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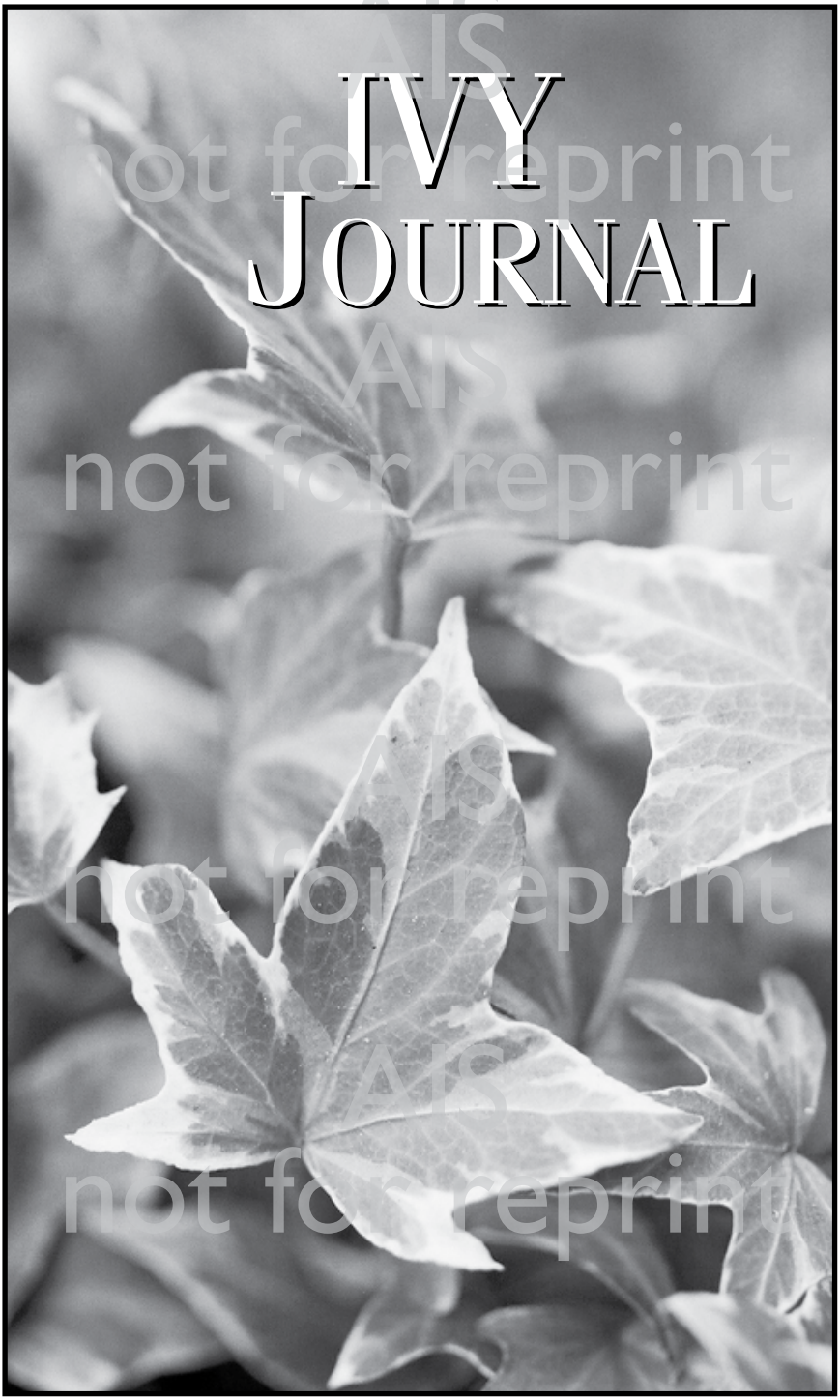

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General Information
American Ivy Society
P. O. Box 2123
Naples FL 34106-2123 U.S.A.

Membership
American Ivy Society
P. O. Box 2123
Naples FL 34106-2123 U.S.A.

Press Information
Suzanne@hvi.net

Ivy Identification, Registration
Russell A. Windle
American ivy Society
P.O. Box 461
Lionville, PA 19353-0461
IvyID@worldnet.att.net

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SPECIFIC IVY QUESTIONS

Growing Ivy Outdoors
Dr. Sabina Mueller Sulgrove
2624 Center Creek Circle
Spring Valley, OH 45370-9000

Commercial Growing
Frank Batson
19916 Mill Creek Road
Scotts Mills, OR 97375

Judging Standards
The American Ivy Society
P.O. Box 2123, Naples, FL 34106-2123

AIS CHAPTERS

Atlanta
Rosa Capps
575 Milligan Drive
Stone Mountain, GA 30083

Central Coast
Evelyn C. Maddux
700 Fairway Drive, Camarillo, CA 93010

Eastern
Russell Windle
P.O. Box 461, Lionville, PA 19353

Naples
Daphne Pfaff
696 16th Avenue South, Naples, FL 34102

San Diego
Pat Hammer
Samia Rose Topiary
P.O. Box 23-1208, Encinitas, CA 92023

Ontario
Barbara Furlong
26 Alcaine Ct.
Thornhill (Markham)
Ontario, Canada L3T2G7

REGIONAL IVY COLLECTIONS

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Ivy Display Collection
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Alexandria, VA 22308
Phone 703-768-5700

Preface

By

Suzanne Warner Pierot, President, American Ivy Society

There is inaccurate, emotional and inflammatory mis-information about ivies—mainly featured on websites by groups focusing on invasive plants—which has caused some states to introduce legislation to ban ivy. Because of this the American Ivy Society is devoting most of this year's Journal to the issue.

The American Ivy Society, along with growers of cultivars of *Hedera helix* and other species, is concerned that ALL ivies are being banned, when the problem ivy, *Hedera hibernica* 'Hibernica' is incorrectly called "English Ivy", a name that is the common name for *Hedera helix* and its cultivars. We note that although *Rosa rugosa*, is on the list of banned plants, ALL roses have not been banned.

Because of the prominence of these websites, their factual errors have been copied and recopied onto other sites, and then into compendiums on invasive plants, further perpetuating the inaccurate statements about ivies. The basis of such emotional hype has been suppositions, anecdotes, hearsay, and unjustified conclusions from incomplete studies, rather than on scientific facts, thorough case studies, or reasoned and careful assumptions. Such emotionalism about non-native plants, has led to hasty legislation to outlaw perceived threats to local ecosystems, with the end result of regulating business of an entire state or region.

It is irresponsible for narrow focus groups, like plant pest councils or native plant societies, to force legislative actions that damage statewide industries, without interaction with nursery groups—in violation of the St. Louis Declaration on Invasive Species (2001).

The American Ivy Society dedicates a majority of its resources to the careful, scientific classification of ivy. It is only through science that the individual characteristics of each species or cultivar can be determined. We, therefore, urge all those agencies involved in determining whether a species or cultivar is invasive to be more precise in their identification and then, perhaps, their efforts will be more focused and more successful.

This article by Dr. Sabina Sulgrove Ph.D, Taxonomist of the American Ivy Society is a reasoned discussion and literature citation of the facts.

Is Ivy Invasive? What's Known about Ivy.

AN OVERVIEW OF THE CHARACTERISTICS AND BEHAVIOR OF IVY, A REVIEW OF THE IVY LITERATURE, AND A DISCUSSION OF WHETHER IVY IS INVASIVE

By Sabina Mueller Sulgrove, PhD
Taxonomist, American Ivy Society
American Ivy Society Director of Research and Registrar, 1977-2003 (AIS 2003)

Author's Note: A great deal of in correct information about ivies is circulating on the Internet and in compendiums of invasive plants. Although there is a wealth of literature available on invasive species in general, both published and on the Web, the literature reviewed here will be applicable to, or refer to ivies.

In these ivy articles a great deal of confusion has been created over which kind or cultivar of ivy is being discussed. **The nomenclatural confusion** comes about because the common name for *Hedera helix* is "English ivy," and this same name is used in the commercial trade for the widely used ground cover, *Hedera hibernica* 'Hibernica', also known in the horticultural community as "Irish ivy."

The problem ivy on the US West Coast actually is *Hedera hibernica* 'Hibernica'**,** which is sold as a ground cover under the name "English Ivy." This cultivar, 'Hibernica', is unrelated to the species *Hedera helix* that has roughly 500 cultivars, mostly grown as pot plants. Because of the incorrect use of the names in legislative proposals to ban English ivy as a "noxious weed," *Hedera helix* and all its cultivars are being banned, rather than the cultivar, 'Hibernica', which is the problem in some parts of the country.

The American Ivy Society presents here documented information about ivies and how they grow, along with recommendations for homeowners on which "safe" ivies to grow and tips for responsible gardening, called "Living with Ivy Now!"

Because of the nomenclatural problems associated with using the term "English ivy," the term "ivy" is used herein to identify ivies that are NOT specified as *Hedera hibernica* 'Hibernica'.

Note about literature citations in the text: Where dates of web site articles are not identified in the web site, an estimate is made by using the date of the most recent literature citation in the references, followed by a "+". Where dates not given or estimates not possible, the abbreviation n. d., no date, is used, and the date of last accession is given.

I. BACKGROUND ON IVIES: THE GROWTH AND DEVELOPMENT OF IVY

In order to understand the ivy problems that have arisen on the Internet, it is helpful to have information about the origin of ivies and how they grow.

Where is ivy native?

The true ivy, *Hedera* (of the family Araliaceae), is currently composed of 16 species of evergreen, vining plants with palmately-lobed leaves with palmate venation. Ivies are native to parts of Europe, including Eastern Europe, northern Africa, India and Nepal, southeastern China, Japan, and Korea.

How Does Ivy Grow?

Juvenile Phase: The Vine. Most people, if they recognize ivy at all, will recognize it as a ground cover, something green that grows in the shade where nothing else will grow. The vines grow along the surface of the ground (or are partially obscured by the litter), but the stems are not underground, with possibly one rare exception: *Hedera helix* var. *rhizomatifera*. The rhizomatous nature of this plant has not been seen in cultivation in the US. No other ivy is rhizomatous with underground stems and only the leaves and petioles above ground.

Ivy is not fussy as to soil type, and although the vines are able to grow in shade, they can also grow in the sun if given more water and fertilizer (Sulgrove 1987a).

Because ivy is a vine, it will continue to grow and spread as a ground cover year after year, unless winters are severe enough to kill vines back to older wood. Thus, pruning is periodically needed to keep ivies within bounds, especially in warmer climates where natural dieback does not frequently occur. When planting ivies as perennials in the garden, adequate space must be allowed for each plant.

Sporting in Ivy. Ivy is unique in that it is capable of sporting easily – both to something more interesting – and to something more ordinary. Most cultivars can revert to more ordinary, faster-growing, green vines. Some cultivars sport or revert more readily than others. Sports and reversions may be defined as a mutation or permanent change in the genetic material. Reversions are to something "less interesting," whereas a "sport" is a mutation or permanent change to something more interesting. Because plain, green reversions grow faster than the cultivar, these vines must be pruned out to keep them from overtaking the slower-growing cultivar.

To grow ivy as a perennial in the garden, choose an ivy that is in scale with the remaining plant materials and allow adequate space for growth. Take advantage of colors, textures, and contrasts of ivy to enhance four-season interest in the garden.

Dimorphism. What most people do not know is that is that ivy exists in two

phases: the more familiar evergreen vine and the lesser known upright, bushy adult plant that produces clusters of yellowish-green flower buds. Very few people, especially in climates where the ground freezes in winter, have even seen adult ivies in flower or fruit because killing temperatures prevent the formation of upright adult stems and flowering branches. In warmer climates the adult stage is a bushy "mop head" found high up in trees or high upon the walls of buildings, out of view of passersby.

Flowering most often occurs near the top of a tree or fence, or high up on a wall. Flowers are usually formed in late summer or fall, followed by dark blue or black fruits, depending on the cultivar, the following spring. However, in mild climates like the San Francisco Bay area, flowers and fruits can be found year-around in *Hedera helix* 'Needlepoint', (Coon 2001), and *Hedera helix* 'Gold Heart' may flower and set fruit twice a year (Coon, personal communication).

Of the 16 species of *Hedera* (Ackerfeld 2003), nearly all the cultivars grown commercially or by collectors are forms of *Hedera helix*, commonly called the English Ivy. *Hedera helix* and all its cultivars differ in a number of ways from the ivy that is sold in the ground cover industry as "English ivy", which is actually a cultivar of *Hedera hibernica*, named 'Hibernica'. The differences between *Hedera helix* and *Hedera hibernical* are summarized in Table 1, p. 19.

Where Do Cultivars Come From?

There are perhaps 500 ivies cultivated over the last 200 years, but roughly 95 percent have been selected and named in the last 60 years. The majority of the introductions have been of juvenile, vining cultivars. A compilation of the important literature on ivies before 1974 was prepared by Schaepman (1974) and amended by Sulgrove (1981). Sulgrove (2002) prepared a literature list of major publications on ivy after 1970.

Cultivars Selected from Sports. The true ivies are unique in that, among woody plants, *Hedera* has a prolonged juvenile phase, from which a large number of forms, or cultivars, have been named. Unlike the cultivars selected in many other woody groups, the cultivars are NOT selections resulting from crossing different strains (hybridization). In contrast, virtually all ivy cultivars have been selected from sports which have originated spontaneously as bud mutations, which in turn produced shoots that differ in leaf shape, color, texture, and/or size, or sometimes growth form. Only recently have seedlings from natural outcrosses of ivies been introduced as new cultivars, such as *Hedera helix* 'Rotunda', Goldfinch', and 'Crochet' (Coon 1997, 2000; Sulgrove 1997c).

Identification Using the Pierot Classification System. In 1974 Suzanne Warner Pierot wrote the first book on ivies since the monograph by Shirley Hibberd in 1872. In her book (Pierot 1974, 1995) Pierot devised a classification scheme to group ivy cultivars together into categories (for example, the Heart-Shaped ivies), based on leaf characteristics or shapes and growth forms. (See Sulgrove 1984c for

illustration of the Pierot system). The Pierot Classification is now being incorporated into the botanical nomenclature of *Hedera* (for example, see Hop, 2001) with the recent introduction of the Group concept (Article 4) in the *International Code of Nomenclature for Cultivated Plants* (ICNCP), commonly called the Cultivated Code (Trehane and others 1995). Only recently have a large number of adult cultivars been named as they have been introduced into the landscape trade both in Europe (Hop 2001) and in the US (Davis & others 1992; Davis 2000; and Sulgrove 2001b). Coon (2001, p. 30) states that, even though adult cultivars are more stable and less prone to bud mutations, they also are susceptible to sporting. Some cultivars, such as *Hedera helix* 'Gold Heart' and 'Gold Dust' easily send out all-green shoots that are more vigorous than the variegated adult shoots, and should be removed to avoid the green growth overgrowing the variegated plant. The adult form of *Hedera helix* 'Chester' often shows four distinct forms in addition to the typical variegation pattern (Coon 2001, p. 30).

THE TRANSITION STATE

Changes in Growth Pattern. Lee and Richards (1991) have outlined the changes that occur in *Hedera helix* from juvenile to adult. In addition, Bényei-Himmer (1999) has detailed the stages of ivy development, including the intermediate, or transition, phase. As these changes in growth habit from seedling to vining, to climbing, to adult phase takes place, the leaves change size, thickness, shape, and lobing; the leaf venation, leaf spacing, and leaf arrangement on the stem are modified; the woodiness of the plant increases; and ease of rooting decreases (Bényei-Himmer (1999).

Vining ivy grows as a ground cover, but it will grow up the trunks of trees that the vines encounter. Ivy is basically confined to the interior of the tree, limited to the trunk and large diameter branches (Heieck 1990, Wharton 1990). No one has documented that ivy prefers to climb certain trees over others, despite studies to find such a correlation (NIL 2004b; Murai 1999). Heieck (1992) has observed that ivy is less likely to grow up a light-colored or reflective surfaces, such as light-colored trees like birch (*Betula*) and white stucco buildings. But it appears, so far, that ivy has no preference, although some ivy have more difficulty climbing than others (Sulgrove 1983).

Ivy Vines Confined to the Interior of the Support Tree. Where you see deciduous trees in winter with ivy growing on it, you will note that the evergreen vines are confined to the central portion of the tree, and you can see the ends of the branches sticking out beyond the ivy. In contrast to ivy's use of adventitious roots to climb tree trunks, native and introduced grape vines (*Vitis*, spp), *Wisteria*, and Honeysuckle vines (*Lonicera*) clamber over the canopy rather than in it (Wharton 1990). Although the common ivy, *Hedera helix*, has the specific epithet "*helix*," the vines do not twine around twigs or small branches, nor do they surround branches (as stated by Swearingen 2000), nor do they strangle anything. Nor does *Hedera* have tendrils (as stated by Thomas 1980) or "suction discs" (as stated by Rose 1996), a term applied casually to the ends of the tendrils of the ornamental vine, Boston ivy

(*Parthenocissus tricuspidata*). (There are plants which are commonly called "ivy" (Sulgrove 1996), but they are not related to the true ivy, *Hedera*). Ivy climbs by means of unbranched adventitious rootlets that fasten to the surface of trees or walls. These rootlets do not exude a sticky or glue-like substance (as stated by Swearingen 2000), but simply adhere to the surface.

Ivy is Not Parasitic. Ivy roots do not penetrate the bark of a host tree (like mistletoe does), or "insinuate" into walls (as stated by No Ivy League, NIL 2001a). Ivy does not obtain water or nutrients from the supporting plant. (For the effects of vines on walls and trees, see Sulgrove 1997, Appendix B - 1).

Sub-Adult Condition. Once an ivy has begun to climb a tree, after sufficient time (age of plant) and if enough light is available (as when the top of a tree is cut off, Sulgrove 1997d), the vine goes through a transitional, sub-adult phase (Bényei-Himmer 1999). The ivy transitional state also can develop on a tree that is stressed and the amount of foliage is reduced (such as with anthracnose of Sycamore, Platanus occidentalis), or when the tree dies and more light is available. Some ivies, like *Hedera colchica* 'Sulphur Heart', may spend one or two years in the sub-adult stage (Coon 2001, p. 29). Schnitzler (1995, p. 232) cites work by Beekman (1984) and Oldeman (1990) that found that ivies will flower when the vines have ascended 4 meters up the tree, because at that height there is sufficient filtered light coming through the canopy to stimulate the onset of the adult stage. [Sulgrove's note: Of course, how high an ivy must ascend before reaching enough light must be related to how dense the canopy cover is for that kind of tree. Oaks have a dense canopy; black locust has filtered light coming through the small leaflets. The canopy of some conifers may be quite dense.]

Although Thomas (1980) studied light levels in a deciduous forest on a Potomac Island in Virginia, he did not correlate specific light levels with adult ivy formation. He noted only that ivy was growing where gaps occurred in the canopy, but did not indicate whether the ivy was juvenile or adult.

For more details on the transition state between vine and shrubby adult, see the section below on "Factors Influencing Flowering."

THE ADULT PLANT

What Does the Adult Plant Look Like?

As the vines approach maturity, the palmately-lobed and palmately-veined leaves, characteristic of the juvenile or vining phase, make a transition to unlobed, elliptical-to-ovate leaves. At the same time that the stems become upright and woody, Coon (1998) has noted in watching the development of adult *Hedera helix* 'Brandywine', that the spirally arranged leaves become closer together as the season progresses, and the leaves become narrower and longer than those of the juvenile (Coon 2001, p. 28). The petioles become shorter such that, just before the inflorescence forms, the

leaves are quite elongated and nearly strap-shaped. The stems and petioles of the adult plants are consistently a medium green, in contrast to most juvenile foliage, in which the stems are purplish or brownish-green (Coon 1998).

Inflorescence Development. Sulgrove (1997d, with additional observations on *Hedera helix* 'Buttercup') has noted that the first year an adult branch forms, the flowering branch is very simple, sometimes only a single umbel. The next year the flowering branch may have several stalked umbels. Thus, in climates where the vines and adult branches are periodically frozen back or the frost-free season or growing season is short, fruiting and seed production is low. In addition, where frost-free seasons are short, pollinators may also be unavailable.

Flowers. The yellow-green flower buds of the adult ivies are borne in inside-out umbrella-like clusters called umbels, and the umbels are arranged in racemes (a single branch with stalked buds) or in panicles (branched racemes). The flowers are symmetrical with 5 longitudinally ribbed petals, 5 stamens, and a pistil with a single style. The 5-yellow green petals that protect the internal flower parts usually quickly fall off as the flowers open [an exception is *Hedera helix* 'Parsley Crested' (Sulgrove 2001a)], leaving the 5 sepals attached to the developing fruit, so that there is a minute, 5-toothed ring near the top of the ripe fruit, denoting that the ovary is sub-inferior.

Coon (2001), in central coastal California, notes that an umbel may have as many as 60 flowers, [but not all will set fruit, Sulgrove observation]. The light green flowers in the San Francisco Bay area attract many bees, bumblebees, wasps, flies, dragonflies, and butterflies (Coon 2001, p, 32; Coon, personal communication 2004a). Whereas the flower buds of most cultivars lose their petals as the flower opens, those of *Hedera helix* 'Parsley Crested' are larger than usual and persist long enough to be noticeable (Sulgrove 2001a).

Davis (2004, personal communication) on the Eastern Shore of Virginia has noted that several kinds of flies, wasps/hornets, butterflies, and dragonflies pollinate *Hedera*. He has observed preying mantises lying in wait on the umbels, waiting for an insect meal to come by.

Fruits. Depending on the cultivar, or geographic race of a species that occurs within their natural range, the fruit may be dark blue or black, occasionally quite blue (as in *Hedera helix* 'Pedata', Sulgrove observation). Yellow-to-orange fruited forms, such as *Hedera helix* 'Poetica' and the recently discovered cultivar, *Hedera helix* 'Sand Hill', also exist, along with the well-known, orange-fruited *Hedera nepalensis*. A detailed description of the flowers and fruits of the cultivar *Hedera helix* 'Treetop', believed by the American Ivy Society (Sulgrove1993) to be the adult form of *Hedera helix* 'Pittsburgh', can be found in Davis, Bilderback, and Fantz (1992).

Bényei-Himmer (2000) and Udvardy and Bényei-Himmer (1999) state in their

studies of *Hedera helix* in Hungary that only 2-3 seeds (of 5) per berry in an umbel of 15 fruits are fertile, whereas in *Hedera hibernica* 4-5 seeds developed per fruit, in umbels of 25-30 fruits.

Coon has found that some ivy cultivars set far more seed than others. He says (Coon 2004b, personal communication), "Among my heavy fruiting ivies (in central coastal California) are *H. he*lix 'Needlepoint,' 'Chester', 'Bulgaria', and 'Gold Heart', *H. hibernica*; and (heaviest of all) *H. cypria*. On the other hand, I am fortunate to find viable seeds on *H. helix* 'California Fan' and 'Cockleshell'. The latter two cultivars also produce very few flowers."

Adult Foliage. Although the adult shrubs generally are reported to have unlobed leaves (Rose 1980, 1996; Fearnley-Whittingstall 1992), Coon (2001, p. 28) has found that juvenile cultivars with very narrow or deeply-cut lobes (Pierot Classification System: Bird's Foot category (Pierot 1995)) have strap-like leaves with small lateral lobes. The adults of *Hedera helix* 'Lalla Rookh' and *Hedera helix* 'Koeniger' always have consistently deeply lobed leaves (Coon 2001, p. 28).

FACTORS INFLUENCING FLOWERING (Maturation to Adulthood)

Although plant physiologists have been able to induce reversions to juvenility from adult plants (Robbins 1957, 1960), no one has yet found a way to make a juvenile become an adult. Despite this, several characteristics have been noted as playing an important role.

Factors. Coon (2001) and the American Ivy Society ([Sulgrove] 1997a,b) have observed that the length of time from juvenility to flowering is influenced by a number of factors:

1. Age of the plant. The plant must be old enough to have a well-developed root system.
2. Physiological maturity. Ivy cultivars that are morphologically closer to the adult form (have unlobed leaves, like the vining *Hedera helix* 'Tomboy', [Sulgrove 1997a, b]), will flower sooner than those that are more juvenile and have lobed leaves (Sulgrove1997a, b).
3. High light intensity helps to trigger adult formation (Sulgrove 1997a, b, d) and flowering in ivies. Where ivy has naturalized in the Santa Cruz Mountains of Northern California, adult ivy growth occurs only when ivy has climbed high enough to gain greater exposure to light; it is never seen on the ivy covering the forest floor (Coon 2001). Light also causes near-adult cultivars like 'Tomboy', if they also have a well-established root system, to become adult when shade is removed (Sulgrove 1997a, b, d).

4. A long growing season must be in effect. The climate must be mild enough to prevent freezing in winter or dormancy in summer (Sulgrove 1997a, b; Coon 2001). If winter temperatures are cold enough to freeze the late-season new growth, then continued growth the next season and subsequent development and maturation to the adult phase are prevented (Sulgrove 1997a, b). This explains why few adult ivies develop in colder climates.

5. Propensity for climbing (Coon 2001). Generally, cultivars that readily climb (a function related to the quantity of aerial rootlets that can form along the vine), are more likely to become adult than those which do not (Coon 2001). *Hedera helix* cultivars that quickly go adult are 'Dealbata', 'Needlepoint', *Hedera rhombea* 'Variegata' and *H. nepalensis* (Coon 2001). Coon (2001) also points out that other factors which might play a role in initiation of maturation, but have yet to be studied, are pH, nitrogen, phosphorous and potassium content, as well as the availability of trace minerals.

6. Adult formation from ground covers. Older ivy plants may appear to be sending up adult sprouts from a ground cover, but, with careful searching, a stump from a cut-off adult can often be found, or a rock which elevated the ground cover slightly and probably contributed to the development of the adult stems (Fletcher 2004). After 6 years as a ground cover in AIS trials in Southwest Ohio in full sun, *Hedera helix* 'Tomboy' sent up one adult stem with a single umbel, and then a more complex inflorescence the following year. 'Tomboy' is a cultivar that has small ovate, unlobed leaves, and is physiologically perhaps already a subadult that was easily able to transition to adult in a short time period, once an extensive root system developed (Sulgrove 1997a, d).

Ivies less Likely to Become Adult. Coon (2001), who has observed about 50 cultivars maturing to adulthood in his San Francisco Bay area garden in the last 30 years and another 10 in the last three years, made the following observations about which cultivars of *Hedera helix* are LESS likely to become adult in central coastal California:

1. Self-branching ivies are slower to reach maturity than non-self-branching cultivars.

2. Miniatures rarely reach adulthood, the exception being *Hedera helix* 'Midget'. Miniatures seldom mature to produce flowers and fruits; or if they do, the flowers are misshapen and fruits fail to form, as in 'Little Diamond'.

3. Curly-leaved cultivars hardly ever become arborescent, with the exception of 'Parsley Crested'; and 'California', which has been seen sporadically in the San Francisco Bay area.

4. Speckled-variegated ivies, with the exception of *Hedera helix* cultivars 'Gold Dust' and 'Minor Marmorata', infrequently become adults.

Not all cultivars mature to adult, fruiting specimens after the same length of time

(Sulgrove and Coon 1997). Some examples of times from juvenility to adult for cultivars growing in pots or in the ground in central coastal California vary from 3 to 12 years (Sulgrove and Coon 1997). *Hedera helix* 'Tomboy' and 'Poetica' may take as little as 3 years, while some, like 'Glacier, took 17 years. Some have not yet flowered even after nearly 20 years (*Hedera helix* 'California Fan'), despite full sun (Coon 2001, p 26). Even different plants of the same species may vary widely in their growth habits (Fletcher 2004) and presumably progress to adulthood at different rates.

PROPAGATION AND CARE OF ADULTS

It is possible to propagate the adult stage of ivy by taking 6-inch long softwood cuttings of selected vegetative adult shoots in August through December in Virginia (Davis 2000, p. 54). Rooting hormone is not absolutely necessary, but wounding the cuttings is important; bottom heat is not essential; and smaller cuttings are less successful according to Davis (2000, p. 54). Young adult plants may produce horizontally spreading juvenile shoots near the base of the plant (Davis, Bilderback and Fantz 1992). These shoots should be left on the plant until the winter of the following year because these shoots are necessary to encourage root growth (Davis 2000, p. 54). Older, propagated adult plants do not show this type of reversion (Davis and others 1992), but Coon (2001, p. 30) notes that the typical species *Hedera algeriensis* and its variegated cultivar 'Gloire de Marengo' revert back and forth in his climate, and that it is difficult to maintain a juvenile or adult plant of either one.

Adult plants are more sun-tolerant than their juvenile counterparts, which in turn are better-adapted to low light levels. Adults are not fussy as to soils, from clay to sand, if the soil is well-drained (Davis 2000, p. 53). Ivy shrubs can tolerate drought well, and in the San Francisco Bay area, can survive without additional watering through the dry season, May through October (Coon 2001, p. 30). Likewise on the Eastern Shore of Virginia, watering is required only at planting time in the fall, to allow the development of a substantial root system before the heat and drought of the following summer (Davis 2000, p. 54). Adults are hardy plants that can survive cold and drought and can succeed in a variety of soil conditions (Davis 2001).

Seed Germination in Ivies

It appears that the length of time for ivy seeds to germinate depends on how the fruits have been treated, and on the environmental growing conditions. Considerable variation is found among the studies on germination; not all researchers identified the species or cultivars studied.

Seed Germination Studies. Clergeau (1992a) studied germination times and percentage in *Hedera helix* (It is not clear whether the species studied was *Hedera helix* or *Hedera hibernica*, which is often lumped under *Hedera helix*). Clergeau compared ripe. whole fruit; cleaned seed sown at 9 deg. C and held for 15 weeks; and seed ingested by starlings and blackbirds and regurgitated. The germination percentages for cleaned seed were 97 percent, and 99 percent for regurgitated seed, while

whole, ripe fruit had a lower germination percentage of 53 percent (Clergeau 1992a, Table 1, p. 682). According to Clergeau (1992b) ivy germination times for whole fruit was from about 5 to 12 days and for cleaned or regurgitated seed about 3-5 days. Thus, the function of a bird is to remove the pulp from ivy berries, since both cleaned and regurgitated seed germinate in about the same time (Clergeau 1992a, p. 683).

Dirr (1990) found that stratification (under his conditions) was required after the seeds were removed from the fruit, and he was unable to get any germination from whole fruit. Dirr and Heuser (1987) found that only 70 percent of the seed is viable. Coon (1989) has obtained germination percentages close to 100 percent by using ripe fruit at the stage when berries start falling off the plant, then planting immediately after preparation. Fruits may contain 1 to 4 seeds, depending on the species and the cultivar, and some cultivars have infertile seeds (Coon 2000). The seeds are squeezed out of the pulp, cleaned, and soaked for 2-24 hours in water, dried, and any remaining pulp removed. The seeds were soaked an additional 2 hours and then sown just below the surface of damp vermiculite or other suitable starting medium (Coon 2000) and provided with bottom heat at 25-30 deg. C (77-86 deg. F.). If three days elapse between harvesting the fruit and preparing the seed, then the germination rate decreases to 50%; after one week the percentage is 20% (Coon 1989).

Germination will take place in 3 to 14 days, depending on the cultivar (Coon 2000). Without bottom heat germination percentages were low (Coon 1989). When seed flats were put outside under a tree, germination was poor and sporadic over a 6-month period and only 6 seed germinated at various times (Coon 1989). Seeds germinated on a paper towel gave consistently good rates over a four-month period (November through February), but seeds harvested late in the fruiting season had low rates (Coon 1989). Although germination on paper towels was good, germination on soilless mixes was low (Coon 1989). Coon (2000) notes that seedlings grow more slowly than cuttings; some grow true leaves very early; whereas others take 6 weeks to several months to produce true leaves. Seedlings can exhibit a wide range of growth habits in contrast to the uniformity of plants propagated by cuttings (Coon 2000).

Reichard (2000), in describing ivy seed germination in general, assumes that the ivy seed has a hard seed coat, and for seeds to germinate, the seeds must need scarification by passing thorough the gut of a bird. In contrast, in English studies, Snow & Snow (1988, p. 32) state that ivy seed, even when mature, are uncommonly soft—a feature that would result in damage to the seeds and lower germination percentages if they were to pass to through the gut of a bird. Clergeau 1992a, p. 680) also notes that ivy has soft-coated seeds.

Bényei-Himmer (2004a, personal communication) has studied seed germination in (cultivated) *Hedera hibernica* in Hungary and found germination percentages of 80-90 percent, but in *Hedera helix* it was only 50-60 percent. She did not identify her germination conditions.

Mill (2004, personal communication) reports that in Scotland *Hedera hibernica* does not fruit, and Hop (2004, personal communication) in the Netherlands has very poor fruit set in *Hedera hibernica*, which is not widespread. Low fruit set, Hop (2004, personal communication) speculates, may be due—not to lack of pollinators (there are plenty)—but rather because *Hedera hibernica* may not be able to self-pollinate, and there are too few clones or specimens to assure out-crossing. Udvardy (2004, personal communication) speculates that heat and drought at the time of fruit formation contribute to fruit abortion in lateral umbels of *Hedera helix*.

Both Windle, in Pennsylvania (2004, personal communication) and Coon (2004b, personal communication) in California, have found seeds germinating while still in the fruit, a condition known as vivipary. Under greenhouse and outdoor conditions Windle observed vivipary in the adult cultivar, *Hedera colchica* 'Green Spice', which is the adult stage of juvenile *Hedera colchica* 'My Heart', whereas Coon indicated it was a common occurrence in a garden setting [Bay area of California]. Whether vivipary improved overall germination that led to viable seedlings was not noted.

Richard Davis (2004, personal communication), studying seed germination for a wide variety of cultivars under diverse conditions and treatments, notes that in variegated ivies, immature fruits often fall off, or fruit never matures; or when seeds form, the seeds are not viable.

Pokorny (2004, see Appendix A - 4), in seed germination studies on the all-green adult, *Hedera helix* 'Lexington', had fruiting but no seeds three years in a row; and the fourth year had poor fruit set with no seed, or poor fruit set and low seed count with only 21% seed viability. Many of the flowers dropped early or did not develop mature fruit, although good fruit set and viable seeds were found at the same time for the all green *Hedera helix* 'Treetop' and 'Prince'—but not for other green adult cultivars.

It is clear from the above examples that fruit set may vary with environmental conditions and the conditions under which the seeds germinated. The species (*Hedera helix* vs. *Hedera hibernica*), as well as the cultivars, also influence fruit set and seed germination times and percentages. Further germination studies are needed to determine whether there is a difference in seed fertility depending on fruit position within an umbel or within an inflorescence. Udvardy (2004, personal communication) suggests that lateral umbels in some ivies are sterile because they mature later when environmental conditions (heat and drought) prevent fruit and seed maturation.

The Role of Birds in Seed Germination and Dispersal. It is very likely that birds start new colonies, but it is unknown how far birds can spread ivies. Murai's 1999 thesis indicated that all ivies in her study of 58 populations in the Pacific Northwest were within 500 meters of roads or buildings, but she did not indicate how close. No documentation has yet been found to confirm that isolated patches

of ivy occur farther than 500 meters from paved roads or buildings, nor what the size of the patches might be, nor how far the isolated sites are located from an adult colony.

In western France, Clergeau (1992a) studied the effect of birds on seed germination of four fleshy fruited plants, including *Hedera helix*. Ninety-three percent of the birds trapped were starlings (*Sturnus vulgaris*) and blackbirds (*Turdus merula*), the principle fruit-eating birds in Brittany farmlands. When it did not rain, it was possible to determine whether the seeds were defecated or regurgitated. Whereas both birds regurgitated and defecated seeds of *Solanum*, *Rubus*, and *Sambucus*, they only regurgitated the ivy (*Hedera*) seeds (Clergeau 1992b) singly, one after another, under natural conditions (Clergeau 1992a, p. 684). In *Hedera*, regurgitation was the only method of seed dispersal. Clergeau notes that regurgitation is a common behavior but is poorly understood (Clergeau 1992a, p. 680). Clergeau (1992a) did not indicate how long the birds retain the seeds before they spit them out, although the time would suggest how far—or near—a bird regurgitator would deposit the seeds. Studies with captive blackbirds in Britain by Sorensen (1984) showed that the comparatively large seeds of sloe (fruit of Blackthorn, *Prunus spinosa*), haw (*Crataegus* spp.), and ivy (*Hedera*) were regurgitated in 6.5 to 8.9 minutes after being eaten, but how far the birds went during this time is not known. [Sulgrove's note: Obviously not very far, if the researchers could track birds and time how long it took for each bird to spit out the seed]. Clergeau (1992b) has also shown that blackbirds and starlings regurgitate ivy seed. Clergeau (1992a, p. 685) hypothesizes that regurgitation is ideal for feeding young birds, and regurgitation allows wintering birds to eat ivy's large fruits and large seeds without having problems of blocked-up stomachs.

Snow & Snow (1988, Table 75, p. 207) in their British studies of the ecological interaction between birds and plants have determined that Wood Pigeons (*Columba palumba*) are ivy seed-predators that destroyed 78% of the seed crop. The birds take the fruit while it is still unripe, sometimes leaving few fruits to mature. There are a few records that ripe fruit is eaten as well, and the seeds defecated (Snow and Snow 1988, p. 173). Wood Pigeons have gizzards which grind the soft seeds of ivy (Snow & Snow 1988, p. 171).

In the US, Coon has noted that Cedar Waxwings (*Bombycilla garrulus*) and robins (*Tu* oon
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II. BACKGROUND ON IVY ON THE INTERNET

Which Ivy Is a Problem in the Pacific Northwest?

Background. Although *Hedera hibernica* 'Hibernica' is a legitimate problem on the West Coast and in Arlington County, Virginia (Sulgrove observation), there has been a great deal of confusion on the Worldwide Web—and in the botanical community as well—between *Hedera helix*, commonly called English ivy, and *Hedera hibernica* 'Hibernica', the ivy sold by the ground cover industry as "English ivy." *Hedera helix* has given rise to roughly 500 cultivars of varying sizes, growth rates, colors, textures, and leaf shapes. Some cultivars are vining and growth is vigorous, others grow only inches a year. Still other cultivars, the self-branching ones, have only modest growth rates. Of course, actual rates are influenced by climate, as well as by the microclimate of the niche in which the plant is growing, and by variations in the weather from year to year.

In order to make identification of the diverse cultivars of ivy easier, Suzanne Warner Pierot developed the Pierot Classification System of ivies in 1974 (also Pierot 1995) and based it on leaf characteristics and shapes. Some of the categories are: Heart-shapes (H), Variegated (V), and the Oddities (O). (See Pierot 1995, p. 37-39, for a complete listing of the categories and descriptions.) This classification system is now being incorporated into cultivated plant nomenclature at the species level (see Hop 2001 for examples).

The Nomenclatural Confusion. "English ivy" of the trade is actually the cultivar *Hedera hibernica* 'Hibernica', which is also known as "Irish ivy" because it is widespread in Ireland. The species itself, *Hedera hibernica* (Kirchner) Bean, is called the Atlantic ivy because it is found on the western seaboard of Europe: in western Great Britain, France, and Spain (Rutherford 1984). To confuse the nomenclature even more, wild *Hedera hibernica,* native to western Europe, was once considered a variety of *Hedera helix* and was called *Hedera helix* var. *hibernica*, and the cultivar 'Hibernica' was attributed to *Hedera helix* with the cultivar name, *Hedera helix* 'Hibernica'. Most of the other species, like *Hedera azorica* Carrière, *Hedera algeriensis* Hibberd, and *Hedera canariensis* Willdenow were also considered earlier to belong to *Hedera helix*, but with later studies these varieties were determined to be species in their own right. *Hedera helix* is native to Great Britain and Europe.

Comparison of *Hedera hibernica* and *Hedera helix*. *Hedera hibernica* (and its cultivar 'Hibernica)' are tetraploid (4x = 96), bearing twice the amount of genetic material as the diploid species, *Hedera helix* (2x = 48) (McAllister 1982, 1984). Any hybrids that might form between plants of differing chromosome number would be sterile. There are no known hybrids between *Hedera helix* and *Hedera hibernica* (Rutherford 1994). In addition, the two species do not even have the opportunity to cross in the wild, because where the two species occur in the same environment, the two flower at different times (Rutherford 1994). Flowering times for cultivars, however, may be quite different from those in natural populations, especially for

greenhouse material or for plants grown in mild climates. According to Coon (personal communication), in his mild San Francisco Bay area garden, *Hedera helix* 'Gold Heart' can flower and fruit both in the spring and the fall, so that even in December you can find both flower and fruits on the same plant.

The best way to compare the two species, *Hedera helix* and *Hedera hibernica*, is to compare the cultivar *Hedera hibernica* 'Hibernica' with the cultivar of *Hedera helix* 'Baltica', which is the cultivar closest to wild *Hedera helix* in Europe. 'Hibernica' has thick, shiny, medium-green leaves with greenish veins. 'Baltica' has thinner leaves that are a dark green with whitish veins. In addition, 'Hibernica's leaves are slightly folded upward, especially in the sun, but 'Baltica's leaves are flatter and have only a small dip in the blade where the petiole is attached. 'Hibernica' has a noticeable, sweet fragrance when the thick stems are crushed, but this fragrance is lacking in 'Baltica' and other cultivars of *Hedera helix*, although some *Hedera helix* smell very musty. In addition, the stems of 'Hibernica' are stouter than those of 'Baltica' (Sulgrove 1992). The differences between the two cultivars are summarized in Table 1 below.

Although the hairs on *Hedera helix* are usually bristly (stellate), the hairs on 'Hibernica' are flattened like a starfish and have fewer rays than in *Hedera helix* (McAllister and Rutherford 1990; McAllister 1994). Sulgrove (personal observation) has noted that this characteristic works best when the ivy materials are fresh, but won't always work to separate *Hedera helix* cultivars from *Hedera hibernica* cultivars. Sometimes the hairs are damaged or broken and then the hair type is unreliable, especially on herbarium sheets.

For a table comparing characteristics of wild *Hedera hibernica* and *Hedera helix* in Great Britain, see McAllister and Rutherford 1990.

Table 1. General Comparison of Vegetative Characteristics of *Hedera hibernica* 'Hibernica' with *Hedera helix* 'Baltica'.

Characteristics	*Hedera hibernica* 'Hibernica'	*Hedera helix* 'Baltica'
Ploidy level	Tetraploid: 4x = 96	Diploid: 2x = 48
Leaf Size	Leaves larger and more widely spaced	Leaves generally smaller and closer together
Leaf Color	Emerald green to deep emerald green; leaves can be yellow-green in nutrient-poor soil	Dark green (more grayish, or a black green)
Leaf Shape	Slightly wider than long; broad terminal lobe	Slightly longer than wide; three-lobed, heart-shaped
Leaf Thickness and Surface Character	Thicker; waxy or glossy surface	Thinner; duller surface
Venation	Pale green to slightly yellow-green, diffuse, not sharply defined, especially the secondary veins	Whitish, very sharply defined; secondary veins distinctly visible
Stem Diameter	Stout, robust	Thinner, more wiry
Scent When Crushed	Sweet, fragrant, when temperature above 45 deg. F.	None, or musty in some cultivars of *H. helix*
Surface Hairs, Lower Only	Flattened on the surface; 5-8 rays	Rays 8-12, bristly
Flowering & Fruiting Times	Earlier	Later

According to studies by Bényei-Himmer (2000, 2004a) and Udvardy and Bényei-Himmer (1999) in Hungary, *Hedera helix* inflorescences that they have studied may bear a maximum of 15 berries, and within each berry only 2-3 of the 5 seeds are fertile. In contrast, 25 to 30 berries per umbel may ripen in the species *Hedera hibernica*, with 4-5 of the five seeds per berry being fertile. But there is a wide variation within a species. It still remains to be determined how these numbers vary among cultivars of *Hedera hibernica* 'Hibernica' and other adult forms, such as 'Deltoidea' (called *Hedera hibernica* 'Arbori Compact' in Europe [Hop 2001[).

How Widespread Is *Hedera hibernica* 'Hibernica' ?

Extensive Use as Ground Covers. Ivies, especially *Hedera hibernica* 'Hibernica', have been widely planted as ground covers. 'Hibernica' is successful as a ground cover because it is a tough ivy that is drought tolerant, vigorous, and winter hardy to about minus 5 to minus 10 deg. F. (Sulgrove observation). It has year-around interest with its evergreen leaves adding a touch of green in winter. Ivies can grow in shady areas where few other ground covers are as successful. It has been widely used as a ground cover, probably in all parts of the US.

How Did Ivies Get There? Ivy is not native to the United States. Ivies were bought to the US by earlier settlers from Europe, and have been used as a ground cover as early as 1718 in Concord Township, Delaware County, Pennsylvania (Windle 1992). Ivy spreads from ornamental plantings or roadway erosion-control plantings into neighboring woods (Murai 1999; Thomas 1980, Sulgrove 2003, Virginia Arlington County Parks about 2003).

Spreading by Neglect. . When they have been neglected, 'Hibernica', and possibly *Hedera algeriensis* (Sulgrove, personal observation), have spread vegetatively into adjacent areas. *Hedera algeriensis* has been used for erosion control along highways in southern California (Sulgrove observation).

On rare occasions ivy is found spreading in southeastern Pennsylvania from compost piles or dumps (Gresham 1998+). Pennsylvania (Gresham 2000) recently removed *Hedera helix* from its list of invasive plants, and put it into a unique, separate category named "Situational Invasive." Situational invasive plants are explained: *"Some plants become problematic invasive species in a given area. For example, some plants are commonly planted for quick ground cover, but can become a serious problem when planted, seeded, or discarded near native plant communities"* (Gresham 2000).

Arlington County Parks, Virginia, is concerned with ivies in its parks, such as Long Branch Park in the city of Arlington. This park is a wooded ravine with a creek that is surrounded by home sites on the rim of the ravine. From observation of the park, it is apparent that *Hedera hibernica* 'Hibernica' has escaped due to neglect from the gardens at the top, and spread vegetatively into the ravines (Sulgrove, April 2003, personal observation).

Likewise, the Theodore Roosevelt Island National Park in the Potomac was a former homestead with ivy around the original house site perhaps as early as 1792 (Thomas 1980), long before being taken over by the National Park Service in 1934. A third public area where ivy has spread is Forest Park, an urban park in Portland, Oregon.

Murai (1999) found that 47 of 58 sites in mostly state, regional, or national parks in Washington, Oregon, and British Columbia had ivy growing adjacent to buildings or roadways, and in the remaining 11 sites ivy was within 500 meters, although distances were not given.

The best documentation so far of naturalized ivy sites is by Quinn and Best (2002), who mapped areas covered by ivy in Stanley Park in Vancouver, British Columbia, using Geographic Information Systems analysis.

Distribution Unknown. There is no documentation describing how extensive ivy may be in states other than Washington. Although Swearingen (2000) reports that English ivy occurs in 26 states, including Oregon, Washington, and Virginia where there has been much publicity about ivies, there are no records of number of occurrences, area covered, or percent of coverage per occurrence. In Ohio, Cusick (2002, personal communication) reports that *Hedera* appears in 8 of 88 counties, but the areas covered are minimal.

Problem Areas. Although the actual extent of the problems with ivy is not documented, it is clear that parts of the countries have legitimate problems with ivy carpets. *Hedera hibernica* 'Hibernica', has become problematic when naturalized in some warmer areas (perhaps Zones 8-10) in the US. For example, Forest Park (Krajick 2003), a 5,000-acre park located in the city of Portland, Oregon, has been using volunteer labor since 1994 to remove ivy from over 90 sites (NIL 2004a); and in Washington State (Murai, 1999b) 50 sites were identified where ivy has gotten out of hand. English ivy is also cited as invasive in California (Reichard 2000; Le and Sonu 2000; CA Pest Council 2004). [See Fletcher 2004 for insights on the West Coast ivy problem.] Although South Georgia does not list English ivy as a problem plant, there is one student project on English ivy removal (Biggerstaff 2002).

The above examples represent very localized problems, even though these sites may represent extensive coverage.

No invasive ivy situations have been reported in other states.

In summary, no documentation has been found that 'Hibernica' is widely naturalized in other parts of the United States. Nor have other cultivars been reported as naturalized. Ivy cannot, with so little information about its distribution, be considered overwhelmingly invasive in the US, despite Swearingen's (2000) implied conclusion.

What Characteristics of 'Hibernica' May Facilitate Invasion?

Vigor. Whether or not ivy vines themselves are capable of spreading vegetatively depends on the vigor and hardiness of the cultivar. Self-branching ivies are less vigorous than the strongly vining cultivars that have been traditionally planted for ground cover use. *Hedera hibernica* 'Hibernica', a vining, non-self-branching cultivar, is one of the most vigorous ivies in warm climate areas (Sulgrove observation)

'Hibernica' and Winter-Hardiness. 'Hibernica' is the least hardy of the traditional ground covers in Ohio (Sulgrove 1992), and it will brown in winter or die back when *Hedera helix* 'Thorndale' or 'Baltica' are only minimally damaged (Sulgrove 1992). *Hedera helix* 'Wilson' (Sulgrove 2001c), a relatively unknown and unrecognized ivy, is promoted in the Midwest for its extreme hardiness. 'Wilson' is smaller-leaved and a more refined grower than 'Thorndale' (Sulgrove 1992) or 'Baltica' (Sulgrove 1988). Bauer and Kofler (1987) substantiate the minimal hardiness of *Hedera hibernica* 'Hibernica'. [Although the authors call the ivy examined *Hedera helix* in the title of the article, the description in the following statement applies to *Hedera hibernica* 'Hibernica']: " In its juvenile phase, ivy, an evergreen of sub-Atlantic and sub-Mediterranean distribution, does not enter into deep winter dormancy and is able only to develop only modest frost hardiness…." (Bauer and Kofler 1987). Rutherford (1994) also points out that *Hedera hibernica* is less hardy the *Hedera helix.* In addition 'Hibernica is also more disease-prone under cool, humid conditions than is *Hedera helix* 'Thorndale' (Sulgrove 1984b, 1992).

In areas of the US where the ground freezes in winter, new growth on ivy vines in late fall will die back in winter. Even when ivies climb walls or deciduous trees, exceptionally cold winters will freeze the vines back to the snow level. This means that ivies will rarely flower and fruit in these parts of the country because the growing tips are continually frozen back. In West Central Ohio, a hard winter occurs every 4 or 5 years, killing back to ground level both ivy vines and any adult branches that may have formed. This is especially true for ivies on trees and walls that face winter sun and wind. Therefore, ivies rarely naturalize or maintain adult stems in such climates. When adult stages develop, they last only a few seasons and are unable to develop masses of fruiting branches before they are cut down by the next killing freeze (Sulgrove observations).

Hibernica and Seasonal Growth Rates as Related to Climate. Thomas (1980, p. 64), studying ivies in the Washington, DC area, presumes that "photosynthesis probably seldom stops in *Hedera*." This statement also then presumes that evergreen photosynthesis is always correlated with growth rate. Although it is attributed to Thomas (1980) that ivy can spread rapidly in winter in deciduous forests and climb trees because of increased light availability, he did not actually do any studies to demonstrate that rapid growth takes place in winter. Murai

(1999, p. 9) cites studies of photosynthesis in *Hedera* in winter by Ryalko and Kacperska (1981) in which they found that internode formation stops when

temperatures drop below 10 deg. C (50 deg. F.; mean air temperature 5 deg. C [41 deg. F]). Murai then postulates that in the mild winters of the Pacific Northwest growth may only stop during 2 or 3 months of the year, but she does not cite any temperature data to support this hypothesis. Bauer and Kofler (1987) cite sources that state ivy does not enter into deep winter dormancy and is thus able to develop only modest frost hardiness. Therefore, low temperatures damage the photosynthetic apparatus. Growth as measured by shoot elongation in ivy stopped at day/night temperatures of 10/0 deg. C. (50 deg F. daytime; 32 deg. F. nighttime), regardless of day length Bauer & Kofler 1987).

The above-cited research studies focused on the effects of low temperatures on photosynthesis rates, rather than on growth rates under winter temperature conditions. Winter temperature fluctuations would vary from one part of the country to another. Thus, more research is needed to determine how winter temperature variations affect growth rate, and whether 'Hibernica' under optimal conditions can grow continuously in winter and how quickly.

Control Measures

When there is a need to control ivy around the home, what should be used? According to Bir (2002), an agricultural extension agent in North Carolina, ivy is not invasive in his state. It is not listed in the North Carolina noxious weed legislation (NC n. d.). When Bir is told about out of control garden plants, he responds with: "Have you tried to control it?" He stresses that when removal is required, proper timing of chemical control (Neal 1998) is important.

Timing of Glyphosate. Neal (1998) recommends controlling woody vines and shrubs with Roundup-Pro (glyphosate), but emphasizes that timing is critical. Research and label guidelines suggest that 2 or 3% solution of Roundup-Pro, applied in early spring at the time of 3 to 5 fully expanded new leaves, is effective. (AIS recommends that to achieve this same condition at other times of year, use a mower set on high or a weedeater to cut back the ivy, and spray after 3-5 new leaves have appeared). On the other hand, Morisawa (1999) found that an application of 25% solution of glyphosate provided good control after cutting stems with a nylon cord weedeater, whereas the herbicide tryclopir or mowing alone provided no control.

The Ivy Removal Project at Forest Park, Portland Oregon, has developed several control strategies for manual removal (NIL 2001c; Diedrich and Broshot 2003) and chemical control (NIL 2001d). In studies to halt the regrowth of ivies on trees after manual removal, Diedrich and Broshot (2003) found that when ivy vines are cleared 6 feet away from a tree trunk, the vines will not reclimb the trunk.

III. THE INVASIVE ISSUE

There has been a growing concern in the United States – particularly within the last 10 years or so — about plants (and animals) that are "out-of-place" (US Congress 1993). This term once was applied to weeds that made their way into our garden and sometimes back out of the garden. But the definition of a "weed" has now been expanded to apply to invasive plants, that is, those that spread to such a degree that they cover more ground or area than desired.

Multiple Definitions. Whether or not a plant is considered invasive appears to be in part a personal judgment related to whether the plant is considered desirable in that area at that time. There are perhaps 500 definitions of what "invasive" means (P. A. Thomas 2003). For some examples of definitions of invasive species and related terms, such as adventive, opportunistic, and naturalized species, see Thomas 2003. For other discussion of invasives see Haber (2001); PCA (2000); Quinn and Best (2002, pp. 7-14); White and Haber (1992+).

The Invasive Species Problem: Invasive Plants

Invasive plants (other than cropland weeds) are considered undesirable because large areas of land (or water) are being covered by a single species at the apparent expense of previously occurring plants that were regarded as more desirable for those areas. The widespread concern appears to be for: 1) the loss of biodiversity in these habitats and the suppression of previously existing flora; 2) the need to rehabilitate these areas by removing the offending plants and repopulating or encouraging the growth of desirable plants; 3) the need to prevent further spread of such undesirable species. According to the National Invasive Species Council, invasive plants are alien (non-native) species (NISC p. 8) that tend to have high reproductive rates, disperse easily, and are able to tolerate a wide range of environmental conditions (NISC 2001, p. 9).

Invasive plants have been targeted by the native plant movement, which has among its supporters those who would ban any non-native, non-indigenous, exotic, or alien species (Avent 1995). Additionally, Theodoropoulos (2000) forcefully states that there has been "breathless hysteria-mongering of the government's websites and press releases, and the systematic exclusion of opposing views..." Regardless of the reasons, whether lack of understanding of the basic biology of particular problem plants or because of self-serving interests of the group, legislation has been hastily proposed without input from the nursery and landscape industry and without objective data to support the listing of species as invasive.

A recent example of such hasty legislative action is the passage of a law in Connecticut on March 22, 2004 (GPN 2004), outlawing the growing of all barberry (including the burgundy cultivars, which may not be invasive), Norway maple, *Euonymus* (with many cultivated forms), and multiflora rose. All these plants are heavily used by the landscape industry and are widely requested by homeowners. No opportunity was

given before the passage of the Connecticut legislation to educate the public on the need for change, and to talk to the nursery industry. Such unilateral legislation is in disregard of the "St. Louis Declaration on Invasive Plants" (St. Louis Declaration 2001), an agreed-upon statement regarding invasive plants and recommended codes of conduct for nurserymen, gardening public, and others. Two of the agreed-upon statements of the St. Louis assembly declare that all groups of plant people need to work together to address invasive challenges; and plant introduction should be pursued in a manner that both acknowledges and minimizes unintended harm.

The International Society of Arboriculture (Harrington and others 2002) cites a need for educating nursery and landscape industry groups and their clients about invasive plants in order to minimize economic disruption to the nursery industry. Above all, there is a need to have accurate, unbiased, scientific data to support conclusions about invasives.

Often definitions of "invasive" appear to define the interests of the group providing the definition rather than being based on scientific studies or widespread data collection. This is in part from lack of knowledge, either about the plants' growth and behavior or from lack of understanding of how the plants perform over an extensive area.

The Role of the Internet in Defining the Invasive Species Problem

The Internet is used not only to educate the public about invasive plants, but also to present student research projects and provide easy online access to published research. It also serves as a means to reach large numbers of people to gain their financial support, gain support for noxious weed legislation, or enlist volunteer labor to remove unwanted plants and restore sites to more desirable plant components. (See http://www.noivyleague.com [NIL], one of the most extensive web sites devoted to promoting public support).

With the explosion of information on the Internet, however, there is no guarantee that the information is accurate, or that the studies described are scientifically sound, or have been peer-reviewed. The Internet is also being used to "publish" student study projects of varying quality, whether or not the conclusions are justified by the often preliminary nature of the research. Therefore, one must read with caution what one finds on the Internet. It is important to evaluate whether the conclusions are justified by the studies or research presented, and not just to accept the conclusions of the author without reading and evaluating the full text.

Invasive Ivy on the Internet. There is much misinformation about ivies on the Internet.

The Plant Conservation Alliance Alien Plant Working Group is a group of 10 Federal government member agencies and 145 cooperating members

who are responsible in part for descriptions and photographs of invasive species posted on the US Government National Park Service web site, http://www.nps.gov/plants/alien/list/all.htm (NPS n. d.). The description of ivy (*Hedera helix*) that Swearingen (2000) has posted on this web site has been widely copied by others. This description was used in Oregon's proposal to add *Hedera helix* to the state's noxious weed list (Murin and Nilsen 2000), by websites (NIL n. d., Diedrich 2001, California Redwood 2002) and native plant groups (Virginia: Arlington County Parks 2002, 2003; Virginia: Arlington County Civic 2002; Mid-Atlantic Natural Areas 2004; Swearingen and others 2002); as well as in compendiums on invasive plants (Randall & Marinelli 1996; Bossard, Randall, & Hoshovsky 2000). Westbrooks (1998) prepared a compendium of invasive plants, and picked up the problems with ivies on the West Coast, using ivy as example of weeds in the yard and garden.

Nomenclatural Confusion Condemns ALL Ivy. Swearingen (2000), by confusing the nomenclature of the cultivar of the problem ivy 'Hibernica' with the common name for *Hedera helix*, suggest that ALL ivies threaten the ecological integrity of neighboring forests and parklands. By not distinguishing areas of the US where ivy has become naturalized from areas where ivy simply occurs in the state records, she suggests that ivy threatens habitats everywhere in the US. This contention cannot be supported; see section above, "How Widespread is 'Hibernica' ?" In addition, there are several factual errors in her text—all of which have been copied and perpetuated by others.

Perspective of Literature Surveys. Some individual literature surveys of invasive ivies, such as Murai (1999), Okerman (2000), and Le and Sonu (2000) quote articles and personal observations which support the contention that ivy is invasive; others, like Quinn and Best (2002,) emphasize the lack of scientific studies to date on the ecological impact of ivies. Fletcher (2004) clarifies in her interview with the American Ivy Society the ecological and biological research necessary to distinguish between whether ivy is the cause of a situation or whether its behavior is the result.
(see pp 66-73)

Few Data Available from Field Studies. It is also important to note that few field studies have been done to analyze what's going on in environments where one species appears to replace others. Researchers (for example, Bernd Blossey and coworkers [Blossey 2003+] from Cornell University) are making strides in clarifying how purple loosestrife (*Lysimachia salicaria*) affects the wetland ecosystem in general, and how loosestrife interacts specifically with other plants and animals in the community.

The errors and other misconceptions—or "myth-information"—about ivies that have been perpetuated in the invasive plant literature and on the Internet are addressed later in this review.

Need for Accurate Information on Invasiveness. Regardless of the definition used for the term "invasive", understanding what makes a plant invasive is important

for determining a method of control, preventing its reoccurrence, and determining how to reintroduce the desirable plants that were supplanted by the invasive plant. If the factors contributing to the invasiveness of the plant are understood, then it is possible to tailor a control that will be successful.

Can Invasiveness Be Predicted?

Introduction. The invasive plant issue is a hot topic. It is a universal problem since invasive species occur in all countries, not just the US. Due to the problem plants that are out of control in some parts of the US (other countries with invasive plants do not necessarily have the same ones), there has been a rush to establish programs to monitor, as well as eradicate problem plants and maintain certain native communities. One avenue of research into invasive species is to predict which species may become invasive and reject their introduction. By preventing importation, later problems of "clean-up" are avoided. Ecological forecasting is a new area of focus for the US government's National Aeronautics & Space Administration (NASA) programs. Schnase and others (2001) with NASA's Earth Science Vision for 2025 (an initiative to develop ecological forecasting) state: "The spread of invasive species is one of the most daunting environmental, economic, and human-health problems facing the United Sates and World today. Non-indigenous species may pose the single most formidable threat of natural disaster of the 21st century." Strong words!

But not all believe that invasive species present such earth-shaking, disastrous problems. Theodoropoulos (2001) counters with the criticism that many US government web sites create unjustified hysteria and concentrate on negative features while leaving out opposing viewpoints.

Model Building. To predict which species introduced into North America might become invasive, Reichard and Hamilton (1997) have analyzed traits of woody plants that were known to be invasive. In their study of 76 species considered pests by resource managers and others, Reichard and Hamilton used traits that could be determined from the literature or herbarium specimens. They then produced a "decision tree" for woody plants for North America (Reichard and Hamilton, 1997, Figure 3, p. 199) based on what was determined to be the most important characteristics in order to decide whether a species should be introduced into North America.

Key Characters. The most important characteristic Reichard and Hamilton (1997) found was whether a species or any of its relatives were invasive elsewhere in the world. In one arm of the decision tree the next most important question was whether the species was in a family or genus with species that are strongly invasive in North America. If both were true, then the proposed introduction would be rejected. For example, *Hedera hibernica* is considered invasive in Europe (Udvardy and Bényei-Himmer 1999). Because *Hedera hibernica* 'Hibernica' is also considered invasive in the Pacific Northwest, then according to Reichard and Hamilton's "decision tree" (1997, p. 1999), all species of *Hedera*, including all new cultivars of *Hedera*

helix introduced in Europe, would be banned, even the most refined cultivars of *Hedera helix*.

Problems with Models and Ivy. Problems arise, however, when using invasiveness in Europe to determine whether all ivies would be banned under Reichard and Hamilton's (1997, Figure 3, p. 199) decision tree. First, *Hedera hibernica* and *Hedera helix* are native to Europe. In the US the 1974 federal definition of a noxious weed (the legal term for an invasive plant; see Colorado [2002]), as well as the Colorado definition, can only be applied to non-native plants, even if a native plants were to move beyond its natural range and be characterized as weedy. If there is no standardized definition of *invasive*, can a native plant ever be considered invasive in its own country?

Second, the *Hedera hibernica* plant in Europe does not match the *Hedera hibernica* 'Hibernica' widely grown in the US. Note that the photo of the European *Hedera hibernica* in Udvardy and Bényei-Himmer (1999, p. 194) shows an ivy with a single, tight umbel bearing dark blue fruits with a high bloom, but it does not match the inflorescence and fruit color of typical *Hedera hibernica* 'Hibernica' found in the US. The American 'Hibernica' fruits are borne in a compound inflorescence (a panicle of umbels) and the fruits are shiny black. Despite this discrepancy all cultivars of *Hedera helix* would be banned from the US—based on the title of a paper—even though the plants are different!

Difficulties of Prediction. Theodoropoulos (2000) cites several authors to support his position that it is impossible to reliably predict which plants will be invasive, and that statistical analysis is no better than the data analyzed. In addition, he states that the Reichard and Hamilton model (1997) and others, developed for regulatory control, only consider negative features, and do not take into account the impact on the recipient ecosystem, or any positive attributes or conservation value of introduced species. Reichard and Hamilton's high rate of false positive (identifying a species as invasive when it isn't) is unacceptable to Theodoropoulos (2000). Depending on the model used by Reichard and Hamilton (1997, p. 2000), the accuracy of predicting invasiveness varied from 76.5% to 86.2%, meaning that about 14 to 24 % of the predictions were incorrect.

In Canada Mosquin (1997), in proposing management guidelines for Canada's parks, cites the Norway/UN Conference on Alien Species (Chairman's report 1996) with the following quote that supports Theodoropoulos' contentions:

"Prediction of the progress and consequences of a biological invasion in a quantitative way is not possible. There are possibilities of making analytical models, but adequate estimates of variables are not possible before an invader has been introduced and has actually spread. However, sufficient independent empirical data (life history, survival rate, fertility rate) are available only for a relatively few species in order to reconstruct "old" invasions."

Invasive species prediction is still in its infancy. Using models for accepting or rejecting

cultivars before introduction into the US, will require more refinement in order to have a higher degree of accuracy. As Schnase and others (2001) point out, however, the problems of invasive species and the monetary consequences of eradicating or containing invasive species is a global problem. Spaced-based sensors and advanced systems involving computational, modeling, and information technologies will be needed to track changes like climate warming, rainfall, soil moisture and runoff in sensitive habitats, as well as monitor the effects of invasive species that alter water relations, carbon storage, fire cycle, and reflective properties of landscapes. Although the accuracy of current models for predicting invasive species still needs improvement and more precision, building and refining predictive models is an important starting point for containing the invasive species problem.

What are Noxious Weeds?

Definition. "Noxious Weed" is a legal definition (PCA 2000) that is used in legislation to regulate the propagation, introduction, and sale of these plants. Such legislation dictates what the green industries of that state can and cannot do and ultimately determines whether a plant can be sold or not. First defined by the Federal Noxious Weed Act of 1974,a noxious weed is (in part) a species of foreign origin that is new or not widely distributed in the US (Federal definition cited in full in Colorado [2002]), and is determined to be an agricultural pest (PCA 2000), some of which may also threaten natural lands (PCA 2000). Individual states may further define which species may be considered "noxious." Oregon includes species officially designated through legislation to be "injurious to public health, agriculture, recreation, wildlife, or any public or private property" (Herring n.d.) Those that have spread so rapidly on public or private land may be declared "a menace to public welfare" (Herring n. d.). Interestingly, Colorado (2002) defines a noxious weed as a non-native (or non-indigenous) species, stating in addition that no native plant species can be designated as a noxious weed by the state or local governments, nor may any native plant be designated a noxious weed even if it expands its range within Colorado due to human influences.

Lack of Guidelines. So far there are no guidelines as to how widespread an invasive species must be before it is declared a noxious weed. It is imperative that accurate information on a proposed noxious weed be available, along with distribution data, to document the severity of the problem. It may not be practical to legislate all noxious weeds at the Federal level because there are too many differences in invasive behavior from one locality or region to another to generalize about treatment. It is more effective to deal with invasive plants locally, rather than to legislate over a wider area.

There are, however, some plants, such as Kudzu, which have been banned at the national level (Bergmann 1997).

Ivy Noxious Weed Legislation. In **Virginia** attempts made to declare ivy a noxious weed based solely on problems within a single county have so far (July 2004) not been successful. In December 2002 native plant groups (Arlington County Civic

Federation 2002) and the Arlington County Department of Parks, Recreation and Community Resources (2002; also VNLA 2002) initiated the Virginia State Legislature (2002) Proposal SB1109 and SB 1300 (Virginia State Legislature [2003; VGIC 2003)] to have English ivy declared a noxious weed, despite that such legislation would have wide-ranging, state-wide consequences. There was no information presented about ivy's occurrence outside of Arlington County. For a discussion of Proposal SB 1109, see Pokorny 2002b, Appendix A - 3.

Oregon. The Portland Bureau of Parks and Recreation played a major role in getting legislation passed in Oregon in 2001 (Murin and Nilson 2000; Sivesind 2001). They initiated a proposal to declare English ivy a noxious weed based on their experiences in Portland's urban forests and parks, especially in Forest Park, a park of 5,000 acres that is dealing with invasive plants including *Hedera helix* (Murin and Nilsen 2000). The No Ivy League website (NIL n. d.) of Forest Park, Portland, Oregon, indicates there is no information on how widespread ivy might be in the state of Oregon (NIL 2003).

Washington. In Washington State the proposal for classifying English ivy as a noxious weed (Washington State Noxious Weed Control Board 2001) appears to be based on Murai's 1999a study of 50 populations in the state's regional, state, and national park areas, but no extent of coverage per occurrence—amount of area covered by the ivy —is given for any site. English ivy, *Hedera hibernica* 'Hibernica'; and three cultivars of *Hedera helix*, 'Baltica', 'Pittsburgh', and 'Star', were placed on Washington State' s noxious weed Class C list (Washington State 2003), of species already widely established in Washington.

Murai (1999a, p 66) declares that *Hedera helix* 'Pittsburgh', 'Star', and 'Baltica' should added to Washington States noxious weed list, based on her experiments of less than one year in the greenhouse. She concluded that the growth rates of these three cultivars were among the fastest, and thus had the potential to be invasive. The American Ivy Society, however, has found that growth rates cannot be predicted in natural situations (non-greenhouse) until well-developed root systems are formed. Thus, it is not possible to predict comparative growth rates until after the third winter. Therefore, Murai's partial-year results are not valid.

'Baltica' was included in Murai's (1999a) list of potential invasives despite only recent introduction into the Northwest (Murai 1999a), because it is hardy, and she found it to be a fast grower. But Murai did not find 'Baltica' in any of the 58 populations she examined, and 'Pittsburgh' was found in only 4 of 58 populations (extent of coverage not given) and given) 'Star' was found only once (extent of coverage not given). Despite the preliminary nature of Murai's unpublished work, it appears to have served as the basis for legislating *Hedera hibernica* 'Hibernica' and the 3 cultivars of *Hedera helix* as a noxious weed in Washington state.

California. California also considers English ivy invasive (Reichard 2000), and it is on the California Exotic Pest Plant Council's (CA Pest Council 2004) 1999 B -1 list of

lesser invasiveness. Earlier, English Ivy (probably including *Hedera algeriensis* as well, Sulgrove observation) was on the A-1 list of damaging species that are widespread in the state (Bossard and others, 2000, p. 9). It forms "ivy deserts" of vigorous vines in forests where nothing else seems able to complete (Reichard 2000). Fletcher (2004) gives a description of "ivy desert" and its causes. Moreover, the number of occurrences, both by number of sites and extent of coverage per occurrence in California is not given. Although *Hedera algeriensis* has been planted for erosion control along the freeways of southern California (Sulgrove, personal observation), Reichard (2000) makes no distinctions between species of *Hedera* and combines all occurrences under *Hedera helix*.

Washington, DC. Ivy is also considered invasive in the Washington DC area, where it is "one of the most abundant and widespread invasive plants" (Swearingen 2000). Thomas (1980) studied 3 widespread species, including ivy, in the Theodore Roosevelt Island National Park, an island in the Potomac River. According to Thomas (1980) earliest land use came in 1792 with the original owner, John Mason, who likely planted ivy around his mansion on the second highest point of the island. It is likely that this ivy is the source of the ivy populations there today. In 1934 Olmsted and Pope, who were evaluating the area, recommended preservation of the scattering of English ivy that was also climbing into some of the trees (cited in Thomas 1980, p. 4). Thomas (1980) does not give dimensions of the areas covered by ivy at the time of his studies.

Thus, none of the above examples from California, Virginia, Oregon, Washington, DC, or Washington State cite any distribution data that estimates the degree of invasiveness by how much area is covered.

Lack of Distribution Data Nationwide. Overall, there is a lack of distribution data at all levels for the number and extent of occurrence throughout the US, of not only ivy, but also other potentially invasive species. Although county and state distribution records for many species are being compiled for state and regional floras, much of this information is available only in specialty locations, such as university and herbarium libraries. Often such information has not been compiled at the national level or is incomplete. In addition, not all possible undesirable problem plants have been cataloged as to their occurrence over their entire range or throughout the entire United States.

Even when records are available, a state list of where a plant occurs only indicates that the plant has been found at least once and does not give the extent of coverage, either in area per occurrence or in number of areas within the a county, let alone the state. For example, the Alien Plant Working Group lists English ivy as occurring in 26 states (Swearingen 2000); this does not indicate whether ivy has been found naturalized in only one small area of each state, or whether it occurs more frequently either minimal or more extensive coverage.

A Way to Quantify Distribution Data Needed. It would be helpful to

quantify invasive plants such that the greater the number of areas in which the particular plant occurs, the greater the degree of invasiveness. This type of monitoring would distinguish between those plants that are invasive in a limited geographical area, and those that are invasive over a wider area. See: American Ivy Society recommendations: Quantifying Invasive Plant Distribution Data, p. 43.

Is the Invasive Problem Real? Theodoropoulos (2000, 2003) is outspoken in his criticism of the US Government web sites. He comments that there has been:

"…breathless hysteria-mongering [on] the government's websites and press releases, and the systematic exclusion of opposing views….The literature of invasion biology… [has]… low standards of evidence, unsupported causal attributions, circular reasoning, selective data-mining, high dependence on anecdotal reports, undefined jargon, unfalsifiable hypotheses [one that cannot be proved to be wrong], and other pseudoscientific characteristics…Contradictory evidence is resisted…" (Theodoropoulos 2000).

Although these are emotive words, in the case of ivy on the Web we can agree with Theodoropoulos. The statements made about ivy on the federal government's National Park Service Web site (http://www.nps.gov/plants/alien/fact/hehe1.htm, Swearingen 2000) contain "unsupported causal attributions" (erroneous statements) about ivy. Of special concern is the denigration of the wrong ivy species when one cultivar, 'Hibernica', which is not related to the species cited (*Hedera helix*), has been observed to be the problem. In addition, this Web site description of ivy is strong on negative attributes ("selective data-mining") even when those attributes are inaccurate ("high dependence on anecdotal reports"), either because of lack of understanding of the biology of ivy or because the facts/statements used were not verified ("low standard of evidence"). The Web article gives the overall impression that ivy is invasive everywhere and is a massive threat, whereas a search of the literature and Internet shows documentation for only one large urban park in Oregon, 50 sites of undetermined size in Washington State, and one county in Virginia (where the number of problem sites is not documented).

Ivy is generally not a problem in areas of the US where the ground freezes in winter because new vines are frozen back annually or killed back to the snow level every 4 or 5 years (Sulgrove observation). Neglect and lack of pruning by its gardener/owner is the cause of many situations where ivy is found beyond its intended borders!

Despite the lack of widespread documentation, *Hedera hibernica* 'Hibernica' is a legitimate problem in the mild, humid climate of the Pacific Northwest, due both to the ideal climate which fosters vigorous growth and homeowners' neglect in maintaining ivy ground covers by periodic pruning. You can't just "Plant it and forget it" when gardening with any kind of vine!

Hedera hibernica 'Hibernica', however, is a totally different plant from *Hedera helix*, a species of 500 cultivars! Because the wrong nomenclature is used in noxious weed legislation, all cultivars of *Hedera helix* are banned.

IV. WHAT PEOPLE SHOULD KNOW ABOUT IVIES

The statements numbered below are responses to assertions made by the Noivyleague web site (NIL 2001a). For explanations as to why the NIL English Ivy IQ Quiz (NIL 2001b) is misleading, see Appendix A – 2.

1. Ivy is an excellent ground cover. A whole industry is devoted to providing ivies for shady areas in the garden.

Ivies are well known as ground covers for shade (Dirr 1990). There is an entire industry based on using ivies for shady areas where other ground covers are not successful. For example, Gilson Gardens, Perry, Ohio, has been in the ground cover business since 1947. Ground covers are used to solve landscape problems like shade, to provide cover for bare soil, and to stop erosion (Kerrigan 1997; Redfern 2004). Ground covers also minimize weeding, unify the landscape and provide a transition between lawn and perennials, reduce maintenance, and provide cover for wildlife (Kerrigan 1997; Redfern 2004).

Although claims have been made that ivy does not stop erosion or stabilize slopes (NIL 2001a; Murai 1999a), there appears to be only one reference (Parker 1996) that ivy is a failure as a ground cover to control erosion. Parker (1996) also claims that ivy is ineffectual in maintaining slope stability (Murai 1999, p. 2). Although Freshwater (1991) is quoted by Murai (1999) as indicating that ivy's root system is too shallow to prevent erosion, Freshwater (1991) does not discuss erosion, but only states that ivy is easily pulled up by hand in the friable soils of Sherbrooke Forest in Victoria, Australia. Westine (2004, see Appendix A - 5) points out that there is a distinction between soil erosion and soil stability. Soil erosion is a soil surface phenomenon, and soil stability is a deep soil characteristic that is influenced by water and pressure. Not even deeply rooted mature trees will stop soil slumping or mud slides when the soil is saturated (Sulgrove, personal experience).

The Washington Department of Transportation (Barnes 2002, Appendix A-1) reports that *Hedera helix* 'Baltica' and 'Thorndale' have been used along the Washington State Interstate highways since the late1980's. These ivies have been used on slopes as steep as 1-1/2:1 with 2:1 slopes being more typical. The ivies have provided excellent erosion control and minimized weed problems. These cultivars have not become adult and have required minimal maintenance at the curb line. Where ivies have climbed walls, the vines have discouraged graffiti (Barnes 2002, see Appendix A - 1).

Some have suggested that a ground cover of ivy harbors mosquitoes and provides a refuge for rats. Both are incorrect. Ivy cannot grow in standing water where mosquitoes breed because ivy cannot grow in standing water or water-logged soils (Thomas 1980, p. 59; Schnitzler 1995, p. 232). Ivy ground covers, however, provide cover for wildlife, including rabbits and mice, but for Norway rats only if they are in the area because of garbage or unsanitary conditions. Poor sanitation is a basic

reason for moderate to high Norway rat populations in urban and suburban areas (Timm 1994). Cowan (2001) mentions that ivy provides shelter for birds to build nests, for bats to roost, and allows ground foraging for birds in winter by protecting the forest floor from full snow cover and frost.

2. Not all ivies are rampant growers or "aggressive invaders." There are 500 ivies to choose from.

Whether or not an ivy is "aggressive" depends on the cultivar and the climate! First, with over 500 cultivars to choose from, there is a diversity of growth habits among cultivars, from vining, to bushy mounds, to upright, to shrubby. There is also a wide variation in growth rates, from slow to fast; and some even grow just a few inches a year. Therefore, pick the right ivy for the right spot in your garden!

Secondly, the vigor of a particular ivy cultivar depends on the local climate. Some ivy cultivars, for example, *Hedera helix* 'Baltica, 'Thorndale', and 'Wilson' (Kerrigan 1997, Table 1)—and even *Hedera hibernica* 'Hibernica'—are good ground covers in Ohio, especially because they are fast growers. In Ohio the new growth developed on these ivies in the warm days of late fall is typically lost in winter freezes, and, at least every 4 or 5 years, the winter low temperatures kill the ivy back to the snow level (Sulgrove observation). *Hedera hibernica* 'Hibernica' is not as hardy in Ohio as the other three cultivars (Sulgrove 1992), especially 'Wilson', which is touted to be the hardiest ivy for the Midwest (Gilson 1997, quoted in Sulgrove 2001c).

Ivies, especially *Hedera hibernica* 'Hibernica', and a lot of other plants grow well in the Pacific Northwest, where the climate is mild and humid (Wharton, personal communication 2004). But it is not yet known why 'Hibernica' grows so much more vigorously there than in other parts of the country, although Fletcher (2004) is doing research to find out.

A questions for thought: If *Hedera hibernica* 'Hibernica' is declared an invasive in Oregon, and is legislated a noxious weed, is the ivy still invasive if it is confined within the garden, and all fruiting branches are removed? [This is where carefully defining "invasive" with regard to ivy is important.]

In summary, there is no evidence to support that any ivy is invasive in all climates or on any large scale.

3. Ivy does not blanket the forest canopy, and does not prevent sunlight from reaching the host trees. There is no evidence that ivy kills trees. Ivy is not a parasite.

Despite citations of Thomas' (1980) work by several summaries or case studies of *Hedera*, ivy does NOT kill trees, especially not by blanketing the forest canopy or by preventing sunlight from reaching the support tree. The reference cited by the Washington Noxious Weed Control Board 2001; Reichard 2000; Murai 1999; Swearingen (2000); and

implied by Arlington County, Virginia (2002), likely is Thomas' (1980) statement: *"English ivy…is a tendril liana…. As the evergreen foliage of the vine mingles with the deciduous foliage of the tree, it begins to shade them out, growth of the tree is suppressed, and the increasingly open crown stimulates the vine already present to more luxuriant growth, which further shades out the tree leaves"* (Thomas 1980, p. 62).

There are 2 errors in this statement by Thomas. The first is to describe ivy as having tendrils. Ivy does not have tendrils but rather fastens to vertical surfaces of walls or to tree trunks by unbranched, adventitious roots that adhere to the surface only and do not penetrate the bark or wall. The second error is to assume that ivy clambers over the canopy and shades the foliage, thus blocking photosynthesis. Ivy, however, is confined to the interior of the tree—the trunk and large branches—and does not cover the foliage on the exterior of the support plant (Wharton 1990; Heieck 1990). On the other hand, vines like grapevine (*Vitis*),and honeysuckle vine (*Lonicera*), clamber over the canopy. Heieck (1990, p. 32), writing from Germany where ivy is native, says that ivy vines don't reach the canopy to clamber over it because once the ivy has climbed up a tree to where more light is available, the ivy has already achieved the adult phase and no longer climbs (Heieck 1990). Heieck (1990, p. 30) also states that when ivies are seen in dead trees, it is because the ivy has a longer lifespan than the support tree, such as locust (*Robinia*), birch (*Betula*), or maple (*Acer*). Heieck (1990, p. 32) also mentions that ivies are less likely to climb on oblique or horizontal branches, but are likely to hang down. If ivies are seen on a horizontal branch, then as the branch diameter decreases, the vines are seen to drape downward (Sulgrove observation).

Thomas (1980) does not show that ivies block photosynthesis in the canopy or that ivy shades out trees, nor does he mention the size (diameter) of the trees that are covered with ivy, or whether the ivy is juvenile or adult.

Nor does Thomas give detail for his other assertions, such as:

"There is an impact [by Hedera helix*] on the over story trees and by deduction on the other layers as well. It kills them, especially* Ulmus…Hedera helix *itself appears to be killing the trees, not only* Ulmus*, but other overstory and understory trees as well…*

"By killing the trees at an accelerated rate, however, the end result of the forest will be replacement by a Hedera helix*-dominated community with few, if any, woody plants getting into the height of the shrub layer." Thomas (1980 p. 60, 61, 63-64).*

Because Thomas (1980) uses statistical correlations to draw conclusions throughout his monograph, the American Ivy Society asked Kurt Hartman (2004, personal communication), a Forest Ecologist at Ohio University (Athens), to review Thomas'(1980) documentation and statistical tables generated to support his statement that ivies kill trees. Hartman (2004) says:

"Thomas essentially said that ivy grows more on dead trees. He did locate two dead trees for which he found that the annual growth of the trees was reduced about the time that the ivy became established on those trees, so it may be possible that the ivy slowed those trees' growth. His study on ivy was observational, not manipulative.

"One would really have to do a well-replicated study using several species of trees and several site locations to really see if ivy does kill trees or reduce their overall health. Thomas showed statistically that ivy incidence was associated more with dead trees than live trees. Those trees may have already been dead, and if that is the case, then the ivy utilized the available light and vertical space to grow. Whether or not the ivy facilitated the death of those trees is another question.

"For now, the debate of whether or not Hedera *growth on trees causes the death of those trees is still unresolved."*

According to Hartman, even though Thomas has found statistical correlations between ivy and dead elms, this association does not indicate whether the ivy grew on the trees after the tree was already dead (perhaps because of Dutch Elm Disease), or whether the ivy somehow killed the trees. Only by experiments of various designs in different areas with a variety of trees can cause and effect be determined.

Despite Thomas' (1980) widely cited negative association of ivy with trees, there are positive benefits of tree trunks being cloaked with ivy. Heieck (1990, pp. 31-32) mentions the covering is useful for protecting tree trunks in winter from wide temperature variations and sunscald; ivy has also been shown to reduce the incidence of bark beetles and phloem beetles (*Hylesinus*) (Heieck 1990).

Schnitzler (1995) studied the arboreal vine densities (including *Hedera helix*) in streamside forests along the Rhine and its adjacent tributaries. A positive attribute of ivy and other vines (*Lonicera, Clematis*), according to Schnitzler (1995), is that "In alluvial lands of the area, lianas [woody vines] are an important structural component of forests and participate in many forest mechanisms. Given their abundance, rapid growth rates and voluminous leaf production, they play an active role in nutrient cycling" (1995, p. 234). Trémolière and others (1988) determined that *Hedera helix* enhanced nitrogen concentrations in the litter of temperate hardwood forests in [France]. Such additional nitrogen could have a positive effect on nearby trees, but such effects have not been measured (Trémolière and others1988). In passing, Putz (1991) states that the beneficial effects of lianas, for example, are reducing soil erosion and contributing to the maintenance of animal diversity. But in the literature review of the physiological ecology of temperate vines, Terramura and others (1991, p. 253) point out that basically very little is known about the interactions of temperate vines [like ivy] with host trees, and what is known is essentially descriptive and speculative.

Ivies do not behave like other vines. Thus, one should not generalize from other vines by attributing their characteristics to ivy. Invasive ivy reviewers (Murai 1999a, Reichard 2000, Swearingen 2000) have transferred to ivies traits from European vines, American vines,

and tropical lianas. For example, characteristics of *Lonicera periclymenum* and *Clematis vitalba*, described in European studies by Schnitzler (1995); traits of *Vitis* spp. (Siccama and others 1976), *Lonicera japonica* (Thomas 1980), and *Wisteria* (Wharton, 2004, personal communication) from American studies; and traits of tropical woody vines (Putz 1991), all of which clamber over and blanket the canopy, and have been applied to ivies. Ivy behaves differently because it is confined to the interior of the tree, and does not cover the canopy. Putz (1991, p. 493) states in a literature review of *tropical* lianas [as they influence forest crop production] that lianas/vines have been repeatedly reported to "compete with trees for water, light, and nutrients; the deleterious effects of lianas on trees can include stem breakage and deformation… and decreased growth rates." These statements, however, refer to woody vines that blanket the canopy and re not applicable to ivies.

Ivy is not parasitic. The rootlets that are formed by new shoots as an ivy adheres to a tree are simply holdfasts for climbing, and do not penetrate the bark or obtain water or nutrients from the supporting tree.

4. The weight of ivy vines has not been demonstrated to harm trees. The ecological literature cited states that grapevines damage trees.

Ivy has been blamed for harming trees due to the weight of the vines (Swearingen 2000, NIL 2002a; WA 2001; Reichard 2000, Murai 1999a). Actually, the statement was not documented for ivy, but rather it refers to an observation made on grapevines (*Vitis* sp.) by Siccama, Weir & Wallace (1976) in Connecticut, and by Putz (1991) for tropical woody vines. Grapevines grow on support plants differently than do ivies. Grapevines do not hug the trunks of trees like ivy does, but rather the thick vines of grapevines drape over tree branches and thus can, with the added weight of ice, cause the branches to snap.

The added weight of ice on any type of vine, or a sail-effect during windstorms, will contribute to the downfall trees that are dying or are already dead.

Wharton (2004, personal communication), Director of the Asian Garden at the University of British Columbia Botanic Garden, Vancouver, however, has noted a specific example where ivy plays a role. First of all, Wharton (1990), states:

*"Ivies, at least up until old age [of the ivy vines] adhere to the trunk and main branches of the host tree, and thus do not significantly affect the main photosynthetic area of the host" (Wharton 1980). "But in the mild, humid climate of the Pacific Northwest, as the vines in time spread outward along the main branches, I have seen ivies enhance the failure of red alders [*Alnus rubra*] in windstorms. The mass of ivy that has accumulated on the trunk and main branches act as a sail to bring down red alders."* Wharton (2004, personal communication).

This problem, however, may be related to the age of the plants: red alders are short-lived trees (WSDOT n. d.; Harrington n. d.), and the type of wood [perhaps weak-wooded:

red alders grow rapidly in early years (Harrington n. d.)]. In this case ivies may contribute to the downfall of already dying trees, and thus promote opening the forest to regeneration.

In contrast, Wharton (1990) says the following about Wisteria:

"Climbing genera like Wisteria *and native grapevines (*Vitis spp.*) clamber over the canopy rather than in it.* Wisteria *has been a real problem, due to its weight, together with wind pressure, can fell trees in as early as 40 years. We no longer grow* Wisteria *in the Asian Garden in the within the University of British Columbia Botanical Garden."* (Wharton 2004, personal communication).

5. Ivy is a nutritious food for native wildlife in late winter when food is scarce. Ivy flowers attract a multitude of insects—you can actually hear them!

Ivy gardeners have a lot of experience with wildlife eating or chewing on ivies! Rabbits like sharpening their teeth on plants recently set into the garden, and deer browse on adult shrubs (Sulgrove observation). In a study of understory plants in woodlands of NW Spain, Gonzalez-Hernandez and Silva-Pando (1999) have found that ivy (*Hedera helix*), along with a honeysuckle (*Lonicera periclymenum*) and alder buckthorn (*Frangula alnus*), have the highest forage value for deer. In addition, because ivy most often fruits in late winter, ivies are a food source for winter birds. Ivy berries are eaten in southern England by blackbirds, song thrushes, mistle thrushes, redwings, robins, blackcaps, and starlings (Snow and Snow 1988). Snow & Snow (1988, p. 31-32) state that ivy berries are one of the most nutritious of wild fruits because they have a high fat content. Among the birds studied by Snow & Snow (1988, p. 224), ivy is preferred to holly, which is the only other major fruit available during late winter and spring.

There is little information in print about which birds devour ivy fruits in the US. Coon (personal communication) has observed cedar waxwings (*Bombycilla garrulus*); and robins (*Turdus migratorius*), a kind of thrush that is related to the European blackbird, eating ivy berries in central coastal California. In Oregon the Ivy Removal Project (NIL 2002a, b) has seen starlings (*Sternus vulgaris*), stellar jays (*Cyanocitta stellari)*, and English house sparrows *(Passer domesticus*) eating ivy fruits.

The flowering adult ivies attract a symphony of insects to the pollen and the nectar that is secreted by the flowers. If you walk past a flowering adult bush, you can hear the hum of the insects, but apparently they are not interested in humans. Coon (2004 b, personal communication) states, "The insects seem to be single-minded when they attend the ivies, and I can work beside a plant, even bumping against it, without bothering the insects." According to Boice (2000, personal communication) insects only sting workers when adult flowering ivies are actually being pruned. In Great Britain wasps, butterflies, bees, and a host of flies are seen visiting the flowers (Cowan 2001). Davis (2004, personal communication) reports that he has seen several kinds of

butterflies, including the Viceroys and Monarchs, at least 5 different kinds of flies, wasps and hornets, and ants visiting ivy flowers.

6. Ivy occurs as a normal stage of forest succession in Europe, where it follows the herb and wildflower stage under a shady canopy. No one in the United States has shown that ivy plays a different role in US forests. There is no evidence that ivy is able to outcompete herbs and trees.

Schnitzler (1995) in Europe has been studied ivy as a normal stage of forest succession. As the old ivy leaves decay on the forest floor, they add nitrogen to the forest soils, and thus recycle nutrients in the forest. Although Putz (1991, p. 493) mentions that [tropical] vines which "display their foliage above the leaves of their host tree… have repeatedly been reported to compete with trees for water, light and nutrients," that statement does not apply to ivy, whose growth is confined to the interior of the tree and does not blanket the canopy.

Murai (1999, p. 15) and Reichard (2000, p. 214) cite Thomas (1980, p. 63): "English ivy is able to outcompete herbs and trees (both stratal layers) *apparently* [Sulgrove's emphasis] because it is evergreen and *probably* [Sulgrove's emphasis] grows all winter in this area, while the native vegetation is dormant." This is simply a supposition on Thomas' part; . he has not described any experiment that demonstrates that evergreen plants have an advantage over deciduous plants, or that ivy grows all winter.

Dr. Franklin A. Pokorny (2002b, Appendix A - 3), a researcher in Georgia working with adult ivies, responds to the statement that "Ivy competes with native herbs and seedlings," by saying: "It is only true in so far as all plant and animal life in a community compete with each other for water and nutrients, and therefore reduce each others vigor." At his home in Georgia, Pokorny has found seedlings of pines and other trees, shrubs, and other plants germinating through ivy ground cover (Pokorny 2002b).

Studies, such as Thomas (1980), Biggerstaff (2002), Le and Sonu (2000) remove ivy vines from an area, and compare them to see what plants will germinate in the cleared area as compared to a control area where ivy vines were not removed. What is often not considered is that in the process of removing the vines, the soil is disturbed, and this disturbance allows seeds in the soil to germenate. It is not just the fact that the vine layers itself is removed, but that the soil is disturbed in the process. The question remains whether ivy came into and spread in the area *before* the herb layer had died out due to shade from the canopy layer, or whether the herb layer died *after* the ivy came into the area. Fletcher (2004) offers suggestions for setting up experiments designed to show whether of not ivy suppresses the herb layer.

7. No one knows how much an ivy can grow in winter. Ivy has not been shown to have any advantage over herbs and shrubs that are not ever green, or even those that are.

Thomas (1980, p. 64) presumes that "photosynthesis probably seldom stops in *Hedera*." This statement also then presumes that evergreen photosynthesis is always correlated with growth rate. Although attributed to Thomas (1980) that ivy can spread rapidly in winter in deciduous forests and climb trees because of increased light availability, Thomas did not actually demonstrate that ivy grows rapidly in winter. Murai (1999, p. 9) cites studies of photosynthesis in *Hedera* in winter by Ryalko and Kacperska (1981) in which they found that internode formation stops when temperatures drop below (50 deg. F. or mean air temperature (41 deg. F). Murai then postulates that in the mild winter of the Pacific Northwest that growth may stop only 2 or 3 months of the year. However, the effects of dormancy—and the stopping of growth—were not considered by either author. Bauer and Kofler (1987) cite sources that state that ivy does not enter into deep winter dormancy and develops only modest frost hardiness; while their own studies (1987) showed that the photosynthetic apparatus can be severely damaged by low temperatures.

More research is needed to determine growth rates of 'Hibernica' in winter in different climates.

8. Ivy does not damage modern walls and fences that are sound or in good condition.

The question of whether ivy or other vines damage walls has been asked for more than 150 years (see literature references by Sulgrove, Appendix B). There is no research data to answer this question, only opinion and observation. Only Kridler (1994), a stonemason involved in building restoration, cites 20 years' experience with building restoration. Old,lime-based mortars of the 19th century were soft, and washed out after many years. Kridler (1994) states that it is important to formulate the correct mortar when repointing old walls. In addition, he finds that the role of enzyme secretion by roots in fastening themselves to stone or brick "does not play a big role" (Kridler 1994) in defacing walls.

Perhaps the most compelling evidence for the benign influence of vines on walls is that the walls at both Kew Gardens, England, and Princeton University, New Jersey (Carrick 1984), although planted with ivy more than 150 years ago, are still standing! The Princeton, New Jersey ivies, first planted in 1866, are the oldest documented ivies in the US. Ivies in Europe are far older, perhaps as old as 400 years (Rose 1996. p. 21).

Sulgrove (1987; also Taffler 1990, Heieck 1990) has observed that if the walls of stone or brick are sound, ivy does not do any damage. If there is a crack, however, the ivy stems may get into it (Sulgrove 1987a). Do not plant ivy (or other vines) on vinyl or wood siding (and then only when exercising extreme vigilance!), because ivy stems may get between the panels and dislodge them as the vines increase in diameter. Likewise, if ivies or other vines are planted on brick or stone walls, the vines should be pruned to prevent them from growing behind shutters, gutters, downspouts, or fascia boards, or into the soffits (Watson 1995). If ivies have been planted on old walls from the 19th century that were made with soft lime mortar, then as the soft mortar falls out, ivies

may get into them (Heieck 1990). Fence preservatives, especially those with arsenic and creosote compounds may inhibit or impede plant growth (Sulgrove 1987a). However, newer, non-toxic wood preservatives and wood substitutes have been formulated in the last 10 years or so, and should be used for trellises, arbors, and raised plant beds.

9. A review of the literature and poisonous plant databases suggests that Ivies are not toxic (poisonous, lethal) to humans. (Note: All sustances are capable of producing toxicity in sensitive individuals.) Considering the great number of ivies that are handle daily in the foliage and ground cover industry, and the numbers of ivy plants found inside or outside of the American home, the incidence of mild toxicity or dermatitis in humans is very rare. Likewise, ivies do not kill songbirds — or any other kind of bird!

The question of whether or not certain plants (or plant parts) are toxic to humans or animals often arises when babies or pets nibble on houseplants. The answer for ivy, however, depends both on where you look for information, as well as what is meant by the term "toxic."

To the general public, "toxic" often means "extremely sickening" or even "lethal." In order to classify degrees of toxicity of various common household products, the American Association of Poison Control Centers (McGuigan 2004) surveyed the literature and sought expert opinion regarding a number of household products, such as diaper rash ointment, crayons, chalk, Calamine lotion, hand dishwashing detergents, household plant food, water-based paints, and hypochlorite bleach (like Clorox). It concluded that 30 products were minimally toxic, which was defined as "when exposure to a large amount produces benign, short-lived effects." In addition, the minimally toxic substances "produce little toxicity, minor self-limited toxicity, or clinically insignificant effects at most doses" (McGuigan 2004). In other words, the effects of the products are self-limiting, such that after a day or two the symptoms disappear on their own. Since ALL substances are capable of producing toxicity in sensitive individuals, nothing is completely non-toxic (McGuigan 2004).

It is difficult to evaluate from the literature and web searches just how " poisonous" *Hedera* may be. *Hedera* and *Hedera helix* are not listed as poisonous substances to humans, dogs, cats, livestock, etc. in the Cornell University Plant Informational Database (Cornell University 2004a, b). On the other hand, such plants as Boston Ivy, *Parthenocissus tricuspidata* (no relation to English ivy, *Hedera*) and English ivy [unspecified], holly berries, buckeye, elderberry, iris, philodendron, tomato vines, etc., are listed in a poisonous plant fact sheet prepared by Vinton County, Ohio (n. d.), from information supplied by the Ohio Poison Control Center in Columbus. The disclaimer on this list notes that the poisonous plants listed may cause a variety of symptoms, from mild stomach ache, skin rash, swelling of the mouth and throat, to involvement of heart, kidneys, or other organs. In addition, "Many plants do not cause toxicity unless ingested in very large amounts" (Vinton County n. d.).

Furthermore, conflicting reports on poisoning by ivies suggests that degree of toxicity may be dependent upon the plant parts involved (leaves, stems, foliage, or fruits), and perhaps differences among the species (Sulgrove 1984d). No one has analyzed difference in the chemistry of leaves and stems, and variations among species, although there are differences between ripe and unripe fruit (Barnea and others 1993), and compounds in the leaves of *Hedera hibernica* 'Hibernica' and *Hedera helix* (Tucker and Maciarello 1994).

Much of the literature in the FDA *Poisonous Plant Database* (FDA 2003) refers to literature citations of examples of dermatitis (skin rash) in *Hedera*, as part of the title. On the other hand, *Hedera* as a poisonous plant mostly appears in this database in individual review articles and compendiums on poisonous plants. It appears that the compendiums are simply copying information from other sources.

Dermatitis is defined as "inflammation of the skin." In general terms, dermatitis often involves a rash, blistering, and itching. Poison ivy (no relation to *Hedera*; see Sulgrove 1996 for unrelated, "fake" ivies) is one of the best-known examples of plants causing dermatitis, which may vary in severity, from mild and self-limiting, to severe, depending on the sensitivity of the individual. Other plants, such as junipers, also produce skin rashes (Sulgrove personal experience). Rare forms of dermatitis, like ivy dermatitis, may be due to being sensitized by some other pre-existing medical or general heath conditions, such as medications, pregnancy, cancer, etc. (McGuigan 2004). Considering the millions of ivy cuttings that are handled daily in foliage nurseries, the cases of dermatitis that occur there, or when pruning ivy from trees and walls, may be due to, or compounded by chemicals on the foliage; and dirt, dust, and insect debris trapped in the leaves (Sulgrove observation).

Ivy do not kill—"songbirds" or any other kind of bird, nor does it cause diarrhea. Perhaps the notion that ivy berries are "toxic" to birds came about because 1) the title of the article by Barnea and others (1993) is, "What parts of fleshy fruits contain secondary compounds toxic to birds and why?" and 2) the ivy pulp contains saponins which are "mildly toxic" to birds, and thus prevents too may fruits from being eaten at one time (Barnea and others 1993). These authors did not discuss detrimental effects of chemicals on the birds, but rather, hypothesized how "mildly toxic" compounds—and their location (in pulp or seed)—may play a role in seed dispersal. Conversely, Clergeau (1992a) studied bird behavior and seed germination percentages as influenced by defecation and/or regurgitation—not detrimental effects of chemical compounds that might be in the fruit and seed. (Clergeau 1992b) has shown that ivy seeds are large, relatively speaking, and are regurgitated instead of passing through the birds' digestive tract. This indicates that diarrhea in birds due to eating ivy berries is not possible.

Thus, there is no conclusive documentation that ivy is generally harmful to humans, pets, or birds. It appears that examples of problems with ivy in humans, rare though they may be, are copied from one compendium to another. In addition, the term "toxic" has been misinterpreted to mean deadly, which ivy is not, considering the few references to such cases in the literature.

10. No one has shown that ivy is responsible for bacterial leaf scorch in ornamental trees — any more so than box elder, buckeye, bitter sweet, dogwood, black raspberries, honeysuckle, or 20 other plants.

A 1999 report by McElrone and others indicates that alternative hosts for bacterial leaf scorch (*Xylella fastidiosa*) were found for the first time in *Hedera* and in box elder (*Acer negundo*), buckeye (*Aesculus* hybrid); bittersweet (*Celastrus orbiculata*); and flowering dogwood (*Cornus florida*). Because leaf scorch disease in American Elm (*Ulmus americana*) was found along the National Mall, Washington, DC, samples were collected from wild and cultivated plants nearby to identify alternative hosts. Six species of 27 tested positive for the bacterium, but 11 of the 27 could not be tested because of technical extraction difficulties. Xylem feeding insects, including leafhoppers, sharpshooters, and spittlebugs, transmit the bacterium from asymptomatic or symptomatic hosts to other plants. Difficulties in extraction techniques must be overcome to assess Japanese honeysuckle (*Lonicera japonica*), wormwood (*Artemisia*, spp.), black raspberries (*Ribes* spp.), dock (*Rumex* spp.), etc., which have widespread ranges and may be important sources of infection. These common plants have been previously reported as sources of the bacterium.

Even though *Hedera* is found for the first time as a reservoir for bacterial leaf scorch in 2 out of 19 plant samples, bacterial leaf scorch has been found in 26 other genera and also in at least an additional 10 others, which can serve as reservoirs. Apparently, no work has been done to determine whether these hosts, including *Hedera*, can serve as sources for infection of wild trees. Although McElrone (1999) mentions the insects that transmit the disease, the conditions necessary for infection and transmission were not discussed.

V. AMERICAN IVY SOCIETY RECOMMENDATIONS

Quantifying Invasive Plant Distribution Data

In order to avoid invasive legislation that affects entire states but is based solely on localized data, distribution records (number of sites) for invasive plants should be expanded to include area covered, and percent coverage of the species within that site. So far, none of the sites publicized in Washington State (Murai 1999), Oregon (NIL n. d.), and Virginia and Washington, DC, have been mapped, but Quinn and Best (2002) have used Geographical Information Systems (GIS) analysis as a technique for digitizing maps and quantifying areas of ivy coverage in Vancouver, British Columbia. To simplify the collecting of area covered and percent-coverage statistics, perhaps terminology can be borrowed from the Endangered Species Program (Ohio 2002). Rather than actually giving the dimensions of each site and percent covered, determine the number of topographical map quads (quadrangles on topographic maps) within which ivy is found in each county. Then, for a plant to be considered invasive at the state level, it ought to be widespread, that is, it should occur in several locations (quads) within individual counties, and also in many counties statewide. The ranges of invasiveness of a species within a state (such as

"Highly Invasive," Moderately Invasive," and "Minimally invasive), based on the number of quads and counties, needs to be determined once such data has been accumulated for a number of invasive species. This data can be used to reflect the degree of invasiveness, and should be required in order to declare a particular species a "Noxious Weed" by a state legislature. Simply to list the number of sites within a state is insufficient to quantify invasiveness.

How To Pick Cultivars for Your Garden

There are perhaps over 500 cultivars of ivy, ranging from fast- to slow-growing, with some growing only inches a year. Others do not vine at all and are upright and can be used in the rock garden. There are also the traditional strongly vining ground covers, which are non-self-branching and have been selected for their rapid growth.

Keep in mind that growth rates for the same cultivar may vary from one part of the US to another. Generally, the colder the winters, the less growth that is made by the plants each year, due to dieback. Therefore, those gardeners in Zone 6 and below can grow almost any ivy, as long as it is winter hardy once established.

Ivies are well-known for growing in the shade, and juvenile vines may be grown in full sun in more northern climates with extra water and fertilizer (Sulgrove 1987a). The adult shrub-like phase requires light in order to flower, but in extreme climates (heat, drought cold) adults may fail to fruit because of lack of pollinators or other biological factors, or suitable conditions for fruit development. (See under Section I, the Adult Plant.)

When choosing among cultivars for your garden, depending on your climate, select:

- Miniature ivies, which are slower-growing than normal-sized ivies.
- Self-branching ivies, which grow more slowly than strongly vining types. Vining types are those that branch rarely, or only when pruned (See Hammer 1991 for characteristics of 250 cultivars).
- Variegated ivies, which are slower-growing than green ivies.
- Upright ivies with stiff stems that do not produce clinging, aerial rootlets. The upright ivies lack the supple stems that grow horizontally on the ground or attach to walls or trees.

Generally, more vigorous cultivars have larger leaves that are spaced farther apart (but smaller-leaved vines that have leaves spaced widely apart are not necessarily vigorous growers). Vigor can be estimated by rate of growth per season, as compared to other cultivars. Note, however, that well-established ivies grow faster than newly planted ones. Any slow- to moderate-growing ivy can be used as a perennial, but almost all will need periodic pruning to maintain their shape (or to remove reversions), because ivies are, regardless of branching habits, vines that continue to grow outward unless killed back by drought or frost. All variegated ivies, because of their limited chlorophyll, should be grown in "protected spots." This may mean in

moderate to southern climates, afternoon part- to all-shade. In all climates, create protection for variegated ivies in situations of extreme sun and wind by using plants or buildings to shelter these ivies.

Any vining—or self branching ivy (for slower growth) may be used for walls and trees. If severe winters do not periodically prune back new growth, prune to six feet (or comfortable height) to prevent flowering—*or* remove fruiting branches before they mature (Prune in late winter). Plant ivy on the north or east side of trees or with northern or eastern exposure on walls to prevent burning under extreme temperatures. Plant 12-18 inches from wall or tree to allow root growth. Vines attach more easily on rough surfaces.

For rock gardens use ivies that are miniatures or are upright ones that don't vine, or use ivies that are fasciated in some way. Some may need occasional pruning to maintain their shape.

It is possible to grow ivies as ground covers in any part of the US by choosing ivies with growth habits that are moderate in that area. In areas of the country where the ground freezes in winter and recent new growth on vines and stems are periodically pruned by freezing temperatures, almost any hardy ivy can be used. The choice of ivy can be made based on growth habit, size of leaves, textures, and color combinations desired. Growth rates, however, are determined initially by the size of plant at planting time, but ultimately by age of plant (older plants with established root systems grow faster than newly planted ones), available light, and especially soil type. A good rule of thumb (when planting any perennial or woody plant) is, "The first year they sleep; the second year they creep; and the third year they leap!"

Southern and warm-climate gardeners can grow any ivy up trees, and keep the ivy pruned to a skirt around the base of the tree and the upward growth limited to 6 feet or so to prevent flowering. Miniature, slow-growing, or self-branching cultivars can be grown as perennials, and pruned seasonally to maintain their shape. Adult ivy shrubs make great landscape shrubs, but until more is known about the germination of seeds under outdoor conditions and their spread by birds, prune back the fruiting branches before the fruits mature. Such pruning is advisable in climates where fruiting is heavy.

"The American Ivy Society is preparing a list of suitable cultivars for various regions of the US," says Russell A. Windle, newly-appointed Director of Research for the American Ivy Society. *"This list is being prepared from recommendations by ivy growers around the country, and should be available in the fall of 2005."*

"Living with Ivies Now!" Homeowners' Guide to Responsible Gardening with Ivies

Because there are so many cultivars of ivy, it is possible to garden with ivies anywhere in the United States—simply by selecting the right ivy for the right site! Beware of fast-growing ivy vines—unless you exercise diligent vigilance! IVY IS NOT INVASIVE when it is kept in bounds by periodic pruning, and when fruiting stems are removed before the fruit ripens.

The American Ivy Society (AIS) recommendations are adapted from general guidelines (Penn State College of Agricultural Sciences 1999) for how landowners can prevent the spread of invasive plants. Larry Kuhns, professor of ornamental horticulture at Penn State, says in his introduction, "Invasive plants are less of an issue for average homeowners who own small, highly-maintained lots up to 3 acres in size, whereas a property owner who has larger tracts of land left in a natural state should be aware of invasive plants." However, if ivies are planted next to any natural area, they should be watched closely.

Although ivies have been touted to colonize disturbed areas, it is not clear what is meant by "disturbed." When ivies spread vegetatively into a neighboring areas, it is not into bare soil or tilled earth, but rather into young woods. According to Fletcher (2004) there is more ivy on the edges of woods than in them, probably because there is more light—or perhaps that is where the birds—the seed dispersers—hang out. Although ivies are touted for deep shade (Morisawa 1999; Randall and Marinelli 1992), light is a limiting factor for ivy (Thomas 1980, p. 58), such that a decrease in light or an increase in shade will cause ivy to decline.

1. Inspect your property—trees and ground cover beds—twice a year. If ivy is found out of bounds, check quarterly, until all wandering vines have been cut back or pulled out.

When gardening with vines, you can't just "Plant it and forget it!" Because vines grow longer every year (except when pruned or when extreme-temperature dieback occurs), ivy ground covers need to be maintained by periodic pruning to keep them in bounds. Reversions to plain green from fancy cultivars also need to be removed, since reversions grow faster and will overtake the cultivar.

Check in the spring after growth has begun, when new leaves and vines are more visible poking through the accumulated leaf litter, and then again in fall before leaf drop covers the vines.

If you want to garden with vines on trees in natural areas, choose variegated ivies, plant them on the N or E side of trees. Variegated vines are easier to spot if they ramble as a ground cover. If fruiting is a potential problem in warmer climates, keep vines on trees pruned to 6 feet in height for ease of maintenance.

2. Once ivy vines have been pulled up, DISCARD THEM IN THE TRASH! —Not in the open compost pile. Do not leave pulled up vines on site!

Because ivies are evergreen, drought tolerant, and root readily, it is possible that cut stems may re-root, especially in compost piles (Gresham 2000). Put clippings in a black plastic trash bag, and dispose with weekly garbage pickup. Alternatively, leave them in tightly closed bags in the sun until the vines and leaves are partially decayed, and then discard them.

3. Mulch the areas where the ivy has been removed, or replant with something else (and mulch), to avoid soil erosion and to minimize weed seed germination in the disturbed soil. If vines have been pulled up, they can grow back from ivy vines left over in the soil. Check twice yearly.

4. If you live in a climate where the vines or adult branches are not periodically frozen back, remove flowering and fruiting stems before the fruits are ripe.

Note to Nurseryman and plant propagators: Discard ivy clippings in the trash. DO NOT discard in an open compost pile!

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VII. Overview

Lack of understanding or experience with ivies has resulted in inaccurate, emotional, and inflammatory myth-information about ivies on websites sponsored by groups focusing

on pest plants. The basis of such emotional hype has been suppositions, anecdotes, hearsay, and unjustified conclusions from incomplete studies—rather than on scientific facts, thorough case studies, or reasoned and careful assumptions. Furthermore, because of the prominence of these websites, their factual errors have been copied and recopied onto other sites, and then into compendiums on invasive plants, thus further perpetuating the inaccurate statements about ivies.

Such emotionalism about non-native plants, as exemplified by the treatment of ivies on the Internet in particular, has led to hasty legislation to outlaw perceived threats to local ecosystems with the result of regulating business of an entire state or region. The American Ivy Society, along with growers of cultivars of *Hedera helix* and other species, are concerned that ALL ivies are being banned, when the problem ivy, *Hedera hibernica* 'Hibernica', incorrectly called "English Ivy," is a name that is the common name for *Hedera helix* and its cultivars.

Regardless of whether the problem is actually local, regional, or only a threat in some small part of the US, there must be discussions with the nursery industry to allow for the industry to cut back on production of problem plants and have time to find suitable substitutes. It is irresponsible for narrow focus groups, like plant pest councils or native plant societies, to force legislative actions that damage statewide industries without first discussing the problems with nursery groups. Such actions are in disregard for the St. Louis Declaration on Invasive Species (2001), an agreed-upon code of conduct for nurseryman, the gardening public, and others.

VIII. Findings

'Hibernica', the English ivy of the trade, appears to be an inhabitant of urban areas, home gardens, and parks where it was planted, either as a practical ground cover in the home landscape or for erosion control. 'Hibernica' is a vigorous grower, especially in the mild, humid Pacific NW where growing conditions allow the vines to spread vegetatively (and most likely also by seed) into neighboring natural areas. *Hedera hibernica* 'Hibernica' is not as winter-hardy and disease resistant as traditional ground covers, such as *Hedera helix* 'Baltica', 'Wilson', and 'Thorndale'. Confusion over which ivy is problematic has come about because the name, "English ivy," is the common name for the species *Hedera helix*. *Hedera hibernica* 'Hibernica' should be called the "Irish ivy."

Ivy (*Hedera*) is not native to the US, but early settlers brought ivy to the US in as early as 1719. There are 16 species of *Hedera*, but perhaps 90 percent of the 500 cultivars that have been selected are vegetative sports of *Hedera helix*, a diploid unrelated to the tetraploid, *Hedera hibernica 'Hibernica'*, also known as the Irish ivy.

Ivy seed germination times and percentages vary with local environmental conditions and probably also may reflect differences in germination among the species. Few researchers identified the species or cultivars they studied, but obtained diverse results (Bényei-Himmer 1999, Coon 1989, 2000, 2004; Clergeau 1992a, Dirr and Heuser

1987), with germination occurring as soon as in a few days, to several months, from nearly 100% germination to only 50%. Is ivy a widespread invasive in the US? The search of the literature and Internet shows documentation for only one large urban park in Oregon (NIL 2004a); fifty ivy sites of undetermined size in Washington State (Murai 1999a); and one county in Virginia. Legislation was passed In Oregon based on problems in Portland's Forest Park, although how widespread ivy is in the rest of Oregon is unknown (NIL 2003). The Master's Thesis by Murai (1999) became the foundation for Washington State's declaration of *Hedera hibernica* 'Hibernica' as a noxious weed, although the size of the ivy sites was not determined. Observations in only one county in Virginia (number of sites not documented) led to drafting noxious weed legislation in Virginia, but this legislation failed (as of July 2004). Thomas (1980) studied ivies in a national park in Washington, DC, but he did not determine the extent of the area covered by ivy. Based on the American Ivy Society's experiences and observations around the country, the problem ivy appears to be *Hedera hibernica* 'Hibernica', although in Southern California the Algerian ivy, *Hedera algeriensis*, may also be involved.

There is no other documentation that ivy is invasive. Ivy is not a problem in areas of the US where the ground freezes in winter because new vines are frozen back annually or killed back to snow level every 4 or 5 years (Sulgrove observation).

Despite the lack of documentation, *Hedera hibernica* 'Hibernica' *is* a legitimate problem in the mild, humid climate of the Pacific Northwest, due both to the ideal climate that fosters vigorous growth, compounded by homeowner's neglect in maintaining ivy ground covers by periodic pruning. You can't just "Plant it and forget it" when gardening with vines! Regular pruning can contain ivy, and ivy can be removed from neglected areas by manual and chemical methods. *Hedera hibernica* 'Hibernica' and Algerian ivy are not invasive when properly maintained by pruning. Ivy is most often found naturalized at edges of habitats because ivies, both juvenile and adult plants, thrive in more light than in deep shade.

In spite of comments to the contrary, ivy (*Hedera*) has no tendrils, and does not twine around stems (despite the epithet *helix*), nor does it blanket the canopy and shade out foliage of the support tree. Its adventitious roots merely adhere to the surface of trees and to walls that are sound. If the walls have cracks in them, the stems may get into them. Ivies do not damage wood, brick, or stone, but pruning is essential to keep ivies (and other vines) from dislodging downspouts and gutters, or getting under wood or vinyl siding, fascia boards, or soffits. Although the oldest ivies in Europe have been estimated at 400 years old, the oldest documented ivies in the US, at Princeton University, are about 150 years old. The oldest ivies in Vancouver, British Columbia, are relatively young, mirroring the age of the town, at no more than 80 years old. In its well-known, long, juvenile state, ivy is a shade-loving, evergreen vine with lobed leaves. Ivy will develop into a stiff-stemmed, upright adult only when it is old enough to be morphologically and physiologically closer to the predominantly unlobed adult plant, and when there is adequate light to initiate flowering. Fruiting may take anywhere from three years for cultivars that are unlobed, to never at all. In central

coastal California perhaps the average time to maturity is perhaps 15-20 years, but time in other warm parts of the country could vary with microclimate and temperature. Fruiting may never occur in areas where the growing season or climate contributes to failure of flowers and fruits to form, or to abortion of fruits due to poor growing conditions, like heat, drought, or cold.

Ivy berries provide food in late winter for at least birds and deer, when other food is not available, and the vines provide shelter for small animals. Ivy fruits are high in fat content and thus are ideal for over-wintering birds and nestlings. Ivy is not toxic/poisonous/harmful to birds, cats, dogs, cattle, or humans. Although rare, severe reactions may result from ivy, as with any plant, depending on health and medical condition, and amount ingested. Although ivy has been noted to cause dermatitis, it is very rare, considering the millions of cuttings produced annually by the foliage and landscape industries. Ivy dermatitis or asthma may also be caused by the dust, dirt, and insect debris trapped in ivy vines.

Ivies as ground covers, especially for shady areas, have long been staples of the landscape industry throughout the US. *Hedera helix* 'Thorndale' and 'Baltica' have been used successfully on the West Coast for erosion control along the Washington State Interstates sine the mid-'80's. Because ivies do not grow in standing water, ivies do not harbor mosquitoes, but the foliage provides cover for small animals and foraging birds. Ivy has not been proven to kill trees, though many cite Thomas' (1980) National Park Service Monograph on the study of three non-native species, including ivy, in the Potomac Island Roosevelt National Park. What Thomas (1980) actually showed is that there is a statistical correlation between ivies and dead trees, but he did not determine whether ivy colonized the American elms (*Ulmus americana*) after they had died of Dutch Elm disease, or whether ivy climbing on the elms contributed in some way to their decline and death. Thomas (1980) also mistakenly assumed that ivy (*Hedera*) was capable of blanketing the canopy of trees and causing their death by blocking sunlight to the trees foliage. Actually, ivy vines and adult upright stems are found on the trunk of the tree, not in the canopy.

Because there are many cultivars of ivy that are available, homeowners can pick the right ivy for the right spot in their gardens. The American Ivy Society provides suggestions for evaluating cultivars for use as ground covers or in small areas, for use as perennials, for covering trees, and for rock gardens. Recommendations for gardening responsibly with ivies, "Living with Ivies Now!" are included.

IX. Abstract

Due to widespread misinformation about ivies, especially on the Worldwide Web, but also in compendiums on invasive plants, a review of the ivy literature and web sites related to ivy was undertaken to assess their accuracy. Because of confusion in the nomenclature of ivies, the wrong ivies, *Hedera helix* and its cultivars, mostly grown as pot plants, are banned in legislative proposals and laws, instead of the problem ivy, *Hedera hibernica* 'Hibernica'. On the West Coast ivy has been declared a noxious weed

in Oregon, apparently based solely on (1) ivy problems in a large urban park (without further documentation of invasive ivy elsewhere in the state), and (2) on misinformation about ivy taken from a national invasive species web site. In Washington State a Master's Thesis' preliminary report appears to have served as the basis for legislating *Hedera hibernica* 'Hibernica' as a noxious weed along with and three cultivars of *Hedera helix*. Attempts were made in Virginia by native plant groups to ban *Hedera helix* and all its cultivars, based solely on ivy problems in one county, using misinformation from the national web site. To clarify how ivy grows both in the juvenile and adult stages, the botanical literature is reviewed, and ivy researchers are queried about their experiences. Documented information is provided to counter inaccurate statements about ivy found on the Internet. The American Ivy Society makes the following recommendations: (1) a suggestion on how to quantify invasives; (2) suggestions for evaluating cultivars for ground covers, perennials, trees, and rock gardens (3) guidelines for responsible gardening with ivies, called "Living with Ivies Now!" There are extensive literature citations. The Appendices quote pertinent email messages and lists additional references concerning vines on walls and trees. The American Ivy Society will present a list of suitable cultivars by region at a later time.

X. Literature Cited

Where dates of web site articles are not identified in the web site, an estimate is made by using the date of the most recent literature citation in the references, followed by a "+". Where dates not given or estimates not possible, the abbreviation n. d., no date, is used, and the date of last accession is given. Because accessing Internet sites is extremely undependable from hyperlinks (especially after business hours), try inserting the title surrounded by quotes into a web search engine like Google.com or Ask.com. If you are unable to access the information, copies can be requested from AIS for a small fee.

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XI. Appendices

Appendix A. Email

Appendix A – 1. Barnes, Bob. 2002. Email from Bob Barnes, November 13, 2002, to Sabina Sulgrove and others," 'Thorndale' and 'Baltica' as ground covers along the Interstate highways in Washington State."
Bob Barnes is Olympic Region Landscape Architect, Roadside and Site Development Office, Washington State Department of Transportation.

"We chose to use a couple of cultivars ('Baltica' and 'Thorndale') for projects in the Olympia and Tacoma areas back in the late 1980's. We were corresponding with you in 1986 about bacterial leaf spot and some of the more desirable characteristics of the other cultivars which are less rampant and less prone to develop the adult characteristics more associated with 'Hibernica'. I have not noticed either the 'Baltica' or 'Thorndale' varieties exhibiting the adult form, which is less desirable and more problematic in developing seedlings that escape. We have established these ivies on slopes as steep as 1 1/2: 1 with 2:1 slopes being more of the norm. The ivies have provided excellent erosion control and weed

control, minimizing our maintenance of these steep slopes, and creating a more refined look in urban settings. We have not had any major maintenance problems with controlling the ivy. Occasionally it requires trimming along curb lines or from hanging on the pavement, but is easily controlled with some selective pruning, and sometimes a little chemical growth regulating. Our maintenance crews often use State corrections crews in addition to their own personnel to perform this function. They also use a product called Krenite, which acts as a growth regulant to retard tip growth. This reduces the need and frequency of the mechanical pruning. Overall, I am pleased with the function and appearance of both ivy cultivars thus far. They have performed as expected, maintaining a prostrate habit except where they climb or hang on walls and reduce graffiti potential.

"Administration for the Olympia Freeway. Ivy was a key ingredient in the picture that helped us win that design award. I hope this answered some of your questions, and I would be happy to send pictures or answer any other questions you may have. I appreciate your work and recommendations and hope this will help some of your readers."

Bob Barnes
Olympic Region Landscape Architect
Roadside and Site Development Office, Tumwater, WA 98504
360-357-2733
barner@wsdot.wa.gov

Appendix A - 2. Pokorny, Franklin. 2002a. Email from Dr. Franklin A. Pokorny, November 14, 2002, to Suzanne Pierot, copied to Sabina Sulgrove, "Responses to the No-Ivy-League questions and answers on Ivy Quiz. [On-line at http://www.noivyleague.com/Pages/ivy_iq.html.]" Franklin A. Pokorny, PhD, is Professor Emeritus of Horticulture, University of Georgia, Athens, and president of Oakbend Nursery, Athens. References cited herein are given at the end of this email.

NIL (Noivyleague) Question 1: "English ivy is native to: a) Massachusetts; b) Antarctica; c) Hades; and d) Europe."

" The answer is "d," Europe. I have no problem with the first question, although I find the selection of possible answers interesting. "

NIL (Noivyleague) Question 2: "English ivy is a major food source for: a) lambs; b) giant Pacific salamanders; c) banana slugs; d) no native wildlife."

"The correct answer, according to the web site, is d) no native wildlife. I have difficulty with the use of the words "major" as it relates to "food source" and "wildlife" as used in multiple choice answer selection d). A food source will vary

from season to season depending upon food availability. When a preferred food is unavailable, then something else becomes a primary (major) food source. Deer, for instance, will graze English ivy in winter and very early spring when their preferred food is not available or is in short supply. I interpret the term "wildlife" to mean all uncultivated living things in a community. This would include insects, fungi, bacteria and all soil-borne living organisms. If one takes the time, one can observe bees, wasps, butterflies, and other presumably beneficial insects utilizing open ivy blossoms as a source of pollen and nectar (major sources of food for these living organisms) at a time when little else is in flower (Fearnley-Whittingstall 1992). In addition, information presented on the NoIvyLeague web site clearly states that robins, jays, and cedar waxwings, all native to the area, eat ivy fruit when it ripens in early spring (Fearnley-Whittingstall 1992). It certainly appears to me that ivy berries are indeed a major food source for native wildlife. Therefore, question 2, as written, has no valid answer offered. "

NIL Question 3: "English ivy is a very shade tolerant plant that can grow in as little light as: a)10%, b)15%, c) 1%, d)8%."

"Answer "c," 1%, is indicated as correct. No information is provided relative to what the light source is, the intensity of the light source, nor the duration of the light exposure. All of this information is needed to arrive at a valid answer. English ivy can be grown in an interiorscape under artificial light intensities of 75 to 150 foot-candles, but only if the light duration is approximately 12 to 14 hours per day. If either the light intensity or duration of light exposure is insufficient, plants will decline and die.

"Using the minimum (1%) and maximum (15%) percentages given as possible answers, calculated light intensities would yield 0.75-1.5 foot-candles (FC) and 11.5-22.5 FC, respectively, too little to sustain plant growth. One must assume that the light source referred to in the question is natural daylight, and furthermorethat the sky is cloudless and that the sun is shining brightly at midday (a bright sunny summer day). On such a day, one might measure light intensity of approximately 10,000 FC. Using this set of assumptions as a basis for calculation, the possible answers provided would yield a) 1000 FC; b) 1500 FC; c) 100 FC; and d) 800 FC. It is my opinion that between 800 and 1500 FC would be needed under natural conditions to sustain ivy growth. It should be pointed out that on cloudy, rainy days and in the morning and late afternoon, light intensity is considerably diminished, especially under a forest canopy. Furthermore, light duration is shortened under such circumstances. The season of the year will further affect the light intensity, quantity, and light quality plants receive under the forest canopy. The correct answer to this question is unknown, but my best estimate is that the light intensity required for growth lies somewhere between 800 and 1500 FC (8% to 15% of sunlight) under natural conditions. There are too many unknowns and variables involved to allow for a more specific answer to be given.

NIL Question 4: "English Ivy spreads by: a) Vines; b) Roots; c) Seeds; d) All of the above."

" The answer, Ivy spreads by stems (vines) and seeds. Roots of ivy lack stem tissue and the capacity to develop adventitious buds and therefore cannot develop new shoots (stems). This is evidenced by the fact that leaf-petiole or leaf-stalk cuttings of ivy when placed in a suitable rooting medium with adequate moisture will form roots (Hackett and others 1988), but the rooted leaf-petiole cuttings will never develop into new plants and will eventually die. "

NIL Question 5: "Mature English Ivy that produces flowers and berries looks: a) Very much like the pointy leaf vines except that the leaves are wrinkled; b) Very much like the pointy leaf vines except that the vines turn yellow; c) The same s the juvenile form; and d) Looks very different and has rounded leaves growing in a spiral around a stalk-like vine."

"The answer, d) Looks very different etc. [from the juvenile vine], is correctly given on the website. However, when the ivy vine becomes adult, the stems are upright; the plant is no longer a flexuous vine but rather is shrub-like. "

NIL Question 6: "English Ivy damages trees by: a) Competing for nutrients and moisture from the soil; b) Adding great weight making the tree more susceptible to toppling; c) Interferes with the trees ability to perform photosynthesis; d) All the above and more."

"All the possible answers to question 6, at first glance, may appear to be true, but when placed in the proper context, are not entirely valid. Answer a) states that ivy competes for nutrients and moisture and thus damages trees. All plants in a forest (native or not) compete for nutrients and moisture and cause damage to each other. In addition, the soil rhizosphere supports a large population of microorganisms which require moisture and nutrients, which they obtain from the soil in competition with the trees and understory plants of the forest. Water is also lost from the soil surface in the absence of a plant cover or a mulch of forest litter. Broad-leaved as well as narrow-leaved evergreen plants retain their foliage for approximately 2 years, when the foliage abscises and dies. Soil microorganisms decompose the dead foliage, returning nutrients to the soil. This is also the process with English ivy.

"As to answer b), the issue is not so much the additional weight the ivy adds but the added resistance to wind action that results in a tree toppling. Key (1999) confirms that ivy, which has climbed old or diseased trees, can cause a tree to break or topple, but suggests that it is nature's way of making way for younger, healthier trees to develop. Fearnley-Whittingstall (1992) also points out that ivy will not hurt a host tree unless it is very old, weak, or diseased.

"Answer 6c states that ivy interferes with a tree's ability to perform photosynthesis. Juvenile growth on the trunk of a tree does not interfere with the photosynthetic

capacity of the tree. Ivy foliage does carry on photosynthesis in the presence of light utilizing carbon dioxide from the atmosphere and water to yield carbohydrates (food) and oxygen. Thus, oxygen in the atmosphere is replenished and carbon dioxide is diminished. Certain atmospheric pollutants are also removed by the ivy (Fearnley-Whittingstall 1992). "

NIL Question 7: "Ivy is a useful landscaping plant because: a) it stops erosion; b) it stabilizes slopes; c) it repels rats and mosquitoes; d) none of the above."

According to the NIL web site, the correct answer is "d) none of the above." I beg to differ. English ivy is generally recommended as a ground cover (Bush-Brown 1980, Dirr 1990, Mackenzie 1989); but is also used on shallow banks and mild slopes where it protects the soil from heavy rains and soil erosion, thus reinforcing the bank or slope (Mackenzie). Ivy can be planted on banks and slopes where grass can be grown but where mowing might be hazardous or difficult. Answers 7 a) and b) appear to me to be the correct answers to this question, not d). "

NIL Question 8: "English ivy is good for: a) forage; b) topiaries; c) attracting songbirds; and d) a tasty snack when hiking in the woods."

"Topiaries" – b) — is reported to be the correct answer. Yes, that is correct, but so is a) "forage" and c) "attracting songbirds." These have been documented earlier in this letter. "

"This test is very biased and designed to leave a negative impression on the test-taker and to promote the NoIvyLeague agenda. I've not had time to make a thorough review of the NoIvyLeague web site but have seen enough to know that it is also designed to mislead a visitor. "

Regards,
Frank Pokorny

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Appendix A - 3. Pokorny, Franklin. 2002b. Email to Suzanne Pierot, copied to Sabina Sulgrove, December 17, 2002. " Re:Arlington [VA] English

Ivy Proposal, including the charge that ivy reduces tree and plant vigor by competing for nutrients, etc." Franklin A. Pokorny, PhD, is Professor Emeritus of Horticulture, University of Georgia, Athens, and president of Oakbend Nursery.

"The plant name, English Ivy, is a common name, and is of no botanical standing and does not identify the so-called "problem plant" in question. Only a valid scientific name composed of the genus and specific epithet can be used to specifically identify the plant in question. It is apparent from the proposal that this has not been done. Let me point out that a plant will have only one valid scientific name that is used on a worldwide basis to identify a specific plant. As for the use of common names, a plant may have as many as 8 or more common names depending on the locality, region, or country where it is grown or found growing. I think it incumbent upon the organization(s) sponsoring this proposal to correctly identify the problem plant by submitting samples to a qualified ivy taxonomist for positive identification.

"Nothing in the Arlington proposal indicates the extent of the so called problem on a statewide basis, and therefore I must assume that the problem is a local issue. I would think that data as to the extent of the ivy problem on both the local and state level would be needed to justify this proposal.

"As to the charge that ivy prevents growth of seedlings and herbs and reduces tree and plant vigor by competing for water and soil nutrients, this is nonsense. Most escaped ivy that I have seen have seedling trees, shrubs and other plants penetrating through the ivy ground cover. In my own garden, I must remove pine seedlings and those of other trees, as well as poison ivy and Virginia creeper, from my established ivy beds. As to reducing tree and plant vigor by competing for water and soil nutrients, this is true only insofar as all plant and animal life in the specific community compete with each other for water and nutrients and therefore reduce each others' vigor. The soil in which the plants are growing is teeming with bacteria, fungi, nematodes, worms, and a whole assortment of other living organisms, which, in addition, compete for water and nutrients. In the final analysis, nutrients are returned to the soil when ivy leaves die and are decomposed by soil microorganisms. Ivy foliage is replaced approximately every 2 years.

"Bacterial leaf scorch may have been found in ivy foliage, but there are at least ten other native species which also harbor the problem disease. "

Regards,
Frank Pokorny

Appendix A – 4. Pokorny, Franklin A. 2004. Email to Sabina Sulgrove, March 7, 2004. "Seed Viability in Hedera." Franklin A. Pokorny, is Professor Emeritus of Horticulture, University of Georgia, Athens, and president of Oakbend Nursery, Athens, Georgia.

"I mentioned earlier the possibility that the fruit of the 'Lexington' adult selection that I have was produced parthenocarpically, as the fruit I had checked was seedless. If I remember correctly, that fruit would have been produced in late fall or early winter of 2000-2001. Fruit produced in 2001-2002 and 2002-2003 were also checked for seed and were found to also be seedless. However, fruit checked this year, 2003-2004, did yield some seed, much to my surprise. About 21% of the collected fruit contained seed. Fruit set last fall was not good and I was only able to collect about 120 fruits to check for seed. Many of the flowers in each umbel either abscised early or did not develop a mature fruit. I plan to recheck my plants again to see if more fruit fill out and ripen so that I can increase my sample size.

"Most of my adult selections that flowered this year (2003-2004) had poor to no fruit set, even the all green selections, with the exceptions of *Hedera helix* 'Treetop' and 'Prince'. I am not sure of the reason, because we had plenty of rain last summer, even though September and October were on the dry side.

"I believe seed of adult variegated cultivars is viable, but the seedlings derived from the seeds of variegated cultivars will be all green. I can think of no reason why the seed of variegated ivies would not be viable when planted, if the seed was cleaned before it was planted. As I have indicated to you previously, the pulp of the fruit surrounding the seed apparently will inhibit seed germination. If, when the fruit falls to the ground intact, seed germination will indeed be prevented until the pulp disintegrates and the inhibitors removed.

"M. A. Dirr and C. W. Heuser, Jr. in their book entitled "The Reference Manual of Woody Plant Propagation," report 70% seed germination using cleaned (de-pulped) seed, but no germination when uncleaned seed was sown immediately or was stratified. I have obtained similar results using cleaned and de-pulped seed."

Regards,
Frank Pokorny

Appendix A – 5. Westine, Peter. 2004. Email to Sabina Sulgrove, February 11, 2000, "Soil Erosion vs. Soil Stability." Peter Westine has a Masters degree in Civil Engineering Structures, Cornell University. He has published many reports and papers in the area of dynamic phenomena associated with soil mechanics.

" To those with a background in soil mechanics, soil slope instability and soil erosion are two different things. Soil erosion is a shallow water or wind removing inches of topsoil. Usually grass or any well developed, fibrous root structure is effective in preventing erosion.

"Slope stability is a question of deep soil strength. An example of the question of soil slope stability was your own [Sulgrove] house, and whether the weight [of the

house] would cause your cliff to fall deep down into the gully so that your home would end up in the creek bed. Another soil stability problems would be a footing [of a house] on flat soil. Soil stability failure here would be that the pressure on the footing [from the weight of the house] is so great that the soil is pushed down under the footing and up and out to the side so that one or several sides of the footing rises into the air. This is not a surface phenomenon."

Appendix B. Topics.

THE CONSEQUENCES OF IVIES and OTHER VINES ON WALLS AND TREES

Annotated Reference List

Compiled by Dr. Sabina Mueller Sulgrove, Director of Ivy Research, 1997; edited, 2002, 2004.
American Ivy Society, P.O. Box 2123, Naples, Florida 34103-2123 USA

There is no research data, only opinion and observation. Only Kridler's 1994 paper reports experiences. The most compelling evidence for the benign influence of vines is that the walls at both Kew Gardens and Princeton University, although planted with ivy for more than 100 years, are still standing!

American Ivy Society Editors. 1982. [Notes]. Ivy League Sans Ivy. Ivy Journal 8(3): 2. [The ivy torn down from the walls of Harvard University in 1982 is not Hedera, but Boston Ivy, Parthenocissus. "There is a strong feeling that it [the ivy] is causing deterioration of the buildings."]

American Ivy Society Editors. 1982. [Notes]. Insulate with ivies. Ivy Journal 8(3): 3. [A report of the June 1982 British Ivy Society Newsletter 5(1):17, promoting ivies for its thermal insulation and water shedding properties.]

Brick Institute of America. [n.d.] Ivy on Brickwork: Pros and Cons. 1 p. Engineering and Research Digest. Reston, VA. ["There is no single easy answer. . It is possible that…ivy can…dislodge masonry units…if the walls are not properly constructed. . . Plant growth …may tend to keep moisture entrapped and in contact with the masonry…[which] may lead to efflorescence or staining of the wall. . . Plant growth can harbor…nesting insects, birds or other animal life and offer them easy access to the inside of the building. Ivy reduces wall temperature and sheds rainwater. . . A wall [that] is well-built…. can…last hundreds of years…[but] the growth of ivy…may shorten the life. Removal should be attempted in a small area. Inspect the exposed area for condition and appearance. . . Cut [the ivy} away close to the wall. . . Do not use chemicals or acids…[which] will…damage or stain the wall. . .Leaves the "suckers' in place until they dry up…[and] they can be removed with a stiff fiber brush and laundry detergent."

Carrick, Elizabeth. 1984. The Walls of Ivy. Ivy Journal 10(2): 9-12. [The history of planting ivies on the walls of Princeton (NJ) University — a tradition begun in 1866.]

Fearnley-Whittingstall, Jane.1992. False Accusations. pp. 7-10. In: Ivies. Random House. New York. 160 pp. [Ivy is not poisonous, although the seed is a purgative to humans; it does not damage sound walls or trees. Ivy is beneficial to walls, sometimes holding together old walls. Its roots are no more a risk to a foundation than any other plant's; top growth, by its weight, is only detrimental to vulnerable walls. An experiment at Winchester

College, 1890-1942 showed that there was no difference in girth of trees that had ivy growing on them as compare to trees that had ivy removed every 10 years.]

Heieck, Ingobert. 1990. Was man vom Efeu noch wissen sollte. pp. 31-33. In: *Der Efeu auf unseren Friedhöfen.* Gartnerei Abtei Neuburg. Heidelberg. Germany. 34 pp.[...Do not plant ivies on walls constructed with lime mortar; or on unsound walls including plastered walls with cracks or ornamentation that could come loose; or on porous, laminated surfaces in which the outer layer could peel off. Ivies do not grow on white painted walls in the sun, on white birches, on walls with high pH (pH 13), and walls with a covering of loose sand or fine particles that are loose and abrade naturally. Ivies are not parasites, do not damage trees, and often outlive their host tree.]

Hibberd, Shirley. 1893. [Ivies on walls and trees]. pp. 20-30. In: *The Ivy*, Second Edition. W. H. Collingridge. London. 115 pp. [Damage to walls by ivies is "practically unimportant." Ivy damages trees by "checking circulation of sap in the rind of the tree", and "robs its support of light and air."] *Editor's note: This opinion of ivy damage to trees is not supported by more recent observations.*

Horticulturist and Journal of Rural Art and Rural Taste, Editors. 1856. [Editors Table, Answer to Correspondents. How to get an ivy to cover a wall]. *Horticulturist and Journal of Rural Art and Rural Taste* (New Series) 11: 45-46. [To promote ivy growth on a wall, remove unattached terminal ends by cutting back to where stem is attached to wall.]

Kridler, David. 1994. Dispelling the myths. II. Some Thoughts Concerning Vines on Masonry. *Ivy Journal* 20: 46-52. ["In the field it is very important to carefully diagnose the condition of a structure when determining the effects that vine coverage might have." Kridler discusses how to analyze the condition of old walls, and the importance of formulating the correct mortar composition when repointing. In his 20 years' experience, the role of enzyme secretion into walls to the detriment of mortar and ultimately to brick or stone "does not play a big role." Kridler, a practicing stonemason from Fresno, Ohio, is involved in on-going restoration at Stan Hywet Hall, Akron, Ohio.]

Mathes, Martin C. 1987. The Hallowed Walls of Ivy. *Ivy Journal* 13(1): 35-36. [How to control ivy growth on walls by planting specimens in bottomless 10-inch containers].

Newlands, Willy. 1980. Good cheer for Ivy. *The Daily Mail* (London) [1980? issue not identified]. Reprinted in the *Ivy Bulletin* 6(4): 11. [A listing of positive attributes of ivy, according to the Forestry Commission in England. Ivy is a boon to wildlife: it prevents ground freezing, enabling small birds to forage in hard weather; provides nesting crevices and warm cover for birds, and winter retreat for butterflies; provides abundant nectar in early winter when few sources available. "Ivy does not. . . strangle anything. It does not compete noticeably in the soil for nutrients and it does not harm healthy trees."]

Princeton University. 1992. Princeton's Green Menace. [*Princeton Alumni Magazine*], Sept. 1992. [In order to repoint ivy-covered walls that had not been repointed since the mid-1800's, ivies were peeled back from the walls, supported by scaffolding, and then refastened. "We pay dearly for ivy-covered buildings," says the university's grounds director of the $320,000 project.]

Rose, Peter Q. 1980. *Ivies*. p. 23. Blandford Press. Poole, Dorset. England. ["Ivies will not harm any building in good repair. The museum buildings at the Royal Botanic Gardens, Kew, have supported ivies for almost 100 years with no sign of trouble..."]

Rose, Peter Q. 1996. p. 21. In: The *Gardener's Guide to Growing Ivies*. Timber Press. Portland, Oregon. 160 pp. [Ivy is not parasitic; rootlets of climbing shoots have no penetrative powers but help plant adhere to support. If a tree is in good health, the ivy is a secondary plant, ascending the trunk and into branches, doing no harm. If tree declines for any reasons. The ivy will take over—as seen in trees killed by Dutch elm disease. On very old walls where mortar is weak, it is possible for ivy shoots to take root in the gaps, but on sound walls ivy is harmless. Ivy keeps walls dry in winter and cool in summer. Very weak walls [as in old British castles] may fall if ivy bushes out at top and becomes heavy with snow, and thus susceptible to pull of strong winds; clipping obviates this possibility.]

Sulgrove, Sabina Mueller. 1987. Versatile new ivies. [Plant Page]. *Garden Design* 6(3): 78, 80, 82, 84, 86.[If mortar and walls are sound, ivy does no damage; if there is a crack ivy will get into it. Do not plant ivies on vinyl or wood siding. Ivies thrive on unpainted walls, but after painting, walls are less porous and ivies do not do as well. Fence preservatives may impede or inhibit plant growth. Ivies are not parasitic and do not damage trees, but rather thrive in the light of defoliating old, dying trees.]

Taffler, Stephen. 1990. The Myth of Ivy Damage to Walls. pp. 96-97. In: *Climbing Plants & Wall Shrubs*. Crowwood Press. Swindon, England. 128 pp. Also reprinted as "Dispelling the Myths. I." In: *Between the Vines* (American Ivy Society) 4(1): 4, 1992 [Lime-based mortar, used in very old walls, is weak, and can crumble under the weight of neglected, arborescent ivy buffeted by the wind. Old walls covered with ivy are often in better condition and are dry as compared to those without ivy.]

Taffler, Stephen. 1990. In Defence of Ivy. p. 97. In: *Climbing Plants & Wall Shrubs*. Crowwood Press. Swindon, England. 128 pp. Also reprinted as "Dispelling the Myths. I." In: *Between the Vines* (American Ivy Society) 4(1): 4, 1992 [The shade cast by a healthy crown will confine an ivy to the trunk & lower limbs. Only when a tree is dying and has lost its canopy of foliage does the ivy rapidly climb in response to the available sunlight. Ivies are neither parasitic, nor strangle their host.]

Watson, Lori A. 1995. Dispelling the Myths. III. A Literature Review: The Effects of Fungi, Bacteria, and Plants on Historic Buildings; and Recommendations for Wall Maintenance. *Between the Vines* [Newsletter of the American Ivy Society} 7(2) 1.3-4,7-9, 11. [First printed as, *The Effects of Botanical and Biological Growths on Buildings*, I: "The Historic Dimension Series," A publication series prepared by students in the Department of Housing and Interior Design at the university of North Carolina at Greensboro; revised and re-titled for the American Ivy Society.] ["Decay [is] often a symptom rather than a cause of structural problems." How to recognize and remove fungi is reviewed. "Vines may have a harmful effect if they are not properly maintained, or if brick or mortar is of the soft variety. Vines hinder the inspection of gutters, downspouts, and cornices. . .and may contribute to the efflorescence and staining of the wall. On structurally sound walls, [vines] can act as insulation against wind, frost, cold, and rain. 4 categories of vines damage walls differently. . .Plants cause damage to wood through discoloration, abrasion, moisture retention, and prying and splitting when seeds germinate in cracks of old timbers. Roots of trees and shrubs can interfere with drainage and contribute to ground soil movement." How to remove vines from walls and how to choose and care for vegetation is also reviewed. Bibliography included.]

Whitehouse, Ron. 1980. Does Ivy Have the Killer Instinct? *Ivy Bulletin* 6(4):10. [Although ivy extracts have been reported to kill bean sprouts in a student project, Whitehouse points to concentration as a probable cause.]

Tara Fletcher: Research to Identify Factors that contribute to English Ivy's Successful Invasion in the Pacific Northwest. An e-Interview with Sabina Sulgrove, American Ivy Society Taxonomist, March 25-April 20, 2004

Very little is actually known about ivy behavior in natural situations. Much of what has appeared in print is actually supposition, anecdotal, or attempts to explain ivy behavior based on other kinds of vines. Here, in this e-interview, Tara Fletcher presents what is currently known—and not known—about how ivy behaves in natural situations; and explains what answers she is hoping to learn through her research.

Fletcher: I am a PhD candidate at the University of Washington, Seattle, studying the biological factors that have enabled English ivy to be a successful invader in the Pacific Northwest. My research site is in the early stage of ivy invasion, so it provides

the opportunity to study how reproductive success, seedling survival, and seed dispersal contributes to the success of this species.

Sulgrove: Where are you doing your studies?

Fletcher: St. Edward State Park is a 316-acre, very hilly, urban Seattle park that was a Catholic seminary from the 1930s to 1978. The original buildings are still there, and from what I can tell by looking at old maps, the land use hasn't changed much. As a seminary, St. Edward escaped the clear cutting that occurred throughout Seattle. There is a lot of lawn, parking areas, and pavements near the buildings. Small walking trails run though this relatively undisturbed lowland forest. St. Edward has a large expanse of undeveloped lakeshore, and the seminarians had a boathouse on the shore. Near the old boathouse location is a patch of *Vinca* that must have been planted. (*Vinca* occurs nowhere else in the park). In addition to ivy, there are a fair number of non-native American Hollies and a few Laurel cherries. None are in areas where they would have been intentionally planted, so birds must have dispersed them.

I see little evidence that ivy was used for landscaping at the seminary. There is one area, however, that seems to have been landscaped with ivy—and still is—the grotto area. Originally, I believe priests used it, and now it is used for weddings. Ivy grows on the stone grotto, and I suspect that was planted during the seminary years. However, this ivy is not reproductive so it cannot explain the ivy within the park

Sulgrove: Could this ivy have been fruiting some time earlier, and then been cut down? I have visited parks on the West Coast, and the first time there were beautiful adult shrubs; when I returned a few years later, they had been cut down. **Are there any ivy patches close enough to the grotto, or is the grotto centrally enough located to explain some of the ivy patches?**

Fletcher: The grotto has artful juvenile tendrils growing up its front; to maintain this appearance, it is probable that the grotto ivy has been cut back at various times. There are no ivy patches immediately surrounding the grotto (it is surrounded by lawn and flower bed). I see no evidence at all of adult stems, so I believe it is unlikely that the grotto ivy has ever attained adulthood. In the forest edge near the grotto, there are several ivy patches and approximately 10 reproductive ivies. They do not appear to have been intentionally planted, so I do not know whether they are related to the grotto ivy. Many mature ivies grow in the suburbs surrounding the park. Thus, I suspect that the ivy growing in St. Edward State Park came, via birds, from suburban populations.

I have investigated ivy that appears to be fruiting on the ground. Generally, if adult shoots are found coming from a ground cover, there is a stump or a large stone upon which it appears that ivy has climbed; or there is evidence that a larger adult was once present, but was cut back or otherwise damaged.

Sulgrove: What kind of ivy are you finding in the park?

Fletcher: The ivy most probably is *Hedera hibernica* 'Hibernica', the ivy everyone here on the West Coast is calling English Ivy. The areas with ivy are more frequently found on the edges of the woods rather than in it.

Sulgrove: What means are you going to use for identification of the ivy?

Fletcher: At this point, I am most interested in distinguishing *Hedera helix* from *H. hibernica* 'Hibernica'. These species have different ploidy levels, so I am going to use flow cytometry. This technique can use DNA content to distinguish diploid *Hedera helix*, tetraploid 'Hibernica', and potential hybrids. If some invading ivy is *H. helix*, I will probably seek assistance to identify the variety.

Sulgrove: You mentioned earlier that you found more ivies growing on the edge of woods, rather than in it. Why do you suppose ivy is more frequently found on the edges?

Fletcher: I have two main theories of why ivy is more common on the edge than the interior: 1) The bird species that disperse ivy tend to hang out on the edge of the forest more than the interior. 2) Ivy survival is higher on the edge than the interior due to environmental factors. Fieldwork this year will test these two ideas.

Sulgrove: How distant are your ivy patches from the surrounding ivy, whether juvenile or adult (in feet or meters)?

Fletcher: The suburban ivy is adjacent to the park boundary, but not adjacent to the park patches themselves. (Three or four juvenile ivy patches extend directly from suburban yards into the forest, but I am not looking at these patches.) Park ivy patches range from 100-1500 meters from suburban reproductive ivy. The greatest distance between ivy patches within the park is about 600 meters.

Sulgrove: Is it possible that some of the areas you are studying in the park could have come from vegetative spread?

Fletcher: It's unlikely that the areas that I am studying came from vegetative spread. There is no intentionally planted ivy near these areas, and it isn't likely that fragments were accidentally carried long distances and then rooted in the new locations. So far, the suburban patches have not vegetatively spread that far into the park.

Sulgrove: What about the neighbor to the park whose ivy got away? Can you determine how far the ivy has spread in the 30 years or so since it "escaped?"

Fletcher: I did not actually see the patch in her yard. The suburban patches that I see on the north side of the park extend only 10-20 meters into the park itself. Without management they will continue to spread, but it isn't a major issue in this park now.

Sulgrove: Are you saying that the ivy from neighbors you spoke to, who

were distressed that the ivy got away from them, this ivy has only grow 10 to 20 meters in 30 years?

Fletcher: It is hard to know the growth rate of ivy. Ivy patches seem to have a very variable growth rate. If conditions aren't ideal, they may remain small for long periods. However, if conditions are good, they can grow very quickly. I haven't studied this aspect myself, but Midori Murai studied growth rates in her 1999 University of Washington Master's Thesis and found ivy can grow many centimeters a year. It can also be hard to measure growth rates because ivy is regularly pulled from forests. The pulling rarely, if ever, permanently kills the patch, but it can slow its spread.

Sulgrove: You mentioned in an earlier email that robins ate the ivy fruits. Can you determination how far from the seed source the birds have deposited the seed? Have you seen anything else eating ivy fruits?

Fletcher: During 10 hours of survey I only saw robins eating berries; one crow seemed interested, but I didn't actually see it consume fruit. Unofficially (not during the survey) I saw a song sparrow eat several berries, and I have seen starlings foraging in other areas of Seattle. Based on the size of the ivy seeds, Josh Tewksbury (Ecologist at the University of Washington) thinks that birds may actually regurgitate the seeds rather than defecate them. This would suggest they don't travel very far from the seed source before they are dropped. Thus, ivy may move by short spurts. For example, seeds may have been carried from the suburbs to the edge of the park's forest. Now those ivy are fruiting and birds may carry seeds from the park ivy short distances into the interior (or perhaps back into the suburbs).

I'm not sure how far the birds carry the seeds. Some sources suggest that ivy is mildly toxic to birds so that they eliminate the seeds within a relatively short distance. I will be doing some bird work to try to determine whether they regurgitate or defecate the seeds and how long they keep them in their bodies.

Sulgrove: Do you see evidence of ivies being carried by birds via discrete jumps within the park?

Fletcher: I don't know where the birds carry the seeds once they swallow them. I have seen robins eating the fruits from park ivy, and I see robins flying throughout St. Edward State Park. Therefore, I can only assume ivy seeds are being carried throughout the park. Although I can't follow the birds through the dense Pacific Northwest forest to see where they go after feeding, my field work this spring will identify the direction the birds go after feeding to get an idea where they may disperse the seeds they have eaten.

Sulgrove: I have heard the term "Ivy Desert" used for populations of naturalized ivies on the West Coast. What are they?

Fletcher: Juvenile ivy can form incredibly dense patches that exclude other plant spe-

cies. Because they are hostile places for other species, they have been nicknamed "ivy deserts." Ivy is at an early stage of invasion at St. Edward, so patches tend to be small and most don't really qualify as ivy deserts. However, other Seattle parks are much more severely invaded, and within those patches, there is little growing other than ivy.

Sulgrove: Another question about ivy invasion and ivy deserts. As you may know, ivy is a normal part of forest succession in Europe. Generally the herb layer in any successional pattern of change can only survive where there is adequate light for its own regeneration. Do you suppose the ivy comes in before the herb layers have been supplanted by the normal following changes in canopy cover? Or, alternatively, do you think that ivy comes in after the herb layer has already been supplanted by the next, very shady stage, and that ivy colonizes this stage because it can grow in the kind of shade characterized by this later stage of succession? In other words, **is ivy growing in dense mats because nothing else will grow there anyway (and ivy has taken advantage of this niche), or is it because ivy has changed the environment so that nothing else grows. How would you determine which is the correct scenario?**

Fletcher: This is an excellent question, and no one has done the research to test this question. The question is, does ivy grow there because nothing else can, or is nothing else growing there because ivy is there. From my observations, I think both scenarios can occur. In areas with dense native vegetation, especially salal (*Gaultheria shallon*) and Oregon grape (*Berberis* sp.), I do not find ivy. In areas with an open forest floor, ivy seems to do really well. Unfortunately, even though the shady forest floor naturally has a low-density of native species, native trees commonly germinate in these places, and ivy seems to suppress their germination and survival. The best way to tease apart this issue is with an experimental approach. Comparison plots can be established — some with abundant native vegetation, some with sparse native vegetation. Ivy seeds or seedlings could be planted into both places and its survival and growth can be compared between plots with native vegetation and those without. This would test whether native species affect ivy establishment. A second experiment could be undertaken in which native species are planted into ivy patches and into adjacent ivy-free patches and the survival and growth of native species compared. This would test whether ivy affects native species.

Sulgrove: Wouldn't it be better to disperse pulp-free ivy seed into both places, since your hypothesis is that birds disperse the seed? The only thing the birds do is remove the pulp, and earlier research has shown that germination percentages are the same in either case. In the second experiment, likewise, wouldn't you need to disperse fruits (seeds, whatever) of native plants into ivy patches to see if the density of the ivy patches hinders germination? Just the act of planting an ivy disturbs the microenvironment, and in addition, does not appear to mimic natural conditions or consequences.

Fletcher: This can be a tricky issue. Yes, ideally you would want to plant seeds and observe all life stages. However, practically, this is not possible for several reasons: 1) Seeds often don't grow because it can be hard to mimic the natural germination regimes.

Ivy is probably an exception here because it doesn't need to be pretreated in order to germinate. (In fact, I will be doing a germination trial with ivy this year to see how the environment affects germination rates). 2) Seed germination is usually pretty low, many times too low to get adequate data in a study. Thus, ecologists often have to rely on transplanting very young seedlings to make sure they can get enough data. Admittedly, this shows only early survival rather than germination; however, both are probably similar most of the time. 3) Some plants take so long to grow that it isn't practical to plant seeds. Thus, if you are interested in survival, you have to use seedlings. The best combination is probably to use both. Plant a lot of seeds to judge germination, and then plant seedlings to ensure a large enough sample to judge survival.

Sulgrove: It has been stated that invasive plants colonize disturbed areas. Is there a good definition for "disturbed?" The one I found defined "disturbed" as bare soil or tilled soil. How does this fit in with ivy?

Fletcher: Disturbance can be a tough word to define, and ecologists often argue about the definition. One definition of disturbance is an unpredictable and biologically significant change in the biomass (weight of living material per unit area). For example: roads, dams, landslides, grazing, and wind throw can decrease biomass, while cultivation and nutrient loading can increase biomass. All are considered disturbances.

Sulgrove: You mention that European species are especially good at invading because they have had any centuries to adapt to human civilizations and "disturbance" in Europe. **Do you think that all European aliens, therefore, must be invasive? If ornamental ivy is associated with human "disturbance," such as landscaping, how does vegetative spread by ivy fit into this "human disturbance?"**

Fletcher: Eurasian species seem to be especially good at invading. One theory of why this is so is that invasive species often originated in areas with a long history of human disturbance. Thus, they were pre-adapted to thrive in disturbed areas that resulted when humans colonized new areas where native species weren't used to disturbance. Unlike many invasive species, ivy does not seem to depend on disturbance. It grows in areas that are closest to sites disturbed by humans, probably because it is closest to seed sources, rather than the environment per se. In addition, as I mentioned before, ivy is also common in edges, which are more disturbed than interior regions. However, this likely reflects dispersal as well. Even in the most undisturbed parts of St. Edward, I have found ivy seedlings and juveniles, so I think it is capable of growing just about anywhere that it is dispersed. However, disturbed areas tend to be sunnier, so reproductive output of ivy may be greater in disturbed areas than in undisturbed ones.

The majority of European aliens are not invasive—in fact, only a very small proportion of introduced plants can survive without human care, and an even smaller proportion of them actually can be considered invasive (aggressively

outcompeting native species). However, those that prove invasive can create tremendous biological and economic problems, so it can be risky to introduce new species. The disturbance of landscaped areas isn't that important when thinking of ivy as an invader—after all, landscaped areas are specifically tended to encourage ivy growth. We are more worried about whether natural areas have been impacted by disturbance (i.e. trampling, logging, etc). If human activities in natural areas facilitate the vegetative spread of ivy, that would fit the disturbance theory. However, in reality,

human disturbance probably doesn't explain the ability of ivy to spread so well. Ivy can grow well even in relatively undisturbed forests.

Sulgrove: Why are plants from other parts of the world such good invaders of new regions?

No one really knows why a species that is introduced to a new region can become such a problem. One would expect that the native species would have an advantage, but that is not necessarily true. The "preadaptation to disturbance" hypothesis is just one idea that has been proposed to explain this. Other hypotheses include escape from natural enemies, superior competitors, and ability to fill an empty niche. These theories are not mutually exclusive, and none of these theories completely explain why some species are such successful invaders. In fact, invasion biologists are continually searching for explanations as to why some species are good invaders and others are not.

Sulgrove: Someone asked me, "If I had an ivy ground cover around my house, and it isnot fruiting, or the fruits have been cut off, is the ivy still invasive?"

Fletcher: In my opinion (though some might disagree), non-fruiting ivy growing around a house is not invasive. Native species are not going to grow in those spots anyway, and yard grass is also nonnative. However, since yards can be very sunny, it is typical for ivy to fruit. In addition, if the yard is adjacent to a natural forest area, juveniles often grow into native habitats and compete with native species. A neighbor to St. Edward said that when she and her husband moved in 20 years ago, they planted ivy in their backyard. It totally got away from them and has grown into the park, which they find distressing. Thus, if a yard is adjacent to a natural forested area, ivy might not be the best choice for a yard (at least in the Pacific Northwest which has the perfect climate for ivy!). However, if you do plant ivy in these areas, it is best to choose varieties that are less aggressive.

Sulgrove: Thank you Tara, for taking the time to describe to us your observations on how ivy grows in areas where it has been left untended. Good luck with your research! Please keep the American Ivy Society informed about your findings.

This literature review on ivies will appear on The American Ivy Society web site, www.ivy.org in 2005. It will include addtional material, up-dates and photos.

2004 NEW REGISTRATIONS

When a new ivy is registered, it is photographed and described in detail in the *Ivy Journal*. This is done in order that the correct name is associated with a specific ivy. In addition, a herbarium specimen is made and deposited in the Willard Sherman Turrell Herbarium (MU), Department of Botany, Miami University, Oxford, Ohio, 454045 and in the Claude E. Phillips Herbarium (DOV), Department of Agriculture & Natural Resources, Delaware State University, Dover Delaware, 19901-2277. The letter(s) used in parentheses after the cultivar name refer(s) to the Pierot Classification System (Pierot 1974, 1995) and *Knowing and Growing Ivy* (AIS 1997). The AIS numbers are identification/ verification numbers used by the American Ivy Society to keep track of the history of every ivy sent for identification. The first two digits are the last two digits of the year the ivy was received, and the last three digits are the sequential numbering during that year. All new cultivars are presumed sports of *Hedera helix*, unless otherwise noted.

Hedera helix 'Dedos' C, BF

By
Russell A. Windle
Registrar

HISTORY

'Dedos' (AIS 97-062) Fig. 1, is a Curly (C), Bird's Foot (BF) ivy in the Pierot Classification System (Pierot 1974, 1995). It was submitted for registration by Patricia Riley Hammer of Samia Rose Topiary, 1236 Urania Ave, Encinitas, CA 92024. This ivy was found as a mutation from *Hedera helix* 'Pixie' in 1997 by Tomasa Fuentes. The name Dedos is Spanish for Fingers, which, looking at the leaves of this ivy, you can see the name.

DESCRIPTION

The leaves are predominately five lobed, but occasionally there are 2 extra basal lobes or protuberances. The base is cordate to truncate; the lobes are elongated out like small fingers which curl slightly down. When the leaves are fully expanded, the margins of the leaves turn up, with the tip of the lobe curled down. The leaves are covered with pubescence, which is most evident on the newly emerged leaves. As the leaves expand and mature the hairs are less noticeable. New growth is light green, with raised veins becoming medium-green with light green veins with age. This ivy is very self-branching, making mounds of growth.

SIMILAR CULTIVARS

The only similar ivy that combines the hairiness and curliness seen in this ivy is a mutation of 'Olive Rose', introduced by Fibrex Nurseries in 1989 called *Hedera helix* 'Malvern' fig. 2. The main differences in these two ivies is that 'Malvern' (Rose 1996) has larger, and curlier leaves, and has a much more open

Above: Figure 1
H.h. 'Dedos'
Photo by: Rachel Cobb

Right: Figure 2
H.h. 'Dedos' (L) and
H.h. 'Malvern' (R).
Photo by: Russell Windle
6/16/04

growth habit, and does not self- branch as profusely.

SOURCES

Contact the American Ivy Society for a complete list.

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2004 NEW REGISTRATIONS II

Hedera helix 'Ballet' V, BF

By
Russell A. Windle
Registrar

HISTORY

'Ballet' (V, BF) (AIS 00-019, 03-018) Fig. 1 is a Variegated (V), Bird's Foot (BF) ivy in the Pierot Classification System, (Pierot, 1974, 1995). This ivy is registered by request of Jim Maddux, Heritage International, LLC, 700 Fairway Drive, Camarillo, California, 93010.

The American Ivy Society Research Center first received this ivy in a collection of ivies received from Hervé Canals, France in 1999. Herve had purchased the ivy at the Stift Neuburg Nursery, Heidelberg, GE, in 1998. Stift Neuburg had received the ivy from Stauss Brothers Nursery, Germany. We have so far been unsuccessful in getting a history of this ivy from Stauss Brothers.

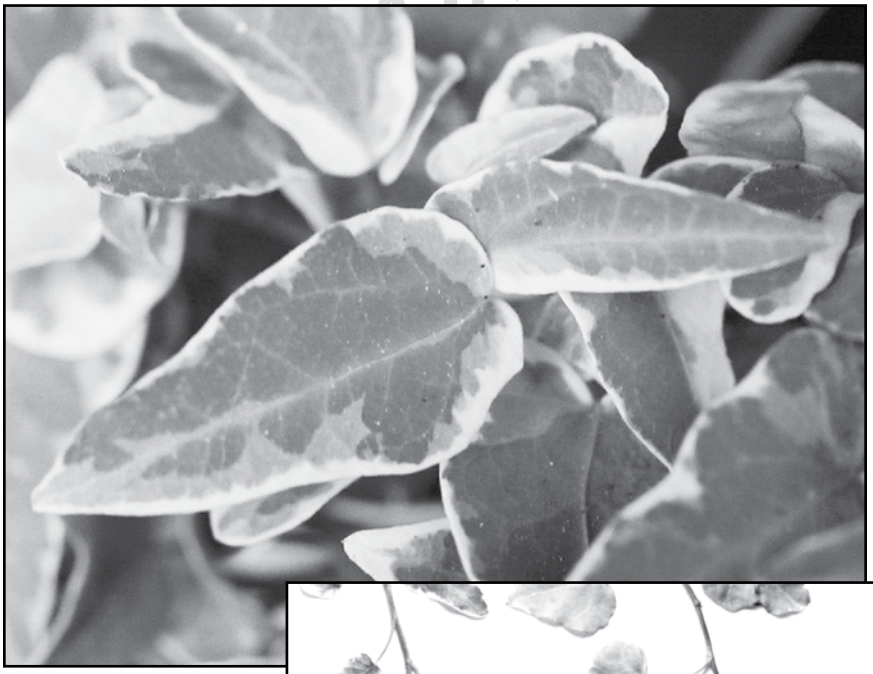
Jim Maddux found the same ivy in a retail nursery in Southern California in 2001 and sent it in for identification.

DESCRIPTION

The leaves are predominantly unlobed, linear, with an obtuse base, but during rapid growth you can find leaves with two and more lobes, up to 5 lobed, and star-shaped. There is an irregular cream-white margin with a gray-green center, and white veins. The variegation is light sensitive, meaning that good sun light is needed to bring out the best variegation. Under low light levels the variegation can fade to almost green.

SIMILAR CULTIVARS

The closest ivy to *Hedera helix* 'Ballet' is an ivy introduced by the Glasshouse Works, Stewart, OH, called *Hedera helix* 'Brazil', Fig.2. They state that the ivy was discovered by G. Johnson in Brazil's Rio plant market. *Hedera helix* 'Brazil' has mostly unlobed, elongated leaves, but the tip is more pointed and the base is slightly cordate. You can also find leaves with one or two basal lobes. The variegation differs in that there is no regular pattern. The over all leaf color is gray-green with raised white veins, and splashes of white here and there. You will occasionally find a leaf that is all most completely white. The variegation is light stable, so the variegation does not fade with low light levels.



Above: Figure 1
H.h. 'Ballet'
Photo by: Rachel Cobb

Right:: Figure 2
H.h. 'Ballet' (L) and
H.h. 'Brazil '(R).
Photo by: Russell Windle
6/16/04

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Contact the American Ivy Society for a source list.

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2004 NEW REGISTRATIONS III

4 NEW IVIES FROM ACROSS THE POND:

Hedera helix 'Golden Girl', 'Ira', 'Jake', and 'Jubilation'

By
Russell A. Windle
Registrar


'GOLDEN GIRL'


'IRA'


'JAKE'


'JUBILATION'

HISTORY

Fibrex Nurseries LTD, Honeybourne Road, Pebworth, Near Stratford-Upon-Avon, Warwickshire, CV37 8XP, UK, is a family run business, established by Hazel and Dick Key over 45 years ago. Fibrex nurseries offer a wide selection of Hardy Fern, *Hedera*, Hellebore, and *Pelargonium*. Fibrex also houses the National collection of *Hedera* and *Pelargonium*.

Over the years the Ivy Research Center and Fibrex Nurseries have exchanged ivies, for identification and for introduction. In this article four new ivies from Fibrex are introduced.

All four ivies are registered by Angela Tandy, Fibrex Nurseries, LTD.

DESCRIPTIONS

'Golden Girl' (V,I) (AIS 95-053) fig. 1. The American Ivy Society received this ivy unnamed in 1994, with the notation of S3 for identification. The interesting history of this ivy is that it was found in the United States in 1992. Hazel Key and daughter Angela Tandy were here for the AIS Convention, and to visit other nurseries, when she found this ivy at a Kroger's Supermarket in Charlesburgh West Virginia. They sent it back to AIS in 1994 for identification. Since it was something new, Fibrex named it 'Golden Girl'.

Hedera helix 'Golden Girl' on first glance looks very much like *Hedera helix* 'Gold

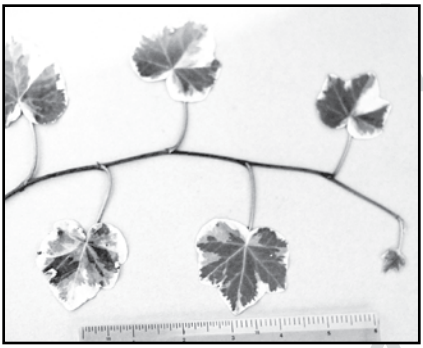

Figure 1 *H.h.* 'Golden Girl'
All photos by Russell Windle

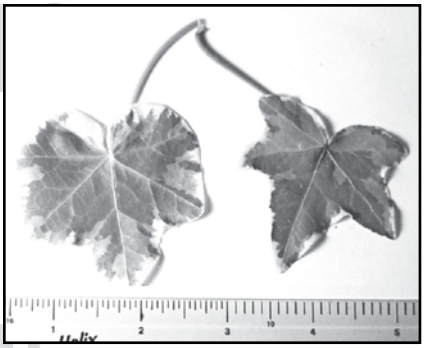

Figure 2 *H.h.* Golden Girl' (L)and *H.h.* 'Gold Child'(R).

Child' fig. 2. At closer examination you can see the difference. In 'Golden Girl' the leaves have three to five broad, rounded lobes with a cordate base; 'Gold Child' has narrower pointed lobes. The variegation is again similar to 'Gold Child', having a gold margin with a green to gray-green center, and raised lighter veins. The gold coloration is most intense under cool temperatures and bright light. In higher temperatures the gold coloration may fade to a pale creamy yellow.

Angela states that in Great Britain 'Golden Girl' is a good climber, ground cover, and trailer; and grows well in sun and semi-shade. Under our growing conditions, it has preformed very similarly to 'Gold Child'. Winter hardiness has not been tested yet.

Figure 3 *H.h.* 'Ira

'Ira' (V, I) (AIS 96-026, 03-033) Fig. 3. On November 11, 1995, AIS received this ivy from Fibrex Nurseries, with the notation "Small 'Golden Ingot', may be 'Ira'." This ivy was first discovered by Mrs. Helena Hall, Webb's Garden Center, Wychbold, Worcestershire, England under the name 'Ira'. Angela Tandy of Fibrex Nurseries received it in mid-1995.

For a short time the nursery *Hedera* Denmark had advertised an ivy that appeared to match this plant under the name *Hedera helix* 'Evergold'. Recent searches have not been able to find this name. Since this name had not been published with a description, it does not have any standing.

Hedera helix 'Ira' has small leaves with 3 to 5 blunt lobes, and a cordate base. The margin of the leaf is dark green with a gold, green and gray-green center that irregularly follows the major veins. The plant is compact and self-branching. The

gold coloration is most intense in cool temperatures under bright light. It does have some similarities to *Hedera helix* 'Golden Ingot', but is about half the size, and the variegation pattern is different.

The next two ivies, *Hedera helix* 'Jake', and *Hedera helix* 'Jubilation' were received from Hervé Canals, Jardin Botanique de Barnave, Moulin de Jansac, 2630 Barnave, France, had purchased them at Fibrex Nurseries on a visit to the nursery. Hervé had sent them on to me since they were new to him.

Figure 4 *H.h.* 'Jake'
All photos by Russell Windle

Figure 5 *H.h.* 'Jake' (L) and *H.h.* 'Lightfinger'(R).

'Jake' (V, H, M) (AIS 03-034) fig.4 This ivy was discovered by Ursula Key Davis in 1998 as a sport of *Hedera helix* 'Lightfinger' fig. 5. It was named 'Jake' in 1999.

The leaves have three rounded lobes with a cordate base. The leaf shape is similar to *Hedera helix* 'Christian' ('Direktor Badke')[Heieck 1980]. The terminal lobe is elongated to twice the size of the basal lobes. Under rapid growth some leaves have shown more-pointed lobes, but this appears to be a seasonal variation. The color is bright yellow on the new growth, which fades to a pale lime green with age. Bright light and cool temperatures intensifies the color. The leaves are short-jointed and the plant is very self-branching.

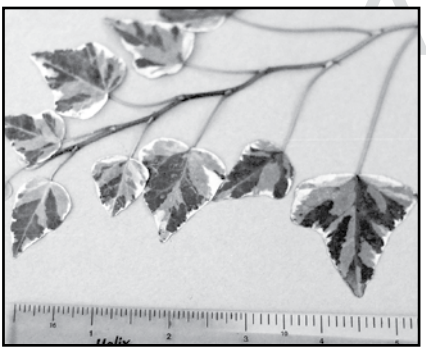

Figure 6 *H.h.* 'Jubilation'

Angela states that it has suffered winter damage in exposed areas. Hardiness has not been tested in the United States.

'Jubilation' (V, H, M) (AIS 03-035) fig. 6 This ivy was discovered by Eileen Osborn, Fibrex Nurseries, in a batch of pot ivies at a market stall in Evesham, Warcestershire, England in 1997. The name Jubilation was chosen in 1998.

Jubilation has unlobed, teardrop- shaped to barely three-lobed leaves. Under rapid growth more lobing has been noticed, but this is seasonal and the shape returns with slower growth. The variegation consists of a gray to gray-green center and a narrow white margin. The plant is self-branching, and makes nice runners.

This ivy has some similarities to a large *Hedera helix* 'Jubilee', (Sulgrove 1982) or the more recent introduction of '*Hedera helix* 'Celebity' (Windle 2002). This ivy has been grown outside and under cover for the past 7 years at Fibrex. Winter hardiness has not been tested in the states.

SOURCES

These ivies are currently being propagated for introduction. If you are interested in getting stock of any of these ivies, contact the American Ivy Society for availability.

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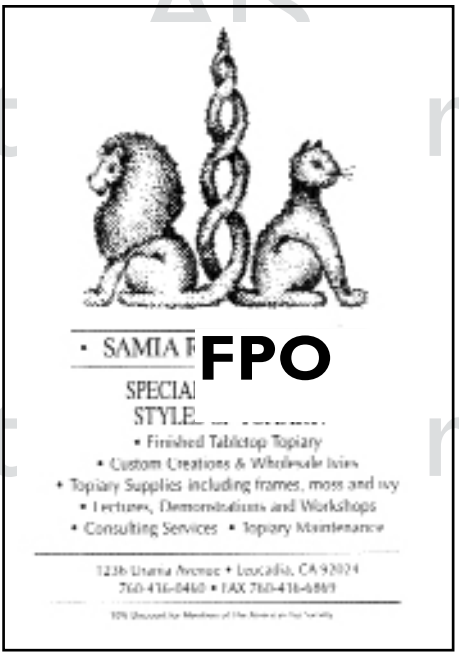

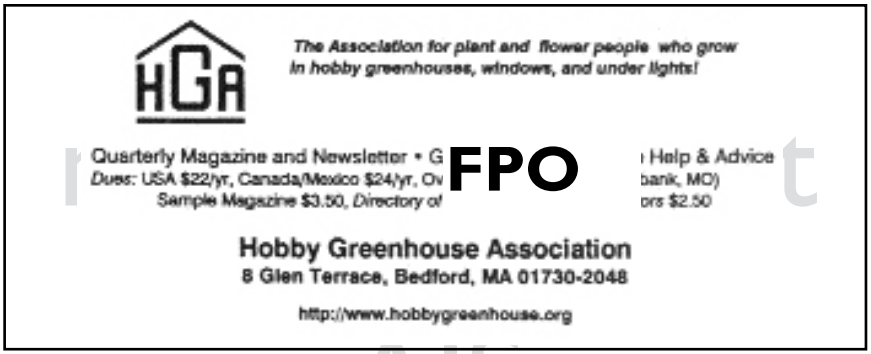

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IVY OF THE YEAR 2005
Hedera helix 'Misty'

For an ivy to be chosen "Ivy of the Year" it must meet certain criteria. It must be easy to grow, hardy, lush, beautiful, and not invasive. 'Misty' not only meets these standards, but it is also one of the top six ivies used by professional growers for both large and small topiaries. It tends to be very consistent in leaf size throughout the year and with minimal acclimation it does well in full-sun situations.

H.h. 'Misty' is a variegated, miniature, Bird's Foot ivy in the Pierot Classification system, and was found as a mutation of *H.h.* 'Needlepoint' in the late 1970's. Ivies are called "Bird's Foot" when the shape of the leaves resembles the track a bird's foot makes in the snow.

The leaves of 'Misty' have five narrow lobes in various shades of green and gray-green, with a thin white margin and white veins. The over-all color is silver gray. Under cool temperatures the white is suffused with a pink blush. Although it does well in the sun, the variegation does not fade in the shade, so it will also do well in a dark corner of the garden.

With its self-branching habit and small leaves, 'Misty' is well suited for pots, baskets and topiaries. It is winter hardy, surviving to at least –20 degrees F.

The American Ivy Society initiated the "Ivy of the Year" program in 2001 with *H.h.* 'Lady Frances'. The ivies selected have been *H.h.* 'Golden Ingot' 2002, *H.h.* 'Teardrop' 2003 and *H.h.* 'Duck Foot' 2004.

To join the American Ivy Society: $20 annually.

Rachel Cobb

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