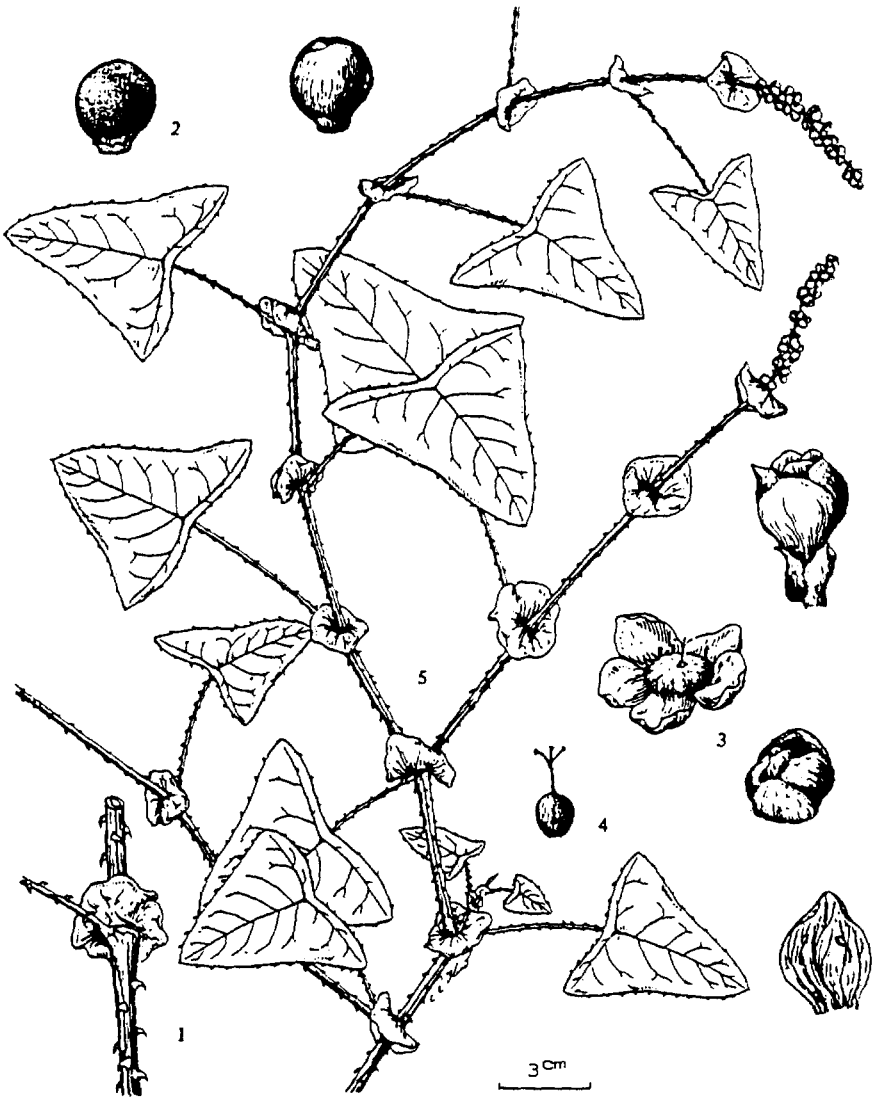

Figure 1. *Polygonum perfoliatum,* showing ocrea (1), nut (2), flower (3), pistil (4), and habit (5). Reproduced with permission from Li et al. 1976.

BIOLOGY

Polygonum perfoliatum is an annual that propagates from seeds each spring (Mountain 1989). In the temperate climate of southern Pennsylvania, it establishes seedlings by late April (Hill et al. 1981), grows rapidly from May through August, and produces mature fruits from mid-July to November. In the autumn,

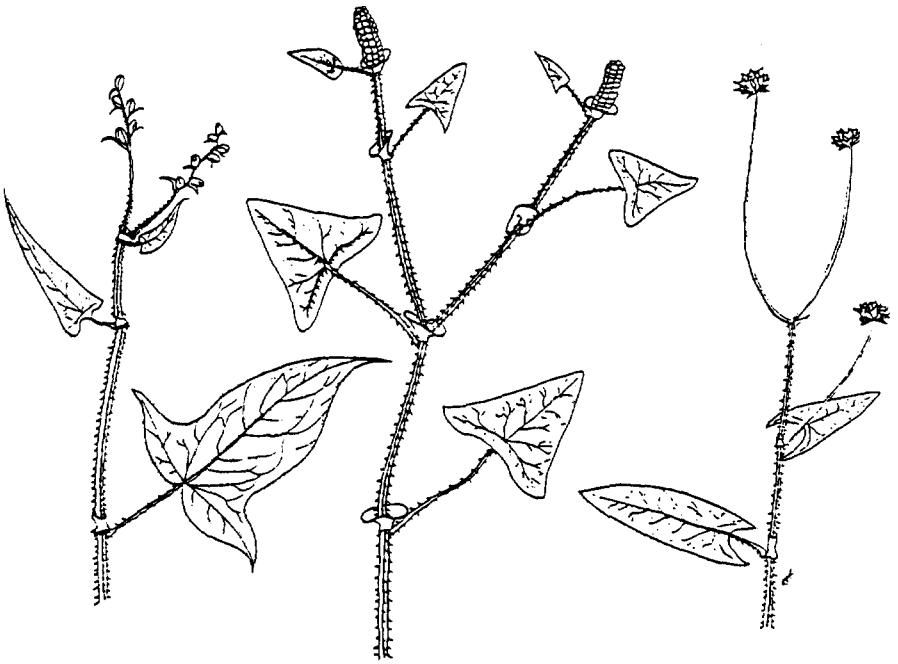

Figure 2. Line drawings of *Polygonum arifolium* (left), *P. perfoliatum* (middle), and *P. sagittatum* (right). Reproduced with permission from Riefner and Windler 1979.

the fleshy, pendulous fruits are suitable for dispersal by birds and rodents (Mountain 1989). Seeds are also carried downstream in rivers and streams, especially during flooding; and may be artificially dispersed by transported logging equipment (McCormick and Hartwig 1995).

Common habitats for *P. perfoliatum* are mostly disturbed areas, but undisturbed areas are also colonized. Disturbed habitats include roadsides, edges of woods, nurseries, wood piles, fallow fields, clearings, moist thickets, and ditches (Mountain 1989). Natural habitats include wet low ground such as low meadows, as well as open stream banks. The plant generally grows in areas that have abundant plant litter, such as leaves, decayed organic matter, or brush on the soil surface that keeps the seeds moist. Riefner and Windler (1979) state that it displays a marked preference for moist, well drained habitats. It has some tolerance to shade but grows best in sunny locations (Mountain 1989). Preliminary greenhouse trials suggested that a cold, moist treatment of several weeks was needed to overcome dormancy and cause germination (Mountain 1989). Ambient temperatures might limit the reproductive potential of *P. perfoliatum* in subtropical regions of the United States (Mountain, pers. comm. 1996).

Mile-a-minute weed not only produces numerous fruits, but a high rate of seed set which is consistent with its rapid geographic spread. However, little is known about the numbers of seeds released (Mountain 1989). *Polygonum per-*

foliatum is being reported with increasing frequency from Atlantic coast states but it is relatively new to the area and not concentrated in any one location, and estimates of population densities have apparently not yet been made.

IMPORTANCE

The plant is a viny colonizing species with the ability to outcompete the native United States flora in some habitats (Hill et al. 1981). Plants form tangled mats that climb 6–8 m over shrubbery and understory trees, shading out herbaceous and woody vegetation beneath (Rosellini 1991). Native taxa such as elderberry (*Sambucus canadensis* L.) and brambles (*Rubus* spp.) are overgrown and killed (Moul 1948).

Polygonum perfoliatum has no known economic value, and is a pest species in American parks and gardens. Along Deer Creek in Deer Creek State Park, Pennsylvania, for example, picnickers and campers have been annoyed by dense thickets of this prickly species (Reed 1979a).

Some dispute exists about the degree of weediness of the species in its home range. Mountain (1989) states that in Japan and Korea, plant scientists indicate it is a weed of minor significance with little or no agricultural significance. Holm et al. (1979) describe *P. perfoliatum* as a common weed in Japan, i.e., one that is very widespread in many crops or regions, requiring constant effort and expense to hold at bay, but never seriously threatening a crop. Cusick and Ortt (1987), however, state that it is a major agricultural pest throughout its home range but they do not cite sources, nor state how it behaves as a pest.

The appearance of the species in orchards and nurseries in the United States suggests that it is a weed of economic significance (Hill et al. 1981). Viable seeds are transported in the rootballs of nursery stock or when attached to barbed stems.

The plant thrives in areas where forests are clear-cut for timber, and commonly interferes with commercial forest regeneration (McCormick and Hartwig 1995). Populations can cover an area at about the time of tree replanting and smother tree seedlings.

In general, *P. perfoliatum* poses an invasive threat to a wide range of habitats in the United States. It will probably continue to enter a number of native as well as disturbed habitats, and threatens to become a problem in ecological restoration and reclamation sites, unless it is controlled.

MANAGEMENT OPTIONS

The herbicide Roundup effectively controls dense stands of *Polygonum perfoliatum* in dry habitats (Hill et al. 1981). Rodeo, the aquatic version of this glyphosate herbicide, should be effective in wet areas. In a reforestation clear-cut, a late postemergence application of Arsenal (imazapyr) killed the vines while Velpar (hexazinone) was effective for preemergence and postemergence treatments (Mountain 1989). Recent field studies indicated that low preemergence rates of Arsenal, Velpar L, Oust (sulfometuron methyl), AAtrex (atrazine), Pursuit (imazethapyr) and Pursuit Plus (imazethapyr + pendimethalin) were highly effective in controlling the plant (McCormick and Hartwig 1995). Of these herbicides, Roundup and Arsenal provided the best postemergence control. Pre-

emergence applications of most of these herbicides were more effective than postemergence applications (McCormick and Hartwig 1995). For preemergence treatment, herbicide must be applied before germination, which starts in Pennsylvania around April 1, and presumably earlier further south (Mountain 1989).

Polygonum perfoliatum can be controlled by mowing or cutting (Mountain 1989). This must be done early in the warm season before excessive vining and seed set. Gloved hand or rake removal is practical for small horticultural areas but seeds may be left behind, and this can cause future infestations.

Areas of heavy deposits of dead and decaying plant matter should be cleared, if feasible, to reduce the mulch available to seeds (Mountain 1989). Since brush piles and old wood piles provide ideal habitats, they should be eliminated where appropriate, e.g., by fire.

Polygonum perfoliatum is an introduced pest with no important natural enemies, at least not in the United States (Mountain 1989). Surveys in Pennsylvania have illustrated that although numerous insect species feed on this plant, they have little apparent effect on it. These native insects are predominantly ectophagous, sap and foliage-feeding insects (Wheeler and Mengel 1984) and are not very useful for biocontrol because they are polyphagic on a number of other hosts. *Polygonum perfoliatum* contains anthocyanin pigments, including malvidin 3,5-diglucoside in the pericarp and cyanidin in the stem (Yoshitama et al. 1984). Insect herbivores from eastern Asia which feed on the plant should be tested as biocontrols. One beetle that has been tested in China is *Gastrophysa atrocyanea* (Xiaoshui 1991). Although it feeds on *Polygonum perfoliatum,* it is not monophagous. It feeds on other plants such as native *P. hydropiper* and other Polygonaceae, so it is not appropriate for use as a biocontrol.

SUMMARY

The exotic species *Polygonum perfoliatum* has been spreading through wild and disturbed areas, including low wet habitats, in the eastern United States. It is a fast-growing vine that quickly covers large areas of the landscape, somewhat like kudzu, *Pueraria lobata* Willd. Ohwi. Tolerance for shade, sunlight, dry, and wet soil conditions results in a significant rate of natural colonization. The southward direction of spread suggests that this plant will probably proliferate in a number of southern states, unless it is actively controlled.

Prospects for herbicidal control have been partially evaluated. Mechanical methods are not likely to be completely effective because seeds are often left behind. No appropriate biocontrols are known, at least not yet. If *Polygonum perfoliatum* enters more states, it may come to dominate larger areas. The plant poses a threat to natural and restored ecosystems because of its capacity to rapidly overgrow other species and outcompete native plants. Since it competes with and replaces other plants that provide good habitat and food for native mammals, it could have a negative economic impact on money-generating hunting and tourism industries.

In general, further investigation of this little-known weedy species might benefit various avenues of plant research. Not only might weed control be enhanced, but our knowledge of colonization, population growth, and other demographic aspects of plants might also be significantly enhanced.

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