ELEMENT STEWARDSHIP ABSTRACT

for

Melia azedarach

Chinaberry, Umbrella tree

To the User:

Element Stewardship Abstracts (ESAs) are prepared to provide The Nature Conservancy's Stewardship staff and other land managers with current management related information on species and communities that are most important to protect or control. The abstracts organize and summarize data from many sources including literature and from researchers and managers actively working with the species or community.

We hope, by providing this abstract free of charge, to encourage users to contribute their information to the abstract. This sharing of information will benefit all land managers by ensuring the availability of an abstract that contains up-to-date information on management techniques and knowledgeable contacts. Contributors of information will be acknowledged within the abstract.

For ease of update and retrievability, the abstracts are stored on computer at The Nature Conservancy. Anyone with comments, questions, or information on current or past monitoring, research, or management programs for the species described in this abstract is encouraged to contact The Nature Conservancy’s Wildland Invasive Species Program.

This abstract is a compilation of available information and is not an endorsement of particular practices or products.

Please do not remove this cover statement from the attached abstract.

Author of this Abstract: Michael S. Batcher, Consulting Ecologist and Environmental Planner, 1907 Buskirk-West Hoosick Road, Buskirk, NY 12028, e-mail: mbatcher@netheaven.com.

THE NATURE CONSERVANCY

4245 North Fairfax Drive, Arlington, Virginia 22203-1606 (703) 841-5300

SCIENTIFIC NAME

Melia azedarach L.

SYNONYM

Melia japonica var. *semperflorens* Makino

COMMON NAME

Chinaberry, Umbrella tree, Persian lilac

DESCRIPTION AND DIAGNOSTIC CHARACTERISTICS

Melia azedarach is a small to medium-sized shrub or tree in the mahogany family (Meliaceae). Branches of chinaberry are stout, with purplish bark and dotted with buff-colored lenticels. Leaves are twice to three-times compound, alternate, and puberulent to glabrous. Leaflets are 2-8 cm long, serrate or crenate, dark green above, often with sparse hairs along the veins and lighter green and generally smooth below. The inflorescence is a panicle from leaf axils and from leafless nodes on the lower part of the new growth. The perfect flowers are 5-parted. Sepals are green, 1.5-2 mm long. Petals are pinkish lavender, ligulate, 1-1.3 cm long. Stamens are united into a cylindrical, dark purple tube, 6-8 mm long, cut at the apex into 15-25 slender teeth. Each flower has ten anthers. Flowers are fragrant. The fruit is a stalked, one-seeded drupe that is greenish yellow to yellowish tan, globose, and 1-1.5 cm in diameter (Burks 1997; Radford et al. 1968).

M. azedarach is distinguished from other members of the Meliaceae in the southeastern U.S. by the nature of its compound leaves, and by its drooping, persistent clusters of yellowish fruits. *M. azedarach* is not easily confused with any other plants in its introduced North American range (K. Burks, personal communication).

STEWARDSHIP SUMMARY

M. azedarach is an invader of disturbed habitats, and is highly resistant to insects and other pathogens (Nardo et al. 1997; Neupane 1992; Vallardes et al. 1997). *M. azedarach* has a high fruit and seed output, and the fruits are consumed by birds which then disperse the seeds (Burks 1997). *M. azedarach* leaf litter has been evaluated as a potential soil amendment that can increase mineralizable nitrogen and increase soil pH in acidic soils (Noble et al. 1996). Extracts of the plant have been used for various medical purposes, including the treatment of viral infections such as herpes (Barquero et al. 1997).

The most effective means of control are cut-stump and basal bark applications of triclopyr-based herbicides. Dilute foliar treatments with triclopyr-based herbicides provide less effective control and require large volumes of herbicide solution (Kline and Duquesnel 1996).

RANGE

M. azedarach is native to Southeast Asia and northern Australia. In the New World, it is commonly cultivated as a shade or reforestation tree, and has escaped to the wild throughout tropical America, from the southeastern U.S. and Mexico to Argentina, and to some Caribbean islands (including Puerto Rico). In North America, *M. azedarach* is established from Virginia, south through Florida, and west to eastern Texas. Reported occurrences of *M. azedarach* in North America include: Alabama, Arizona, Arkansas, California, Delaware, Florida, Georgia,

Hawaii, Louisiana, Maine, Mississippi, Missouri, New Mexico, New York, North Carolina, Oklahoma, Sonora, South Carolina, Tennessee, Texas, Utah, and Virginia.

IMPACTS AND THREATS POSED BY *MELIA AZEDARACH*

M. azedarach can invade disturbed and relatively undisturbed areas, and by doing so, it can decrease native biodiversity. *M. azedarach* has numerous defenses against insects and other plant pathogens, giving it a competitive advantage over many native species (Nardo et al. 1997; Neupane 1992; Vallardes et al. 1997). Its leaf litter can increase the pH of soils and add nitrogen, significantly altering soil chemistry (Noble et al. 1996). *M. azedarach* is a prolific seed producer, and birds readily disperse its seeds. This invasive plant can also successfully reproduce vegetatively, forming dense thickets (Burks 1997). These characteristics contribute to its becoming established throughout much of the southeastern United States, and negatively impacting native populations of plants and animals. *M. azedarach* occurs primarily in disturbed areas, but it has begun to invade relatively undisturbed floodplain hammocks, marshes, and upland woods in Florida (Burks 1997). In Texas, riparian woodlands and upland grasslands have also been extensively invaded by *M. azedarach* (Randall and Meyers-Rice, unpublished).

HABITAT

M. azedarach invades along road rights of way, fencerows, and other disturbed areas. It has also been found in upland grasslands, woodlands, and riparian areas in the southeastern U.S. (Randall and Meyers-Rice, unpublished) and in southwestern Africa (Everett et al. 1989, Henderson & Musil 1984).

BIOLOGY AND ECOLOGY

Little has been written on the ecology of *M. azedarach*. Based on general descriptions of habitat, it is likely that *M. azedarach* requires open sun, is not shade tolerant, and is adapted to a wide range of soil moisture conditions. In South Africa, *M. azedarach* has spread along streambanks and can often be found along roadsides (Henderson 1991; Henderson and Musil 1984).

Horticultural references indicate that *M. azedarach* is fast growing. It can reach 6-8 meters in height within four or five years. Maximum height can be 12-16 meters. *M. azedarach* is highly tolerant of heat, drought, and poor soil conditions, and can quickly provide dense shade (Time Life Plant Encyclopedia Virtual Garden 1999).

In comparative studies of plant growth in India, *M. azedarach* completed most growth during the initial dry part of the growing season, indicating that it uses reserves from the preceding year for growth (Bisht and Toky 1993). *M. azedarach* also has a shallow root system, generally within the top 70 cm of the soil, and allocates most of its photosynthate into aboveground shoots (Toky and Bisht 1993).

The leaf litter of *M. azedarach* can significantly increase the ash alkalinity (an estimate of organic anion content) of the soil, which results in an overall increase in pH of the soil. Leaf litter of *M. azedarach* was also effective in reducing aluminum levels in soil (Noble et al. 1996). Decaying *M. azedarach* leaf litter can enhance the soil concentration of mineralizable nitrogen by an amount comparable to nitrogen-fixing legumes (Singh et al. 1996).

Reproduction

M. azedarach flowers and fruits when it reaches the size of a shrub. In North America, flowers are produced in the spring. Fruits are long-maturing, large in number, and persist past leaf fall. The

fruits are poisonous to humans and to some other mammals. Birds, however, eat and disperse the fruits and seeds, but may sometimes gorge themselves to intoxication (Burks 1997).

Seeds of *M. azedarach* are highly tolerant of desiccation, surviving to 3.5% moisture content. The seeds can remain viable for prolonged periods, up to at least 26 months (Hong and Ellis 1998).

M. azedarach also reproduces vegetatively by forming root suckers. This ability can often result in dense monotypic thickets (Langeland and Burks 1998).

ECONOMIC USES

M. azedarach is often planted as an ornamental shade tree. Several compounds from Chinaberry have been isolated for medical purposes. Meliacine, a peptide isolated from leaves of *M. azedarach*, exhibits potent activity against herpes simplex type 1 (HSV-1) (Villimil et al. 1995*). M. azedarach* has also been used as an abortifacient, an antiseptic, a purgative, a diuretic, an insect repellent, etc. (HerbWeb 2000).

MANAGEMENT

Potential for Restoration of Invaded Sites

M. azedarach has a high degree of reproductive vigor, a wide range of adaptability to different soil conditions, has numerous defenses against pests and predators, and produces copious amounts of bird-dispersed seeds. If controlled during the early stages of establishment, the potential for successful management is high. The potential for large-scale restoration of wildlands where *M. azedarach* has already become established, however, is probably low.

The best control of *M. azedarach,* as reported by land stewards/managers, occurs with the use of chemical methods. Manual/mechanical methods as well as the potential for biological control of *M. azedarach,* is limited (Neupane 1992). No studies were found which determined if prescribed fire would help in the control of this species.

Mechanical Control

M. azedarach has the ability to send root and stem suckers from underground storage organs. Mechanical methods of control may therefore be ineffective in controlling the spread and extent of chinaberry.

Herbicides

The control method of choice is a basal bark application of triclopyr (brand names Garlon, Pathfinder II, and others). A 10% solution of Garlon 4 works when applied as a 20 cm (8-inch) band near the base of the trunk (Kline and Duquesnel 1996). According to Greg Jubinsky from the Florida Bureau of Aquatic Plant Management, a 10 cm (4-inch) band of Pathfinder II (a pre-mixed 18% solution of triclopyr) at the base of the trunk is also effective. Jubinsky reports that a cut stump treatment of 8% Garlon 4 or Pathfinder II is also nearly 100% effective. A foliar treatment using a 1% solution of Garlon 3A provides good control, but high volumes of the solution must be applied (Kline and Duquesnel 1996).

Biological Control

No biocontrols for *M. azedarach* have been identified.

CONTACTS

Kathy Burks, Botanist
Bureau of Invasive Plant Management
Florida Department of Environmental Protection
3917 Commonwealth Blvd.
Mail Station 710
Tallahassee, FL 32399-3000
(904) 487-2600
kathy.burks@dep.state.fl.us

Greg Jubinsky
Florida Dept. of Environmental Protection
Bureau of Aquatic Plant Management
3917 Commonwealth Boulevard
Mail Station 710
Tallahassee, FL 32399.
(904) 487 2600
jubinsky_g@inolO.dep.state.fl.us

Richard Martin
The Nature Conservancy
P.O. Box 4125
Baton Rouge, LA 70821
(225) 338-1040
rmartin@tnc.org

Dan Snodgrass
11617 FM 2244
Austin, TX 78704
(512) 263-8878
dsnodgrass@tnc.org

MONITORING

Control efforts must be repeated and monitored for three to five years following the initial treatment, to ensure the control of chinaberry. In natural areas management, monitoring programs will likely combine changes in abundance of *M. azedarach* with changes in abundance of desirable native species or changes in community attributes that are the targets of management. Such programs should have explicit objectives that can be measured and that are meaningful from both a biological and management standpoint. These objectives may vary depending on the abundance of *M. azedarach* and other invasives. For instance, the objective of managing a forest with 40% cover of *M. azedarach* may be to reduce *M. azedarach* cover to 20%. On the other hand, an appropriate management goal for a site with 10% cover of *M. azedarach* may be to prevent an increase of more than 10% total cover (20% total). In addition, increasing regeneration of native species may be an important objective. Monitoring the status of other conservation targets, such as invertebrates dependent on specific nectar sources, may be more important than tracking invasive plant species abundance. In general, the objectives of monitoring should track those of management.

In terms of effort (number of plots established and monitored), transects or long, linear plots are more effective in providing sufficient statistical power to determine change than square or broadly rectangular quadrats. Analyses of plant species composition and abundance can be simplified by (1) collecting data on abundance of dominant species; (2) collecting data on all species and pooling data on less abundant species; and (3) pooling data on species by placing them in guilds (invasive grasses, invasive legumes, native grasses, etc.).

While generally a research technique, measuring change, or lack thereof, in control (unmanaged) areas can be an effective way of assuring that changes detected in treated areas are actually the result of the treatment and not of other factors such as limited rainfall or a wildfire. In forest communities that are in early successional stages or recently disturbed, declines in abundance of the *M. azedarach* may occur over time without management.

M. azedarach has a distinct signature on color-infrared aerial photography, which may make this an appropriate tool for monitoring the spread of *M. azedarach* stands (Everitt et al. 1989).

RESEARCH

The following research topics need attention: 1) What are the mechanisms of *M. azedarach* invasion and spread in a variety of fragmented forest landscapes? 2) What is the light environment of disturbed forests and the corresponding tolerance limits for *M. azedarach* reproduction and survival? 3) What are the effects of *M. azedarach* thickets on herb layer species? 4) To what extent are deer a factor in fostering invasion by *M. azedarach*? 4) Which if any insects or pathogens are effective at limiting *M. azedarach* abundance in its native range? 5) What roles do logging and other forestry practices play in the successful spread of *M. azedarach*? 6) How could forestry operations be carried out to prevent invasion by *M. azedarach?* 7) Which species replace *M. azedarach* when control succeeds? 8) Do prescribed burns reduce or eliminate *M. azedarach* and encourage regeneration of native species in forest types that are fire-influenced?

Work is needed on more efficient control methods, especially where cutting is used. Standard tools such as weed whackers, brush hogs and other equipment are not designed for cutting this species or for use inthe kinds of habitat it invades.

REFERENCES

Abo El Ghar, G.E.S., M.E. Khalil, and T.M Eid. 1996. Some biochemical effects of plant extracts in the black cutworm, Agrotis ipsilon (Hufnagel) (Lep., Noctuidae). Journal of Applied Entomology. 120(8): 477-482.

Andrei, G.M., F.C. Coulombie, M.C. Courreges, R.A. DeTorres, and C.E. Coto. 1990. Meliacine, an antiviral compound from *Melia azedarach* L., inhibits interferon production. Journal of Interferon Research 10(5): 469-476.

Barquero, A.A., L.E. Alche, and C.E. Coto. 1997. Antiviral activity of meliacine on the replication of a thymidine kinase-deficient mutant of Herpes simplex virus type 1 alone and in combination with acyclovir. International Journal of Antimicrobial Agents. 9(1): 49-55.

Bisht, R.P and O.P.Toky. 1993. Growth pattern and architectural analysis of nine important multipurpose trees in an arid region of India. Canadian Journal of Forest Research. 23(4): 722-730.

Breuer, M.and B. Devkota. 1990.Control of Thaumetopoea pityocampa (Den. and Schiff.) by extracts of *Melia azedarach* L. (*Meliaceae*). Journal of Applied Entomology 110(2): 128-135.

Burks, K.C. 1997. *Melia azedarach*. Fact sheet prepared by the Bureau of Aquatic Plant Management, Department of Environmental Protection, State of Florida, Tallahassee, FL.

Chen, C.C., S.J. Chang, L.L. Cheng, and R.F. Hou. 1996. Deterrent effect of the chinaberry extract on oviposition of the diamondback moth, *Plutella xylostella* (L.) (Lep., *Yponomeutidae*). Journal of Applied Entomology. 120(3): 165-169.

Everitt, J.H., D.E. Escobar, and R.W. Neck. 1989. Using color-infrared aerial photography to distinguish Chinaberry (*Melia azedarach* L.) infestations in southern and south-central Texas. The Texas Journal of Science, 41(3): 265-272.

Groninger, J.W., S.M. Zedaker, and J.R. Seiler. 1997. Herbicides to control tree roots in sewer lines. Journal of Arboriculture. 23(5): 169-180.
Henderson, L. 1991. Invasive alien woody plants of the northern Cape. Bothalia 21: 177-189.
Henderson, L. and K.J. Musil. 1984. Exotic woody plant invaders of the Transvaal. Bothalia 15: 297-313.
HerbWeb 2000: Global botanical exchange. http://www.herbweb.com.
Hong, T.D. and R.H.Ellis. 1998. Contrasting seed storage behaviour among different species of Meliaceae. Seed Science and Technology. 26(1): 77-95.
Kline, W.N. and J.G. Duquesnel. 1996. Management of invasive exotic plants with herbicides in Florida. Down to Earth 51(2).
Kroschel, J. 1996. Studies on the use of chemicals, botanicals and *Bacillus thuringiensis* in the management of the potato tuber moth in potato stores. Crop-Protection. 15(2): 197-203.
Langeland, K.A. and K.C. Burks (eds.) 1998. Identification and biology of non-native plants in Florida's natural areas. University of Florida, Gainesville, FL.
Nardo, E.A.B, A.S. Costa, and A.L. Lourencao. 1997. *Melia azedarach* extract as an antifeedant to *Bemisia tabaci* (Homoptera: *Aleyrodidae*). Florida Entomologist. 80 (1): 92-94.
Neupane, F.P. 1992. Insect pests associated with some fuelwood and multipurpose tree species in Nepal. Journal of Tropical Forest Science 5(1): 1-7.
Noble, A.D., I. Zenneck, and P.J. Randall. 1996. Leaf litter ash alkalinity and neutralization of soil acidity. Plant and Soil. 179(2):293-302.
Radford, A.E., H.E. Ahles, and C.R. Bell. 1968. Manual of the vascular flora of the Carolinas, University of North Carolina Press. Chapel Hill, NC.
Randall, J.M. and B.A. Meyers-Rice. unpublished. 1998 Weed Survey of The Nature Conservancy's land managers. Documents on file at TNC Wildland Invasive Species Program, Davis, CA.
Singh, J.P, V.S. Yadav, and Y.P. Singh. 1996. Nitrogen release from leaves of leguminous and nonleguminous tree species in sandy loam soil. Arid Soil Research and Rehabilitation. 10(3): 257-264.
Time Life Plant Encyclopedia Virtual Garden, accessed June 1999, http://www.vg.com
Toky, O.P. and R.P. Bisht. 1993. Above-ground and below-ground biomass allocation in important fuelwood trees from arid north-western India. Journal of Arid Environments 25(3): 315-320.
Valladares, G., M.T. Defago, S. Palacios, and M.C. Carpinella. 1997. Laboratory evaluation of *Melia azedarach (Meliaceae)* extracts against the elm leaf beetle (Coleoptera: *Chrysomelidae*). Journal of Economic Entomology. 90(3): 747-750.
Villamil, S.M., L. Alche, and C.E. Coto. 1995. Inhibition of herpes simplex virus type-1 multiplication by meliacine, a peptide of plant origin. Antiviral Chemistry and Chemotherapy. 6(4): 239-244.
Zakir, U.R., S. Ahmad, S. Qureshi, U.R. Atiq, and Y. Badar. 1991. Toxicological studies of *Melia Azedarach* L. (flowers and berries). Pakistan Journal of Pharmaceutical Sciences 4(2): 153-158.

AUTHORED BY: Michael S. Batcher, Consulting Ecologist and Environmental Planner, 1907 Buskirk-West Hoosick Road, Buskirk, NY 12028, e-mail: mbatcher@netheaven.com

EDITED BY: Mandy Tu and John M. Randall, The Nature Conservancy's Wildland Invasive Species Program, 124 Robbins Hall, Dept. of Vegetable Crops & Weed Science, University of California, Davis, CA 95616. Phone: (530) 754-8891.

EDITION DATE: August 2000