RELATIVE SUSCEPTIBILITY OF WOODY LANDSCAPE PLANTS TO JAPANESE BEETLE *(COLEOPTERA: SCARABAEIDAE)*

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Abstract. The Japanese beetle (*Popillia japonica* Newman) was introduced to a New Jersey nursery in 1916 and continues to spread across the United States and Canada. Adults attack foliage, flowers, and fruit of more than 300 species of plants; however, some plants are notably resistant. This paper summarizes data on plant susceptibility of woody plants to Japanese beetles collected from observations and controlled experiments. Resistance to Japanese beetle has been documented among species of maples (*Acer*) and birch (*Betula*) and among cultivars of crabapple (*Malus*), crapemyrtle (*Lagerstroemia*), and linden (*Tilia*). Production of certain plant odors, presence of secondary compounds in leaves, and leaf pubescence are factors affecting resistance to this insect. Host plant resistance is the most sustainable means of managing feeding damage or plant losses resulting from Japanese beetle adults. When suitable, incorporating Japanese beetle–resistant plants into new landscapes can reduce or eliminate the expense of replacing damaged plants or frequent insecticide applications.

Key Words. *Popillia japonica*; Japanese beetle; integrated pest management; host plant resistance.

The Japanese beetle (*Popillia japonica* Newman) is one of the most damaging pests of urban landscapes in the eastern United States. Yearly costs for management and mitigation of damage are estimated at US$500 million (USDA/APHIS 2002). This scarab was introduced in 1916 to the eastern United States in infested nursery stock (Fleming 1972). At that time, entomologists were unaware of the pernicious nature of this species as evidenced from this quote, "While inspecting a nursery in southern New Jersey during August 1916, our attention was attracted by a scarabaeid feeding on the tips of *Crataegus*. … Inasmuch as it was assumed to be a southern species, no particular attention to it was paid at that time" (Dickerson and Weiss 1918). In the presence of abundant grass and pasture land, and the apparent absence of natural enemies, the Japanese beetle flourished. Currently, this immigrant species partially infests or is established in all states east of the Mississippi River except Florida, and its range extends north into Canada (NAPIS 2003).

Adult Japanese beetles are broadly oval, 8 to 11 mm (about 0.5 in.) long, metallic green in color and have coppery-brown wing covers. Larvae are typical white grubs, C-shaped and cream colored, with three pairs of legs and a light-brown head capsule (Fleming 1972). Japanese beetle has a 1-year life cycle, spending most of its life underground as a grub. A small grub, about 1.5 mm (0.06 in.) long, emerges from an egg laid 3 to 5 cm (1 to 2 in.) deep into moist soil, typically under turfgrass. Females alternate between periods of feeding and mating on host plants and oviposition. During her lifetime, a female will have 12 or more egg-laying bouts and produce 40 to 60 eggs. Once hatched, grubs feed on roots and will reach full size, about 32 mm (1.25 in.) long, by late summer (Fleming 1972). Management of grubs is accomplished with soil insecticides applied preventively (e.g., Merit or Mach2) before egg hatch, or curatively (e.g., Dylox or Sevin) after small grubs are present. Presence of grubs or grub damage may be associated with nearby plants infested with adults; however, females will disperse to find a suitable site for oviposition (Fleming 1972; Potter and Held 2002).

Japanese beetle adults are active from June through August in most of its geographic range. These beetles are day active and mate and feed concurrently on host plants. They can defoliate more than 300 species of woody and herbaceous plants in 79 plant families (Fleming 1972; Potter and Held 2002). Because of their mobility and gregarious habits, swarms of Japanese beetle continually infest and defoliate new plants during the growing season. These factors can complicate control of adults, especially when using short-residual insecticides such as pyrethroids. Certain systemic products delivered through soil or trunk injection are available for control of Japanese beetles on mature, established street and residential trees; however, that treatment may not be an option for newly installed landscape plantings.

Use of insecticides to manage Japanese beetle can be reduced if resistant plants are substituted for more susceptible ones in commercial and residential landscapes. Observations and controlled experiments indicate that certain plant species, and even cultivars of the same species, vary in susceptibility. For example, moderate or complete resistance to Japanese beetle feeding is documented for most evergreens, certain crabapples (*Malus*), lindens (*Tilia*), maples (*Acer*), birch (*Betula*), and crapemyrtles (*Lagerstroemia*) (Fleming 1972; Ranney and Walgenbach

1992; Spicer et al. 1995; Potter et al. 1998; Miller and Ware 1999; Pettis et al. 2004). There is no resistance to Japanese beetle among species or cultivars of rose (*Rosa*) (Potter et al. 1998; Held and Potter 2004).

Most of the information on host susceptibility to Japanese beetle originated from a landmark survey summarized by W.E. Fleming (1972). This publication has since gone out of print; however, the information remains relevant to urban horticulture because of the continued spread of Japanese beetles into the United States and Canada. In his review, Fleming (1972) established a damage rating system based on observations of plant damage noted for each plant species in his listing. This rating system is qualitative and assigns a relative rank to each species based on written and oral accounts of Japanese beetle feeding damage noted from 1920 through 1963, primarily in the New England area (Fleming 1972).

Additional laboratory and field evaluations of Japanese beetle susceptibility for certain horticulturally important taxa have been further investigated by contemporaries of Fleming. These subsequent studies compared the percentage of defoliation of field- or container-grown plants in a common garden type of experiment (e.g., Potter et al. 1998). Blocks of woody plants representing replicates of each cultivar or species were subject to defoliation by natural beetle populations during one or more years. Additional laboratory or controlled field experiments were also used to verify the results of field tests for crabapple (Ranney and Walgenbach 1992; Spicer et al. 1995), crapemyrtle (Pettis et al. 2004), and linden (Miller and Ware 1999). Besides the field observations on *Ulmus procera*, *U. rubra*, and *U. americana* in Fleming (1972), susceptibility of elm species is based on laboratory experiments with detached leaves or defoliation of plants caged with beetles (Miller et al. 2001). Discrepancies in seasonal results from multi-year field evaluations have been noted and are attributed to the relative abundance of adults from year to year (Fleming 1972; Potter et al. 1998).

The purpose of this paper is to provide landscape architects, professional landscape managers, and arborists a comprehensive list of woody plants and their relative susceptibility to Japanese beetle. Although the results of these resistance screenings were reported in scientific or extension publications, there has been no single source of host plant data for Japanese beetle since Fleming (1972). This paper has compiled the data from Fleming (1972) and amended it with data from recent experiments to produce a comprehensive record of plant susceptibility to Japanese beetle.

DESCRIPTION OF DATA PRESENTATION

Data are presented in table form, alphabetically by family, then scientific name. Tables 1 and 4 use a rating to indicate susceptibility. This rating is an adaptation of the system used by Fleming (1972). When a plant is designated "resistant," it means observed plants were either never fed on or rarely fed on by Japanese beetles. "*" and "**" indicate plants on which feeding has been observed but is either occasional or light, respectively. "***" and "****" indicate plants that are commonly fed on by Japanese beetle, resulting in either moderate or extensive feeding damage, respectively. Plants with the latter two ratings will likely sustain considerable feeding damage or be completely defoliated if Japanese beetles are present.

Qualitative ratings for *Prunus serrulata*, *P. serotina*, and *P. virginiana* came from Fleming (1972), whereas all others were adapted from field defoliation data (Ranney and Walgenbach 1992). In the only field study with birch (*Betula*) species and cultivars, defoliation was 1% or less for all nine taxa, except for Himalayan birch (*B. jacquemontii*), which was 16% (Ranney and Walgenbach 1992). Based on these data, most birch are not preferred hosts (Table 1), except for Himalayan, European white, and gray, of which the latter two were ranked as more susceptible by Fleming (1972).

Tables 2 and 3 summarize resistance among cultivars of crapemyrtles and crabapples from field and laboratory experiments. Susceptibility ratings for crapemyrtle varieties are adapted from susceptibility rankings assigned by Pettis et al. (2004). The qualitative ratings assigned to crabapple cultivars (Table 3) were derived from three evaluations conducted in North Carolina (Ranney and Walgenbach 1992) and Kentucky (Spicer et al 1995; Potter et al. 1998). Relative susceptibility of the 26 cultivars common to both sites was similar (Potter et al. 1998).

Crapemyrtle and crabapple species or cultivars are listed under headings indicating their relative susceptibility. As before, "resistant" indicates that observed plants were rarely fed on. For crabapples, only those with less than 10% defoliation in field studies were assigned to this rating. "Moderately resistant" means that beetle feeding was observed but light. Crabapples ranked as moderately resistant generally sustained 20% to 45% defoliation. Plants designated "moderately susceptible" will have noticeable damage by Japanese beetle corresponding to 50% to 70% defoliation for crabapple varieties. All plants considered "susceptible" will be extensively damaged or completely defoliated by Japanese beetle, equivalent to about 75% to 100% defoliation in the crabapple field studies (Ranney and Walgenbach 1992; Spicer et al 1995; Potter et al. 1998).

Ratings for linden taxa (Table 4) were taken from observations in Fleming (1972), a 3-year field study of eight *Tilia* spp. in Kentucky (Potter et al. 1998), and Miller and Ware (1999), which combined laboratory feeding assays with leaves or leaf discs, with field defoliation data of 16 genotypes in Illinois. Ratings of linden were determined based on both studies; however, field defoliation data were used over laboratory results if there was any inconsistency between the relative rankings of the same variety.

Table 1. Relative susceptibility of deciduous and evergreen woody trees and shrubs to Japanese beetles.

Scientific name	Common name	Rating[z]
Aceracea		
Acer negundo	Boxelder	*
Acer palmatum	Japanese maple	****
Acer platanoides	Norway maple	****
Acer pseudoplatanus	Sycamore maple	**
Acer rubrum	Red maple	Resistant
Acer saccharinum	Silver maple	Resistant
Acer saccharum	Sugar maple	**
Anacardiaceae		
Cotinus coggygria	Smoketree	*
Rhus copallina	Flameleaf sumac	**
Rhus typhina	Staghorn sumac	*
Aquifoliaceae		
Ilex aquifolium	English holly	Resistant
Ilex cornuta	Chinese holly	Resistant
Ilex crenata	Japanese holly	Resistant
Ilex opaca	American holly	Resistant
Ilex verticillata	Winterberry holly	*
Berberidaceae		
Berberis thunbergii	Japanese barberry	**
Betulaceae		
Alnus glutinosa	Black alder	***
Betula ermanii	Erman's birch	Resistant
Betula jacquemontii	Himalayan birch	***
Betula nigra	River birch	*
Betula nigra 'Heritage'	Heritage river birch	*
Betula papyrifera	Paperbark birch	Resistant
Betula pendula	European white birch	***
Betula platyphylla var. *japonica* 'Whitespire'	Asian Whitespire birch	Resistant
Betula platyphylla var. *szechuanica*	Asian Szechuan birch	Resistant
Betula populifolia	Gray birch	****
Corylus americana	American filbert	*
Corylus colurna	Turkish filbert	**
Bignoniaceae		
Catalpa bignonioides	Southern catalpa	***
Buxaceae		
Buxus sempervirens	Common boxwood	Resistant
Calycanthaceae		
Calycanthus floridus	Carolina allspice	Resistant
Caprifoliaceae		
Lonicera fragrantissima	Winter honeysuckle	Resistant
Lonicera japonica	Japanese honeysuckle	*
Sambuscus canadensis	American elder	*
Symphoricarpos albus	Snowberry	Resistant
Symphoricarpos orbiculatus	Buckbrush	Resistant
Viburnum dentatum	Arrowwood	***
Viburnum opulus	European cranberry bush	*
Weigela florida	Weigela	**
Celastraceae		
Celastrus scandens	American bittersweet	Resistant
Euonymus alatus	Burning bush	*
Euonymus fortunei	Wintercreeper euonymus	Resistant
Clethraceae		
Clethra alnifolia	Summersweet clethra	****[y]
Cornaceae		
Cornus florida	Flowering dogwood	Resistant
Cupressaceae		
Chamaecyparis lawsoniana	Lawson white cedar	Resistant
Chamaecyparis obtuse	Hinoki cypress	Resistant
Chamaecyparis pisifera	Sawara cypress	Resistant
Chamaecyparis thyoides	Atlantic white cedar	Resistant
Juniperus chinesis	Chinese juniper	*
Juniperus communis	Common juniper	*
Thuja occidentalis	American arborvitae	*
Thuja orientalis	Oriental arborvitae	*
Ebenaceae		
Diospyros virginiana	Common persimmon	*
Ericaceae		
Kalmia latifolia	Mountain laurel	Resistant
Rhododendron catawbiense	Catawba rhododendron	*
Rhododendron maximum	Rosebay rhododendron	*
Rhododendron pericylmenoides	Pinxterbloom azalea	Resistant
Rhododendron viscosum	Swamp azalea	*
Fabaceae		
Albizia julibrissin	Mimosa	Resistant
Cercis canadensis	Eastern redbud	Resistant
Cercis chinensis	Chinese redbud	Resistant
Robinia pseudoacacia	Black locust	*
Sophora japonica	Japanese pagoda tree	*
Wisteria sinensis	Chinese wisteria	***
Fagaceae		
Castanea crenata	Japanese chestnut	**
Castanea dentate	American chestnut	****
Fagus grandifolia	American beech	**
Fagus sylvatica	European beech	**
Quercus alba	White oak	*
Quercus coccinea	Scarlet oak	*
Quercus falcata	Southern red oak	*
Quercus prinus	Chestnut oak	**
Quercus palustris	Pin oak	***
Quercus rubra	Red oak	*
Quercus stellata	Post oak	*
Quercus velutina	Black oak	*
Ginkgoaceae		
Ginkgo biloba	Maidenhair tree	*
Hamamelidaceae		
Hamamelis virginiana	Witch hazel	*
Liquidambar styraciflua	American sweetgum	*
Hippocastaneae		
Aesculus hippocastanum	Horsechestnut	****
Aesculus parviflora	Bottlebrush buckeye	***[y]
Hypericaceae		
Hypericum perforatum	Common St. Johnswort	***[y]
Juglandaceae		
Carya glabra	Pignut hickory	*
Carya ovata	Shagbark hickory	*
Carya tomentosa	Mockernut hickory	**
Juglans cinerea	Butternut	*
Juglans nigra	Black walnut	****
Lauraceae		
Lindera benzoin	Common spicebush	***
Sassafras albidum	Common sassafras	****
Loganiaceae		
Buddleia davidii	Butterfly-bush	***[y]
Buddleia alternifolia	Alternate-leaf butterfly-bush	***[y]

Table 1. Relative susceptibility of deciduous and evergreen woody trees and shrubs to Japanese beetles.

Scientific name	Common name	Rating[z]
Lythraceae		
Lagerstroemia (see Table 2)	Crapemyrtle	****[y]
Magnoliaceae		
Liriodendron tulipifera	Tulip poplar	Resistant
Magnolia grandiflora	Southern magnolia	*[y]
Magnolia × *soulangiana*	Saucer magnolia	Resistant
Magnolia virginiana	Sweetbay magnolia	Resistant
Moraceae		
Ficus carica	Common fig	Resistant
Ficus elastica	Indian rubbertree	*
Morus rubra	Red mulberry	Resistant
Musaceae		
Musa × *paradisiacal*	French plantain	*
Myricaceae		
Myrica pensylvanica	Northern bayberry	**
Nyssaceae		
Nyssa sylvatica	Tupelo	**
Oleaceae		
Forsythia × *intermedia*	Border forsythia	Resistant
Forsythia suspena var. *sieboldii*	Weeping forsythia	Resistant
Fraxinus americana	White ash	Resistant
Fraxinus pennsylvanica	Green ash	Resistant
Ligustrum ovalifolium	California privet	**
Ligustrum vulgare	Common privet	*
Syringa × *persica*	Persian lilac	Resistant
Syringa vulgaris	Common lilac	Resistant
Pinaceae		
Abies concolor	Balsam fir	Resistant
Larix deciduas	European larch	***
Picea abies	Norway spruce	Resistant
Picea orientalis	Oriental spruce	Resistant
Pinus sylvestris	Scotch pine	Resistant
Pinus virginiana	Virginia pine	*
Pseudotsuga menziesii	Douglasfir	Resistant
Tsuga canadensis	Hemlock	Resistant
Platanaceae		
Platanus × *acerifolia*	London planetree	****
Platanus occidentalis	American planetree	***
Rosaceae		
Chaenomeles japonica	Japanese flowering quince	***
Crateagus laevigata	English hawthorn	**
Crateagus monogyna	Singleseed hawthorn	**
Exochorda racemosa	Common pearlbush	**
Malus (see Table 3)		
Prunus × *cistena*	Purpleleaf sandcherry	****
Prunus sargentii	Sargent cherry	****
Prunus serotina	Black cherry	****
Prunus serrulata	Oriental cherry	***
Prunus serrulata 'Kwanzan'	Kwanzan oriental cherry	***
Prunus serrulata 'Mt. Fuji'	Mt. Fuji oriental cherry	****
Prunus serrulata 'Tai Haku'	Tai Haku oriental cherry	***
Prunus subhirtella	'Autumnalis Rosea'	****
Prunus virginiana	Common chokecherry	**
Prunus × *incamp* 'Okame'	Okame cherry	****
Prunus × *yedoensis* 'Afterglow'	Afterglow Yoshino cherry	***
Prunus × *yedoensis* 'Akebono'	Akebono Yoshino cherry	***
Pyracantha coccinea	Firethorn	*
Pseudocydonia sinensis	Chinese quince	***
Pyrus communis	Pear	*
Rosa spp. and hybrids	Roses	****[y]
Sorbus americana	American mountain ash	****
Spiraea trilobata	Three-lobed spirea	**
Spiraea × *vanhoutei*	Vanhoutte spirea	**
Rubiaceae		
Cephalanthus occidentalis	Buttonbush	***[y]
Gardenia jasminoides	Gardenia	*
Rutaceae		
Citrus sinensis	Sweet orange	***[y]
Salicaceae		
Populus alba	White poplar	Resistant
Populus alba pyramidalis	Bolleana poplar	Resistant
Populus nigra italica	Lombardy poplar	****
Salix babylonica	Babylon weeping willow	***
Salix discolor	Pussy willow	****
Saxifragaceae		
Deutzia gracilis	Deutzia	**[y]
Hydrangea arborescens	Smooth hydrangea	Resistant
Hydrangea paniculata	Panicle hydrangea	Resistant
Hydrangea petiolaris	Climbing hydrangea	*
Philadelphus coronaries	Mockorange	Resistant
Simaroubaceae		
Ailanthus altissima	Tree of Heaven	*
Staphyleaceae		
Staphylea trifolia	American bladdernut	Resistant
Styracaceae		
Halesia tetraptera	Carolina silverbell	***
Taxaceae		
Taxus baccata	English yew	Resistant
Taxus brevifolia	Western yew	Resistant
Taxus canadensis	Canada yew	Resistant
Taxus cuspidate	Japanese yew	Resistant
Taxodiaceae		
Cryptomeria japonica	Cryptomeria	*
Taxodium distichum	Baldcypress	***
Tiliaceae (see Table 4)		
Ulmaceae		
Ulmus americana	American elm	****
Ulmus changii		****
Ulmus lanceaefolia		***
Ulmus procera	English elm	****
Ulmus prunifolia		***
Ulmus pseudopropinqua		***
Ulmus rubra	Slippery elm	**
Ulmus taihangshanensis		****
Ulmus wallichiana		****
Verbenaceae		
Callicarpa dichotoma	Purple beautyberry	Resistant
Lantana camara	Lantana	Resistant

[z]Plants designated "resistant" are never fed on or rarely fed on by Japanese beetles. "*" and "**" indicate plants on which feeding has been observed but is either occasional or light, respectively. "***" and "****" indicate plants that are commonly fed on by Japanese beetle, resulting in either moderate or extensive feeding damage, respectively.

[y]Flowers of these species are also fed on by Japanese beetles.

Table 2. Relative susceptibility of crapemyrtles to Japanese beetles.

Resistant		
'Acoma'	'Pocomoke'	
Moderately resistant		
'Biloxi'	'Cordon Bleu'	'Potomac'
'Catawba'	'Lipan'	'Sioux'
'Chicksaw'	'Muskogee'	'Tuskegee'
'Choctaw'	'Osage'	'Wichita'
'Comanche'	'Pink Velour'	
Moderately susceptible		
'Apalachee'	'Hope'	'Seminole'
'Byers Standard Red'	'Hopi'	'Tonto'
'Byers Wonderful White'	'Miami'	'Tuscarora'
'Carolina Beauty'	'Natchez'	'Velma's Royal Delight'
'Centennial'	'Ozark Springs'	'Victor'
'Centennial Spirit'	'Pecos'	'William Toovey'
'Dynamite'	'Powhatan'	'World's Fair'
'Hardy Lavender'	'Raspberry Sundae'	'Yuma'
Susceptible		
'Red Rocket'	'Regal Red'	

Table 3. Relative susceptibility of crabapples to Japanese beetles.

Resistant		
Malus baccata Jackii	'Harvest Gold'	'Strawberry Parfait'
Malus hupehensis	'Jewelberry'	
'Golden Raindrops'	'Louisa'	
Moderately resistant		
'Adirondack'	*Malus halliana* var. *parkmanii*	'Red Jewel'
'Baskatong'	*Malus tschonoski*	*Malus sargentii*
'Bob White'	'Madonna'	'Sentinel'
'Brandywine'	'Molten Lava'	'Silver Moon'
'Callaway'	'Naragansett'	'Snowdrift'
'Centurion'	'Ormiston Roy'	'Sugar Tyme'
'Christmas Holly'	'Professor Sprenger'	'Wintergold'
'David'	'Profusion'	*Malus* × *zumi* 'Calocarpa'
'Doubloons'	'Ralph Shay'	*Malus* × *zumi* 'Winter'
'Gem'		
'Edna Mullins'	'Red Jade'	
Moderately susceptible		
'Adams'	'Indian Magic'	'Ruby Luster'
'Beverly'	'Indian Summer'	'Selkirk'
'Candymint Sargent'	'Mary Potter'	'Sinai Fire'
'Coralburst'	'Pink Princess'	'Snow Magic'
'Donald Wyman'	'Purple Prince'	'Tina'
Malus floribunda	'Red Baron'	'White Angel'
'Henningii'	'Robinson'	
Susceptible		
Malus baccata	'Liset'	'Royalty'
'Dolgo'	'Radiant'	'Velvet Pillar'
'Hopa'	'Red Splendor'	'Weeping Candied Apple'

Table 4. Relative susceptibility of lindens to Japanese beetles evaluated in laboratory or field experiments.

Scientific name	Common name/cultivar	Rating[z]
Tilia amurensis		**
Tilia americana		*
Tilia americana	'Legend'	**
	'Redmond'	***
Tilia caroliniana		*
Tilia chinesis		**
Tilia cordata	'Chancellor'	***
	'Fairview'	**
	'Glenleven'	**
	'Greenspire'	****
	'Olympic'	****
	'Prestige'	***
Tilia × euchlora		***
Tilia heterophylla	'Continental Appeal'	**
Tilia japonica		*
Tilia maximowicziana		**
Tilia mongolica		**
Tilia oliveri		*
Tilia orbicularis		***
Tilia petiolaris	Pendent silver linden	*
Tilia platyphyllos	Largeleaf linden	***
Tilia platyphyllos	'Parade'	*
Tilia tomentosa		**
Tilia tomentosa	'Erecta'	**
Tilia tomentosa	'Sterling'	**
Tilia sp.	'Sundance'	*

[z] "*" and "**" indicate plants on which feeding has been observed but is either occasional or light, respectively. "***" and "****" indicate plants that are commonly fed on by Japanese beetle, resulting in either moderate or extensive feeding damage, respectively.

DISCUSSION

Susceptibility of plants to Japanese beetle should be one factor, among many, considered when selecting plants, particularly long-lived woody plants, for residential and commercial landscapes. Resistance of one plant species to Japanese beetle does not necessarily imply resistance to other plant-feeding insects or plant pathogens (Smitley and Peterson 1993; Pettis et al. 2004). For example, the crapemyrtle varieties 'Tonto' and 'Tuscarora' are moderately susceptible to Japanese beetle, but the same varieties are resistant to metallic flea beetles (*Altica* spp.), an important pest of crapemyrtle in production (Pettis et al. 2004).

Resistance of woody host plants to Japanese beetle is probably mediated by the presence or absence of deterrent compounds found in the foliage (Keathley et al. 1999; Potter and Held 2002). Control products containing certain plant extracts, such as neem (azadirachtin), can effectively deter feeding in laboratory choice tests (Ladd et al. 1978; Held et al. 2001) but often fail to provide similar protection when tested on whole plants in the field (Harper and Potter 1994; Witt et al. 1999). Abundant field populations, however, will reduce the efficacy of both conventional and botanical insecticides because of additional adults re-infesting treated plants.

Elms and lindens are considered preferred hosts for the Japanese beetle. Among elms, only *U. lancefolia* and *U. prunifolia* were slightly less susceptible than the other species (Miller et al. 2001). Although no lindens are resistant, varieties such as 'Parade', 'Legend', and 'Sterling' appear to be less susceptible (Potter et al. 1998). Moderate to dense leaf pubescence may be an important factor in susceptibility of linden and elm to Japanese beetle. For example, foliage of *T. platyphyllos* 'Parade', *T. tomentosa* 'Sterling', and *U. lamellose* have heavy pubescence and is less preferred by Japanese beetle (Potter et al. 1998; Miller and Ware 1999; Miller et al. 2001). Conversely, certain plants, such as species of *Ilex* and *Rhododendron*, with waxy or glossy foliage are also resistant to Japanese beetle (Fleming 1972; Keathley et al. 1999).

Plants with purplish or deep red foliage (e.g., 'Crimson King' Norway maple) are often observed to sustain more damage by Japanese beetle than green-leaved cultivars (Rowe et al. 2002). Foliage color alone, however, does not account for these differences. When two artificial ficus trees with foliage painted either green or purple are placed side by side in the field, significantly more beetles land on the green-leaved plants (Rowe et al. 2002). Flower color, however, does influence susceptibility of flowering plants to Japanese beetle. Rose varieties with yellow or white flowers are more likely to be attacked than those with darker-colored blooms (Held and Potter 2004).

Resistance of certain plants to Japanese beetle also depends on the production of attractive volatile compounds following damage by Japanese beetle or other plant-feeding insects (Loughrin et al. 1995). Japanese beetles use a wide range of floral and fruitlike compounds to locate a host plant (Fleming 1972; Loughrin et al. 1995, 1996). Laboratory tests show that Japanese beetle often cannot discriminate among foliage of plants that differ in susceptibility in the field (Loughrin et al. 1995, 1996). This finding indicates that Japanese beetles are attracted to plants regardless of their status as a host (Potter and Held 2002). However, if susceptible plants suffer feeding damage, they produce an array of attractive volatiles that serve as aggregation stimulants for Japanese beetle (Loughrin et al. 1995, 1996). Therefore, a susceptible plant in the field may not be inherently more attractive, but, if damaged, these plants produce the volatiles that recruit Japanese beetles much like sharks attracted to a blood trail in the water.

Host plant resistance is the most sustainable means of managing feeding damage or plant losses resulting from Japanese beetle adults. Landscape designers in states on the front of this insect's range expansion should consider incorporating resistant plants into residential, commercial, and municipal landscapes as well as any other long-term plantings. This approach can reduce the economic and environmental costs associated with the repeated use of insecticides to prevent or reduce damage to urban landscapes in the future.

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Zusammenfassung. Der japanische Käfer *Popillia japonica* Newman wurde 1916 in eine Baumschule in New Jersey eingeführt und breitet sich nach Norden und Osten quer durch die Vereinigeten Staaten aus. Die Erwachsenen attackieren Blätter, Blüten und Früchte von mehr als 300 Arten, dennoch sind einige resistent geblieben. Dieses Papier erfasst die Daten der für diesen Käfer anfälligen Gehölze, die aus Beobachtungen und kontrollierten Experimenten stammen. Eine Resistenz gegenüber Jap. Käfer wurde bei einigen Ahornarten , Birken, einigen Kultivaren von *Malus*, *Lagerstroemia* und *Tilia* dokumentiert. Die Produktion bestimmter Pflanzengerüche, Präsenz sekundärer Inhaltstoffe in den Blättern und behaarte Blätter sind Faktoren, die die Resistenz gegenüber diesem Insekt beeinflussen. Die Resistenz der Wirtspflanze ist die meistzuerhaltene Mittel um Fraßschäden oder Pflanzenverluste durch den Käfer zu managen. Wenn möglich kann die Inkorporation resistenter Pflanzen in neue Landschaften die Ausgaben für die Ersatzpflanzungen beschädigter Gehölze reduzieren und die Insektizidanwendungen minimieren.

Resumen. El escarabajo japonés, *Popillia japonica* Newman, fue introducido a New Jersey en 1916, y continúa esparciéndose al norte y este a través de los Estados Unidos. Los adultos atacan el follaje, flores y frutos de más de 300 especies de plantas. Sin embargo, algunas plantas son notablemente resistentes. Este reporte resume los datos sobre la susceptibilidad de plantas leñosas a los escarabajos japoneses colectados de observaciones y experimentos controlados. La resistencia al escarabajo japonés ha sido documentada entres especies de maples (*Acer*), abedules (*Betula*) y entre cultivares de manzanos (*Malus*), astronómicas (*Lagerstroemia*) y tilos (*Tilia*). La producción de ciertos olores por las plantas, presencia de componentes secundarios en las hojas y pubescencia de las mismas son factores que afectan la resistencia a estos insectos. La resistencia de las plantas hospederos es el medio más sustentable de manejo del daño o pérdida de plantas resultante de los escarabajos japoneses adultos. Cuando se desea, la incorporación de plantas resistentes en nuevos escenarios puede reducir o eliminar los gastos de reemplazo de plantas dañadas o las aplicaciones frecuentes de insecticidas.

Résumé. Le scolyte japonais (*Popillia japonica* Newman) a été introduit dans une pépinière du New Jersey en 1916 et continue depuis de s'étendre vers le nord et l'est des États-Unis. Les adultes attaquent le feuillage, les fleurs et les fruits de plus de 300 espèces de plantes, mais certaines plantes demeurent résistantes de manière notable. Cet article fait un résumé des données recueillies sur la susceptibilité des plantes ligneuses aux scolytes japonais, et ce à partir de d'observations et d'expériences contrôlées. La résistance au scolyte japonais a été documentée parmi des espèces des genres *Acer*, *Betula* et sur certains cultivars de *Malus*, de *Lagerstroemia* et de *Tilia*. La production de certaines odeurs par les plantes, la présence de composés secondaires dans les feuilles et la pubescence foliaire sont des facteurs qui affectent la résistance à cet insecte. La résistance de la plante hôte est le moyen le plus efficace pour gérer les dommages par causés par l'alimentation ou encore les pertes de végétaux résultants des scolytes japonais adultes. Lorsque cela est possible, l'incorporation de plants résistants au scolyte japonais dans les nouveaux aménagements peut réduire ou éliminer les dépenses pour le remplacement de végétaux endommagés ou les applications fréquentes d'insecticide.