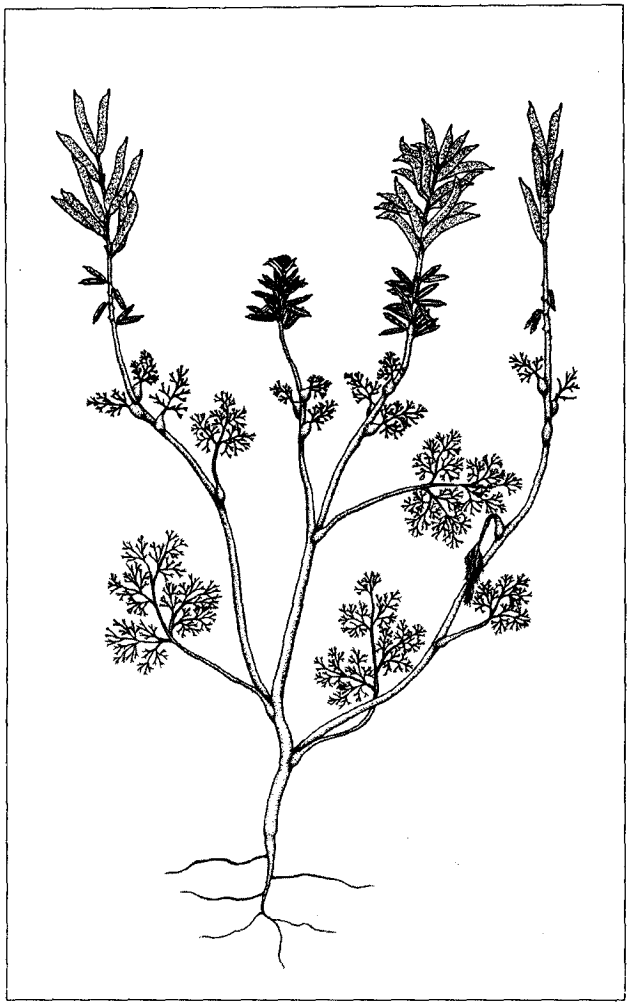
A Q U A P H Y T E

A NEWSLETTER ABOUT AQUATIC, WETLAND AND INVASIVE PLANTS

Center for Aquatic and Invasive Plants
with support from
The Florida Department of Environmental Protection, Bureau of Invasive Plant Management
The U.S. Army Corps of Engineers, Waterways Experiment Station, Aquatic Plant Control Research Program
The St. Johns River Water Management District

UNIVERSITY OF FLORIDA
Institute of Food and Agricultural Sciences

Volume 22 Number 1 Summer 2002 **Gainesville, Florida** **ISSN 0893-7702**



Reconstruction of *Archaefructus sinensis* by K. Simons and D. Dilcher

New Fossil Aquatic Plant Discovered

Using the oldest, most complete fossil angiosperm on record, Dr. David Dilcher, a palaeobotanist with the Florida Museum of Natural History at the University of Florida, recently announced the discovery of a new basal angiosperm family of aquatic plant, Archaefructaceae. The announcement was published in the journal *Science* with coauthors Ge Sun of the Research Center of Palaeontology at Jilin University, Qiang Ji of the Geological Institute of the Chinese Academy of Geosciences at Beijing and three others (full citation below).

The new family consists of a single genus, *Archaefructus,* with two species, *A. liaoningensis* and *A. sinensis* sp. nov. from the Yixian Formation in Liaoning, northeastern China. The fossils are believed to be at least 124.6 million years old and possibly as old as 145 million years (corresponding with Lower Cretaceous to the uppermost Upper Jurassic periods). A specimen is deposited with the Geological Institute of the Chinese Academy of Geosciences at Beijing. Five nearly complete fossil plant specimens in various stages of reproductive maturity were examined. When all characters of the two species were analyzed using a combined matrix of morphology and molecular data, it was determined that a new family of flowering plants was required, Archaefructaceae, which should be considered a sister taxon to extant angiosperms.

The Archaefructaceae are believed to have been aquatic plants because of the long, thin, herbaceous stems that would have required water for support. The finely dissected compound leaves also suggest an aquatic habitat. In addition, the leaves have a swollen petiole base, especially the leaves closest to the reproductive organs and farthest from the base of the plant. This feature would have provided buoyancy to the plant and aided in supporting the reproductive organs above the water during pollination and possibly seed dispersal. Numerous fish (*Lycoptera davidi* Sauvage) are preserved with the fossil plants, further supporting the conclusion that Archaefructus was aquatic.

The researchers state that Archaefructus is part of a complex basal group in angiosperm evolution and does not represent the original angiosperm. They suggest that the original angiosperm may have been a submerged aquatic plant such as some Nymphaeales.

See *Science* Vol. 296 (3 May 2002):899-904, *Archaefructaceae, a New Basal Angiosperm Family* by Ge Sun, Qiang Ji, David L. Dilcher, Shaolin Zheng, Kevin C. Nixon, Xinfu Wang.

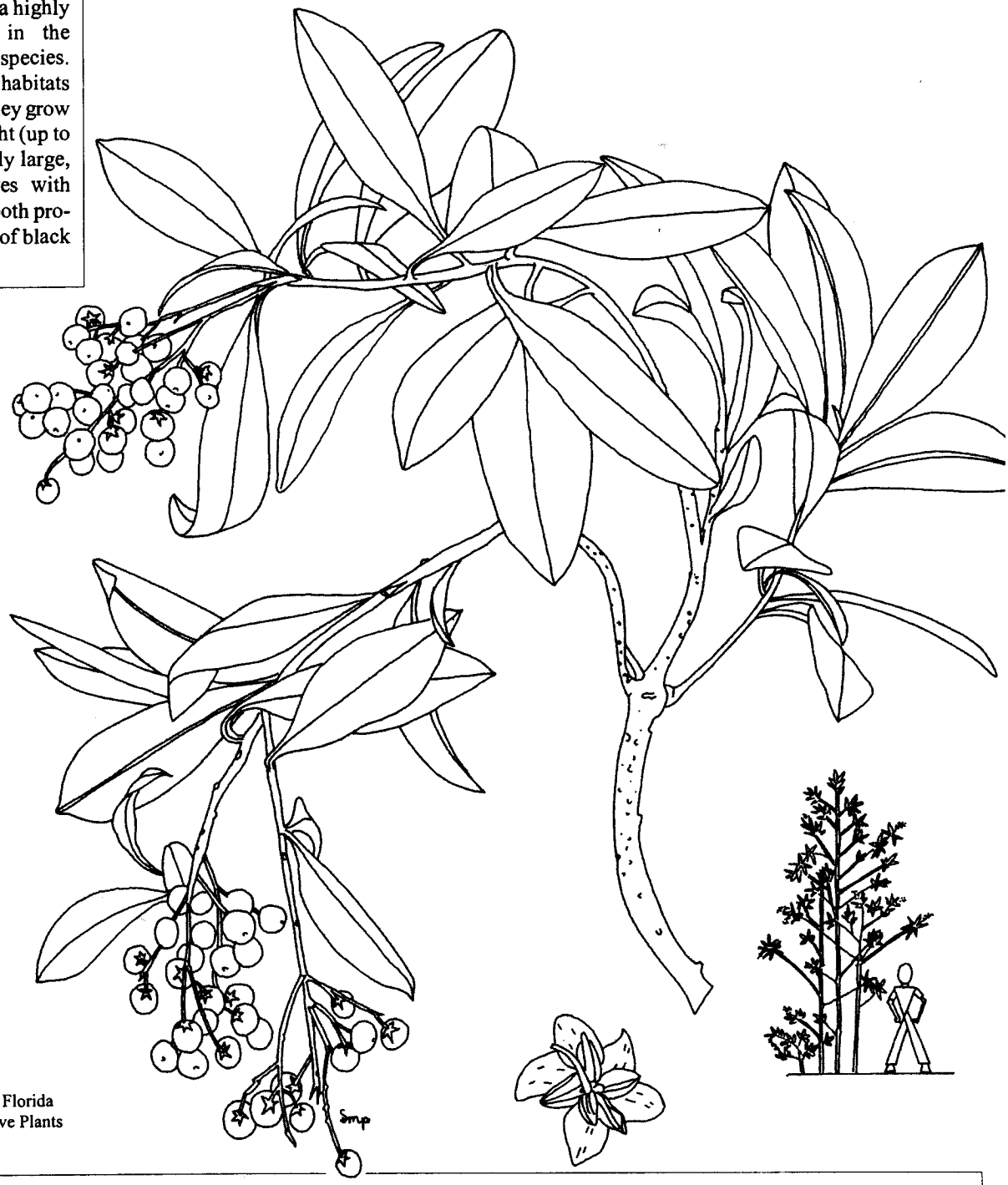
For further information, contact Dr. Dilcher at the University of Florida, Florida Museum of Natural History, POB 117800, Gainesville, FL 32611; E-mail: dilcher@flmnh.ufl.edu

Mistaken Identity?

It is easily possible to confuse the two small trees shown below. However, one is a desirable native to be left alone in Florida; the other is a highly invasive non-native in the state. Both are *Ardisia* species. Both grow in the same habitats of southern Florida. They grow to about the same height (up to 20 feet), have relatively large, leathery, simple leaves with smooth margins, and both produce hanging clusters of black fruits.

Marlberry
Ardisia escallonioides
Native in Florida

The native plant, marlberry (*Ardisia escallonioides*), is somewhat less robust and less leafy, although it may be taller, than shoebutton. Marlberry flowers and fruit clusters are terminal, hanging at the ends of branches.



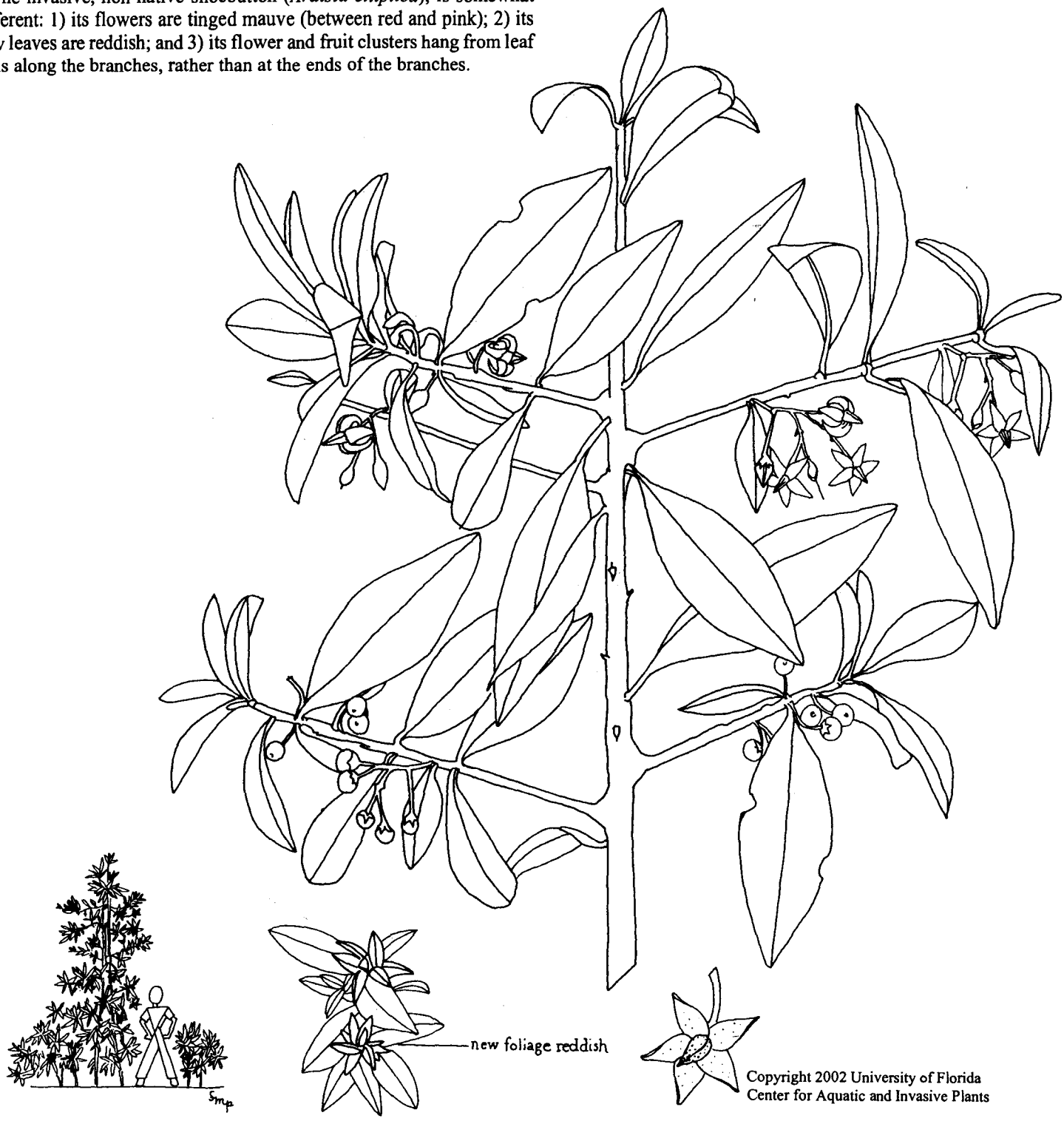
These line drawings are by Sandra Murphy-Pak, Center for Aquatic and Invasive Plants, University of Florida. With proper attribution and in not-for-sale items only, please feel free to use these line drawings for manuals, brochures, reports, proposals, web sites . . . .

Shoebutton

Ardisia elliptica

Invasive non-native in Florida

The invasive, non-native shoebutton (*Ardisia elliptica*), is somewhat different: 1) its flowers are tinged mauve (between red and pink); 2) its new leaves are reddish; and 3) its flower and fruit clusters hang from leaf axils along the branches, rather than at the ends of the branches.



These line drawings are by Sandra Murphy-Pak, Center for Aquatic and Invasive Plants, University of Florida. With proper attribution and in not-for-sale items only, please feel free to use these line drawings for manuals, brochures, reports, proposals, web sites . . . .

Macrophyte Ecology within Experimental Reed Beds Applied for Heavy Metal Removal

by Miklas Scholz, University of Bradford, School of Engineering, Environmental Water Engineering Research Group, West Yorkshire BD7 1DP, UK; E-mail: m.scholz@bradford.ac.uk

Background

Wetlands can be applied for passive treatment of diffuse pollution including mine wastewater drainage (Kadlec and Knight, 1995). The functions of macrophytes in terms of their physical effect on wetlands have been reviewed extensively (Brix, 1994). The biology of *Phragmites australis* was reviewed in 'Biological Flora of the British Isles' (e.g.; Haslam 1972). However, the role of macrophytes within complex reed bed ecosystems treating heavy metal pollution has not yet been fully reported. The aim of this paper is to compare experimental wetland filters of different composition.

Materials and Methods

Wetland habitats were simulated on a laboratory scale with six vertical-flow wetland buckets. The empty bucket volume was 59.2 dm^3. Table 1 indicates the packing order of filter media and plant roots in January 2000.

The experiment ran continuously with modified inflow water taken from a nearby beck. In order to simulate metal contamination such as may be found in process water from mining, copper sulfate and lead sulfate were added to the inflow water to give concentrations of 1.000 and 1.277 mg dm^{-3}, respectively.

The range of the hydraulic load per filter bucket was between 1.35 and 2.02 cm d^{-1} (mean: 1.91 cm d^{-1}). In June 2000, water evaporation accounted for approx. 0.08 cm d^{-1}, *Phragmites australis* evapotranspiration for approx. 0.15 cm d^{-1} and *Typha latifolia* evapotranspiration for a value between 0.12 and 0.17 cm d^{-1}.

TABLE 1. Packing order of vertical-flow filter buckets simulating wetlands.

Height (cm)	Filter 1	Filter 2	Filter 3	Filter 4	Filter 5	Filter 6
56-58	(Water/air)	(Water/air)	(Water/air)	(Water/air)	(Water/air)	(Water/air)
49-55	Water + C	Water + C	Water + C	Water + C	Water + C	Water + C
47-48	6	6 + A	6 + A + B	8 + A + B	8 + A + B	9 + A + B + Fs
41-46	6	6 + A	6 + A + B	8 + A + B	8 + A + B	8 + A + B
37-40	5	5 + A	5 + A + B	6 + A + B	7 + A + B	7 + A + B
35-36	5	5	5 + B	6 + B	7 + B	7 + B
33-34	4	4	4 + B	6 + B	6 + B	6 + B
29-32	4	4	4	5	6	6
25-28	4	4	4	5	5	5
21-24	3	3	3	4	5	5
17-20	3	3	3	4	4	4
15-16	3	3	3	3	4	4
9-14	2	2	2	3	3	3
0-8	1 + 2	1 + 2	1 + 2	1 + 2	1 + 2	1 + 2

1 = cobblestones; 2 = coarse gravel; 3 = fine gravel; 4 = pea-gravel; 5 = coarse sand; 6 = fine sand; 7 = Filtralite; 8 = activated carbon; 9 = charcoal; A = *Phragmites australis*; B = *Typha latifolia*; C = marginal, floating and submerged plants; Fs = Osmocote fertilizer

Discussion and Conclusions

Standardized set-up cost ratios in England (Spring 2000) for Filters 1 to 6 (Table 1) are 1 : 2 : 3 : 37 : 41 : 42, respectively. However, the overall reduction performance of all filters in terms of lead, copper, biochemical oxygen demand (BOD), suspended solids, turbidity and bacteria was substantially great and similar for all filters during the first five months of operation (Table 2).

TABLE 2. Filter efficiencies: reduction of parameters for Filters 1 to 6.

Performance variables (outflow water)	Inflow Water Mean	Unit	Reduction (%) per wetland filter 1	2	3	4	5	6
Lead reduction	1.4	mg dm^{-3}	98	99	99	99	99	99
Copper reduction	1.0	mg dm^{-3}	96	98	97	99	98	99
BOD	2.2	mg dm^{-3}	60	57	41	45	53	41
SS reduction	17.0	mg dm^{-3}	55	42	50	53	51	33
Turbidity reduction	2.3	NTU	95	87	68	80	97	99
DO reduction	8.5	mg dm^{-3}	46	68	74	77	72	78
THB reduction	2948	number per ml	88	98	92	94	91	88
TC reduction	368	number per ml	100	98	69	89	98	96

BOD = biochemical oxygen demand; SS = suspended solids; DO = dissolved oxygen; THB = total heterotrophic bacteria; TC = total coliforms

Table 3 presents a summary of the performance parameter for *Phragmites australis*. Filter 3 showed a relative poor performance (Tables 2 and 3) which may have resulted from a high level of plant decay indicated by mid leaf color transformation (Pavey, 1978). Shoot density was high, stem diameters were sufficiently large and leaf/stem ratios were low (Table 3). These are indicators of good general performance (defined by Haslam, 1972). The strong normal plant diameter distribution shows that the physical strength and growth performance of *Phragmites* is independent of filter media and fertilizer application. However, shading decreased the stem diameters (Haslam, 1972) of *Phragmites* growing in fertilized filter media (Table 3).

The filters containing macrophytes contributed artificially to the inflow BOD. The real inflow BOD to the filter media was, therefore, the sum of the natural inflow BOD (10 - 40%) and the BOD resulting from plant decay (60 - 90%). BOD resulting from plant decay was greatest for filters containing *Typha*. The addition of fertilizer (Filter 6 only) increased the degradation rate.

TABLE 3. Performance parameter of *Phragmites australis* for Filters 2 to 6.

Performance Parameter	Filter 2	3	4	5	6
Total plant number	54	34	48	39	72
Mean plant height (cm)	46.7	47.6	54.7	45.5	46.0
Median plant height (cm)	46.0	47.5	55.5	41.0	46.0
Leaf/stem ratio	4.66	3.62	5.65	4.44	5.68
Average node number	2.04	2.00	2.90	2.33	2.14
Average stem diameter (mm)	2.65	2.8	2.61	2.63	2.55
Average stem and branch number	1.11	1.21	1.40	1.23	1.51
Growth density (number per m^2)	434	273	386	314	579
Cluster density (number per m^2)	30	16	32	24	48
Color: plate; green variations	28.6	28.7	28.6	28.8	28.5
Color: column; intensity E (%)	30	10	30	30	20
Color: column; intensity F (%)	70	90	70	70	80
Color: row; darkness	6.3	5.5	6.6	6.6	7.0

The presence of *Phragmites* (dominant stands) and *Typha* in all reed beds does not lead to an overall increase of the wetland performance in laboratory scale experiments. Plant decay within all reed beds resulted in increases in biochemical oxygen demand and bacteria numbers within the water layer on top of the litter zone.

References

Brix, H. (1994) *Functions of macrophytes in constructed wetlands*. Wat. Sci. Tech. 29(4): 71-78.

Haslam, S. M. (1972) *Phragmites communis* Trin. [*Arundo phragmites* L., *Phragmites australis* (Cav.) Trin. Ex. Steudel].- In Biological flora of the British Isles. J. of Ecol. 60: 585-610.

Kadlec, R. H., Knight R. L. (1995) Treatment wetlands. - Lewis Publishers, Boca Raton, Florida, USA.

Pavey, D. (1978) Methuen handbook of color. 3rd edition, Eyre Methuen Ltd., Norfolk, UK.

Books/Reports

INVASIVE PLANTS AND ANIMALS: Is There a Way Out?

ed. by W. Bergmans and E. Blom. 2001. 80 pp.

(Order from Netherlands Committee for IUCN, Plantage Middenlaan 2B, 1018 DD Amsterdam, THE NETHERLANDS. Email: redacti@nciucn.nl)

This is the Proceedings of a Conference on Alien Invasive Species on the 26th September, 2000 in the National Museum of Natural History Naturalis in Leiden, the Netherlands. Recommendations from this conference include, 1) become more active in the study of invasive species, and adopt policies; 2) set up an institution to systematically collect data on alien pest species; 3) invasive species issues should be included in the agendas of the Convention on Biological Diversity; 4) since not much is known, individual invasions should be dealt with on a case by case basis; 5) measures to counteract invasions should be taken early on; 6) biological control programs for invasive species should be "surrounded by extensive precautions"; 7) a set of fixed definitions of terms must be used; 8) set up a database on invasive species and the damage they cause; 9) necessary funds for research should be had; 10) in the Netherlands, listings are a good idea.

MEETING THE INVASIVE SPECIES CHALLENGE - National Invasive Species Management Plan,

by the National Invasive Species Council. 2001. 80 pp.

(Order from National Invasive Species Council, 1951 Constitution Avenue, NW, Suite 320, Washington, DC 20240. 202-208-6336. WWW: http://www.invasivespecies.gov)

"Despite an array of federal programs designed to stop or control them, the number of invasive species and their cumulative impacts is accelerating at an alarming rate. This Plan is an important first step for a unified and cooperative approach to address invasive species issues... The next and most difficult step will be implementation of the Plan - which is the highest and most immediate priority."

GLOBAL STRATEGY ON INVASIVE ALIEN SPECIES,

ed. by J.A.McNeely, H.A. Mooney, L.E. Neville, P.J. Schei and J.K. Waage. 2001. 50 pp.

(Order from IUCN, The World Conservation Union, Publications Unit, 219c Huntingdon Road, Cambridge CB3 0DL, UNITED KINGDOM. WWW: http://www.iucn.org)

This is the strategic plan of the Global Invasive Species Programme (GISP). GISP is "a component of DIVERSITAS, an international programme on biodiversity science". "GISP is coordinated by the Scientific Committee on Problems of the Environment (SCOPE), in collaboration with the World Conservation Union (IUCN), and CAP International," with financial support from UNEP, UNESCO, NASA, ICSU, La Fondation TOTAL, the David and Lucile Packard Foundation, the John D. and Catherine T. MacArthur Foundation, and the United States Department of State.

The strategic plan gets right to it: "The spread of Invasive Alien Species (IAS) is now recognized as one of the greatest threats to the ecological and economic well being of the planet."

The authors recommend a "consolidated action plan"; believe that, "eradication is difficult and expensive, but possible"; state that, "because the cost and benefit factor influences decisions that results in risk analysis that are often very difficult politically, the criteria for making such decisions should be clearly developed"; and "capacity building and further research on the biology and control of IAS and biosecurity issues should therefore be given attention and priority"; and "an information system regarding the biology and control of IAS is urgently needed...and the information system must be linked to the Clearing House Mechanism of the Convention on Biological Diversity." [Why, *we're* an information system on IAS.]

The "Ten Strategic Responses" include 1) build management capacity; 2) build research capacity; 3) promote information sharing; 4) develop economic policies and tools; 5) strengthen national, regional, and international legal and institutional frameworks; 6) institute a system of environmental risk analysis; 7) building public awareness and engagement; 8) prepare national strategies and plans; 9) build invasive alien species issues into global change initiatives; and 10) promote international cooperation.

BIOLOGICAL CONTROL OF WATER HYACINTH 2 - The Moths *Niphograpta albiguttalis* and *Xubida infusellus*,

by M.H. Julien, M.W. Griffiths and J.N. Stanley. 2001. 91 pp.

(Order from Australian Centre for International Agricultural Research (ACIAR), GPO Box 1571, Canberra ACT 2601, AUSTRALIA. ACIAR Monograph No. 79.)

This monograph treats these two biological control moths, their biologies, host ranges, and rearing, releasing and monitoring techniques. But it also treats, with updated information, the plant's morphology, distribution, habitat and impact. It includes much detailed information about the life histories of the water hyacinth stem borer and the water hyacinth stalk borer, host-range testing for the two insects, and introductions and effects. What follows is a very detailed, step-by-step description of how to rear these insects and then how to release them and evaluate their hyacinth-destroying effects. All sections are copiously illustrated with excellent color photographs.

BIOLOGICAL AND INTEGRATED CONTROL OF WATER HYACINTH (*Eichhornia crassipes*),

ACIAR Proceedings NO. 102, ed. by M.H. Julien, M.P., Hill, T.D. Center and Ding Jianqing. 2001. 152 pp.

(Order from Australian Centre for International Agricultural Research (ACIAR),GPO Box 1571, Canberra ACT 2601, AUSTRALIA.)

This contains the proceedings of the Second Meeting of the Global Working Group for the Biological and Integrated Control of Water Hyacinth, Beijing, China, 9-12 October 2000. The group consists of 31 delegates from 11 countries. The proceedings include 22 papers on the subjects, including reviews of and new work with arthropods and pathogens, with case studies from China, South Africa, Malawi, Rwanda, Egypt, Kenya, Zimbabwe and Tanzania.

GARDENING WITH CARNIVORES - Sarracenia Pitcher Plants in Cultivation and In The Wild, by N. Romanowski. 2002. 106 pp.

(Order from University Press of Florida, 15 NW 15 ST, Gainesville, FL 32611-2079. $29.95 (paperback). WWW: http://www.upf.com)

Pitcher plants (*Sarracenia*) are native to the southeastern U.S. This is "the first complete guide to these ornamental plants, from natural history to hybridization, and from creating a bog garden to using the pitchers as long-lasting cut "flowers"." It is a nicely produced book, and includes a number of full-size color pages of these interesting plants. The book includes 80 color photos, 8 drawings and a bibliography.

A PLAGUE OF RATS AND RUBBER-VINES - The Growing Threat of Species Invasions, by Y. Baskin. 2002. 377 pp.

(Order from Island Press. WWW: http://www.islandpress.org)

"We must make no mistake: we are seeing one of the great historical convulsions in the world's fauna and flora." Charles Elton, 1958. Presenting a slightly different take on the subject, this science writer includes in the book a useful list of her themes: a) we are all in this together...; b) my intent is not to condemn...; c) the language is value-laden...; d) migration and dispersal are natural processes, but...; e) many invaders benefit or please someone...; f) unfortunately, this isn't "a war that can be won once and for all"...; and g) we can't unscramble, but we can work to preserve the native biodiversity we still have.

What she presents isn't simply a list of invasion factoids, one after the other, as in so many of the current crop of books of similar title. Hers is more a very long essay - the author informs the factoids with anecdotes and writings of explorers of centuries past, and of great scientists who years ago rang the first alarms about species invasions.

She concludes, "This homogenization of the life of the earth leaves us poorer, whatever the head count."

FLOODPLAIN FLORA - A flora of the coastal floodplains of the Northern Territory, Australia, by I.D. Cowie and P.S. Short, and illustrated by M. Osterkamp Madsen. Supplementary Series No. 10. 2000. 382 pp.

(Order from Australian Biological Resources Study, GPO Box 787, Canberra ACT 2601, AUSTRALIA. $60.00 (soft cover). WWW: http://www.ea.gov.au/biodiversity/abrs)

From the Flora of Australia Supplementary Series, this book is an identification manual for more than 300 species of the seasonally inundated coastal floodplains (including the billabongs and lagoons) of the Top End of the Northern Territory. The book contains an overview of the floodplains origins; flora and vegetation groups; fauna; aboriginal use; and management and conservation issues. The main part of the book includes descriptions, illustrations and keys. Nearly all species are illustrated with large, well-printed drawings. Also included are numerous excellent photographs (including a spectacular aerial shot of what feral water buffalo can do to floodplain plants). Other works in the Supplementary Series treat the algae, the mosses, the lichens and allied fungi, and others.

WILD RIVERS - Discovering the Natural History of the Central South Island, by N. Peat and B. Patrick. 2001. 142 pp.

(Order from International Specialized Book Services, Inc., 5824 NE Hassalo ST,Portland, OR 97213-3644. $49.95 (soft cover). WWW: http://www.isbs.com)

South Island is in New Zealand. Central South Island is along its eastern shore on the Pacific. Although this book is "strewn with" scientific names and common names, including Maori names, it is a most readable one. What else the book is strewn with is full-page breathtaking photographs of river basins and mountain ranges; grasses and buttercups alongside icy melted glaciers; cushion plants, crack willows and braided rivers. The book concludes with an essay on conservation issues such as invasive species, from the Central South Island point of view.

RARE PLANTS OF SOUTH FLORIDA: Their History, Conservation and Restoration, by G.D. Gann, K.A. Bradley and S.W. Woodmansee. 2002. 1056 pp.

(Order from The Institute for Regional Conservation, 22601 SW, 152 AVE, Miami, FL 33170. $49.95 (paperback). WWW: http://www.regionalconservation.org)

This work is based on the research program, the Floristic Inventory of South Florida. It includes information on several hundred imperiled plants and includes detailed information on their known history in the state, according to historical surveys and herbaria, their current status, their major threats, and useful comments. Also included are floristic status reports for a large number of south Florida conservation areas. For example, in this book one will learn that in Big Torch Key Parcels 884 and 885 (67.19 acres), there are 19 "listed" plants (and they are listed), and 6 FLEPPC exotic plants.

As one reviewer raves about this huge production, "They have produced a permanent reference point against which future plant restoration efforts will be judged. For the first time, there is a comprehensive, regional rare flora that incorporates restoration recommendations for each of several hundred critically-imperiled species alongside general advice and a status report on conservation areas."

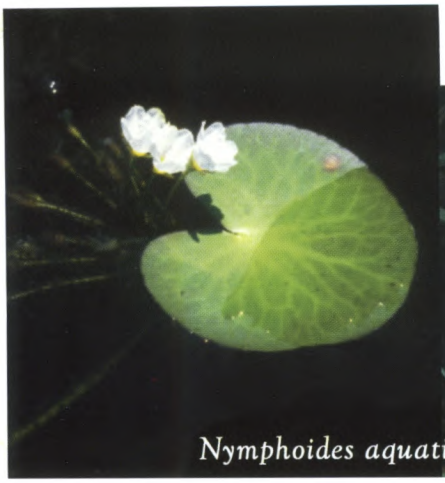
SEDGES: Carex, by R.H. Mohlenbrock, illustrated by P. Nelson. 1999. 328 pp.

(Order from Southern Illinois University Press, PO Box 3697, Carbondale, IL 62902-3697. $59.95. 1-800-346-2680. WWW: www.siu.edu/~siupress)

This book is the fourteenth volume in the *Illustrated Flora of Illinois* series and the sixth and last volume devoted to monocots. Each of the 159 species of *Carex* is precisely illustrated, showing growth habit and the key plant structures used for identification. More than three-fourths of the Illinois *Carex* species occur in wetlands, and useful range maps show distribution by county in this state. Detailed descriptions and a key complete the guide to this confusing genus.

Continued - next page

Florida's floating-hearts

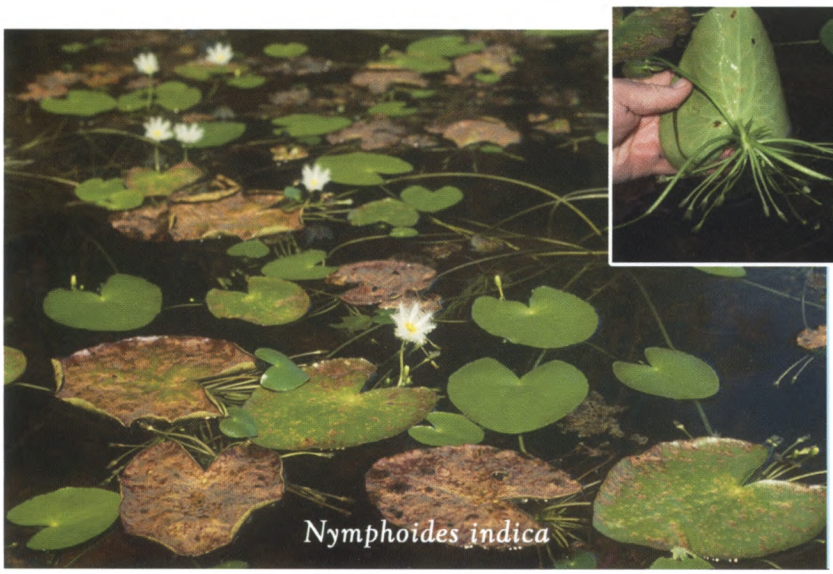


Nymphoides aquatica

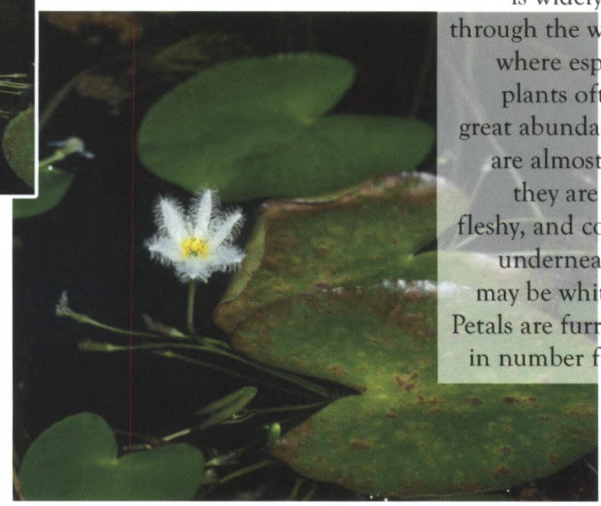
Know *Nymphoides*

Floating-hearts (*Nymphoides*) are an attractive group of water plants with heart-shaped leaves and small, airy flowers. Two species are native to Florida; one frequent throughout the state, the other found only in the Panhandle. Unfortunately, two weedy, introduced floating-hearts are spreading in peninsular Florida. Know these *Nymphoides* with the photos below and the key to their identification on the reverse page.

Nymphoides grow rooted in quiet waters. The leaves resemble those of water lilies (*Nymphaea*). However *Nymphoides* have rounded, not angled, leaf bases and produce smaller flowers that are carried above the water surface on slender stalks. *Nymphoides* species generally look alike, having olive-green leaves, prominent leaf veins and thick root bunches suspended below the flower stalks. Their leaves may be mottled with purple above and pebbled in texture below. Flowers are essential to identify the various species.

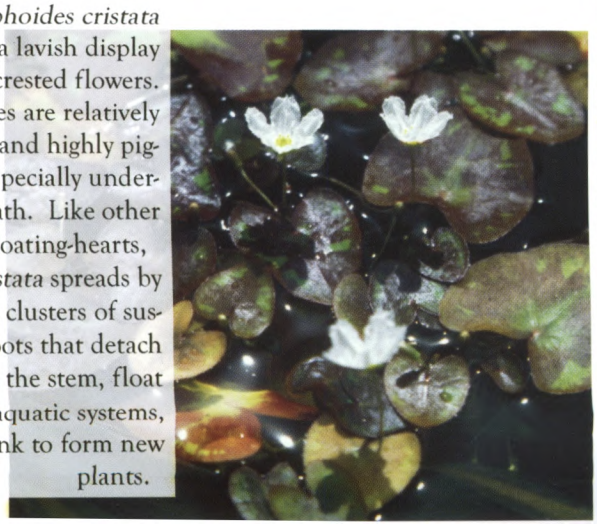


Nymphoides indica



Nymphoides indica is widely distributed through the world tropics where especially large plants often occur in great abundance. Leaves are almost as broad as they are long, thick, fleshy, and colored green underneath. Flowers may be white or yellow. Petals are furry and range in number from 4 to 8.

Nymphoides cristata produces a lavish display of ruffled, crested flowers. Its leaves are relatively thin and highly pigmented, especially underneath. Like other floating-hearts, *N. cristata* spreads by stout clusters of suspended roots that detach from the stem, float through aquatic systems, and sink to form new plants.



Nymphoides cristata

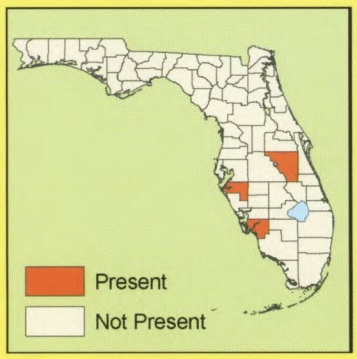
LOOK INSIDE THE FLOWERS ... to separate the introduced floating-hearts from the Florida natives ...

1. Flowers densely covered with hair on the inner surface; flowers 2.5 - 3.7 cm wide . . . . . *Nymphoides indica*
1. Flowers without hair (excepting a few radiating from center); flowers 0.75 - 2.4 cm wide . . (2)

2. Petals bearing a ruffled crest (like a rooster's comb) down the center . . . . . *Nymphoides cristata*
2. Petals without a median, ruffled crest . . . . . (3)

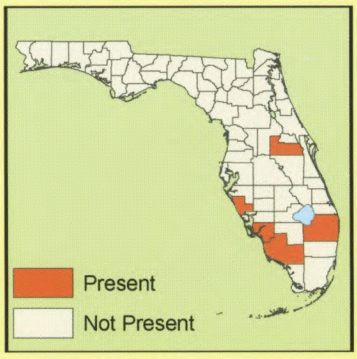
3. Leaf undersurface rough, veins prominent; leaves to15 cm long; plants larger, sturdy *Nymphoides aquatica*
3. Leaf undersurface smooth; leaves to only 7 cm long; plants smaller, delicate . . . . . *Nymphoides cordata*

Nymphoides indica
Water snowflake
INTRODUCED



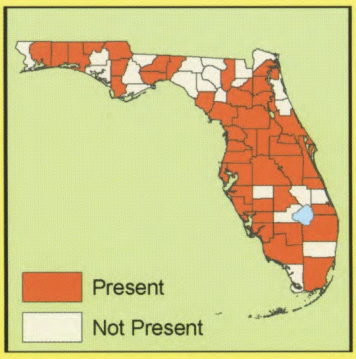
Nymphoides indica is known from-limited, scattered introductions in Florida. First recorded at the Braden River, Manatee Co. in 1983, it has since appeared at a natural wetland in Osceola Co. and a Lee Co. pond.

Nymphoides cristata
Crested floating-heart
INTRODUCED



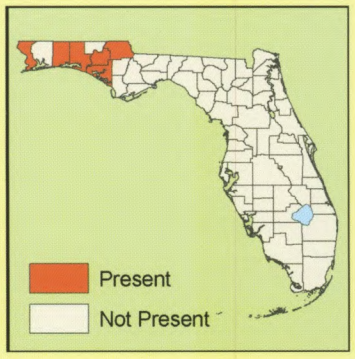
Abundant populations of *Nymphoides cristata* are increasing in distribution. Early introductions included a Lee Co. cypress swamp in 1997. South Florida canal systems and a central Florida lake (Orange Co.) have since been invaded.

Nymphoides aquatica
Big floating-heart
NATIVE



Nymphoides aquatica ranges naturally through much of Florida, and the South, where it flowers from spring through fall. Although the petal margins are ruffled, its inner surface is unadorned.

Nymphoides cordata
Little floating-heart
NATIVE



Drought conditions kept *Nymphoides cordata* hard to find this spring in its Panhandle range. Florida is the southern extent of it's native easterly distribution, which stretches north to Maine.

USGS science for a changing world
UNIVERSITY OF FLORIDA EXTENSION Institute of Food and Agricultural Sciences Center for Aquatic and Invasive Plants
University of South Florida USF
SePRO
HELENA HELENA CHEMICAL COMPANY

May 2002

Author: C. Jacono
Contributors: V. Ramey, A.Gourlay, A. Murray, V. Vandiver, M. Avinger, S. de Kozlowski

LAKESCAPING FOR WILDLIFE AND WATER QUALITY, by C.L. Henderson, C.J. Dindorf and F.J. Rozumalski. 2001. 176 pp.

(Order from Minnesota's Bookstore, 117 University Avenue, Saint Paul, MN 55155. 1-800-657-3757. $24.95 (softcover).)

What a very nice high-value book, and from a government agency, no less: the Nongame Wildlife Program of the Minnesota Department of Natural Resources. This state is well known for its large number of lakes and rivers, and there, like elsewhere, the water's edge is where many people want to be. This book helps the homeowner understand how to live on the water's edge by explaining the values of wild plants and wild animals and demonstrating the unhappy eco-consequences of overdevelopment, overfertilization and overmowing. It also takes the next important step: the book competently helps the homeowner design a lakeshore landscape that is not only very appealing to humans but also abides by the state's eco-recommendations and requirements meant for wildlife and water quality. For example, in many pictures and many colorful site plans, citizens are shown how leaving a buffer zone between their homes and the open water solves many problems, ecologic and aesthetic.

How reassuring it is that in Minnesota there is the expertise and talent to put together such a helpful book for the homeowner, and that there is the will to pay for its (expensive) production and publication.

BIODIVERSITY IN WETLANDS: Assessment, Function and Conservation - Vol. 2, ed. by B. Gopal, W.J. Junk and J.A. Davis. 2001. 311 pp.

(Order from Backhuys Publishers, PO Box 321, 2300 AH Leiden, The Netherlands. US$76.00. Euro 80.00 Email: backhuys@backhuys.com. WWW: www.backhuys.com)

This book, Volume 2 of the 2000 publication of the same name, covers biodiversity in wetlands around the world, from the French river Rhone to the lower Danube, from fen landscapes in the Netherlands to coastal plain wetlands of Southwestern Australia. Other chapters explore East Africa; South America; the world's largest floodplain wetland, the Pantanal do Mato Grosso in Brazil; a Ramsar site in India, Keoladeo National Park; afrotropical wetland invertebrates, and the role of monsoons in South Asian wetlands.

BUSH INVADERS OF SOUTH-EAST AUSTRALIA - A Guide to the Identification and Control of Environmental Weeds Found in South-East Australia, by A. Muyt. 2001. 304 pp.

(Order from R.G. and F.J. Richardson, PO Box 42, Meredith, Victoria 3333, Australia. $A59.95 plus S/H. Email: richardson@weedinfo.com.au WWW: www.weedinfo.com.au)

This well-produced and finely illustrated book is both a field guide and a control manual for invasive plant species in South-East Australia. It can be useful outside this area, however, since many of the species covered are invasive elsewhere. For instance, both South-East Australia and Florida share invasive species such as *Lonicera japonica* (Japanese honeysuckle), *Macfadyena unguis-cati* (Cat's claw creeper), *Lantana camara* (lantana), *Salvinia molesta* (giant salvinia), and others.

The first section of the book discusses the problems of invasive plant species and explains their management and control. Multiple control methods such as drill-fill, cut-paint, frilling, and stem-scrape are described in detail and illustrated with helpful drawings and photographs. Fire, mowing, mulching and other control strategies also are discussed.

The second section serves as a weed identification guide and is grouped by grasses, other narrowleaf herbs, broadleaf herbs, climbers and creepers, shrubs, trees and aquatics. 93 weeds are described, covering over 150 species, sub-species, varieties and hybrids. Each species treatment includes common name, origin, method of introduction, growth form, distribution, a summary of invasiveness, multiple color photographs of very good quality, diagnostic features, reproduction and dispersal, control and removal methods, similar invasive species and confusing indigenous species (where applicable).

Free Videos Available

APIRS has a very limited number of educational video tapes available that are in the **PAL** format. We would like to send these videos to worthy research institutions, universities, or libraries, free of charge. Following is a list of the video tape sets available. We will ship one set (category) of videos to the first people to contact us and we will pay for the shipping. We will only ship one set/category to any institution.

Category: Herbicide Application

Aquatic Pest Control Applicator Training, Part 1 & 2
How To Determine Areas and Amount of Aquatic Herbicide to Use
Calibration - A Field Approach

Category: Aquatic Plant Identification Series

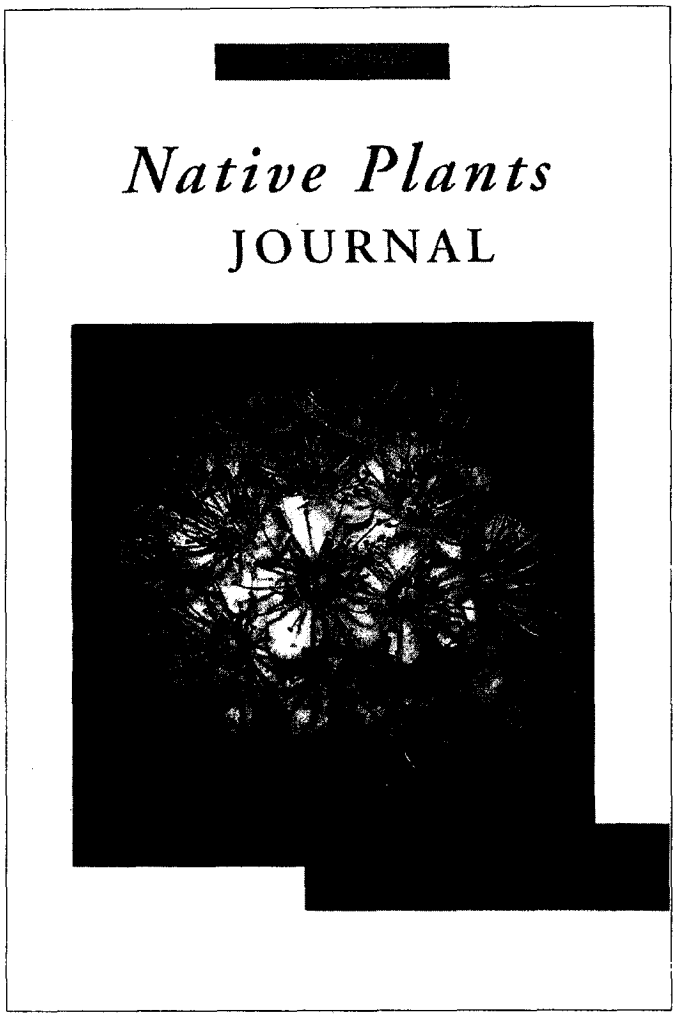
Floating and Floating-Leaved Plants
Submersed Plants, Part 1&2
Grasses, Sedges and Rushes, Pt 1&2

Category: Miscellaneous

Maintenance Control of Aquatic Weeds
Florida's Aquatic Plant Story
Hormone Induced Spawning of Grass Carp

To request free sets of videos, please send your name, institution, and shipping address to:
varamey@nersp.nerdc.ufl.edu

Please include a brief description of your institution and your intended use of the videos.



Native Plants Journal

***Native Plants* Journal** is a cooperative effort of the USDA Forest Service and the University of Idaho, with assistance from the USDA Agricultural Research Service and the Natural Resources Conservation Service. Our goal is to provide technical and practical information on the growing and planting of North American (Canada, US, and Mexico) native plants for restoration, conservation, reforestation, landscaping, roadsides, and so on. Our first issue was printed in January 2000.

We need contributions from scientists, academics, field personnel, nursery managers, and others concerning all aspects of growing and planting native plants. Papers are published either refereed or general technical. Please contact Kas Dumroese (kdumroese@fs.fed.us) if you have a contribution.

Native Plants Network

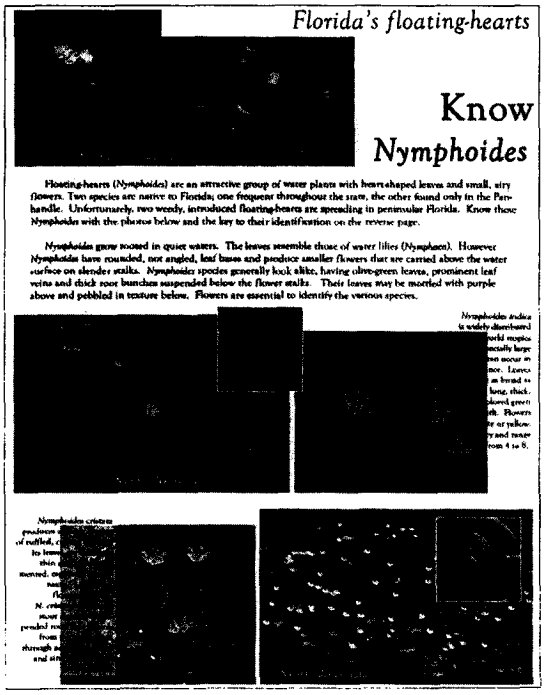
The **Native Plants Network** is devoted to the sharing of information on how to propagate native plants. Feel free to search the database for species you have interest in, and please take the time to upload protocols of species you successfully grow. You will receive full credit for your entry and have the opportunity to add your company logo to the protocol. If you would like to share some propagation techniques, entry is easy using the Protocol Interface.

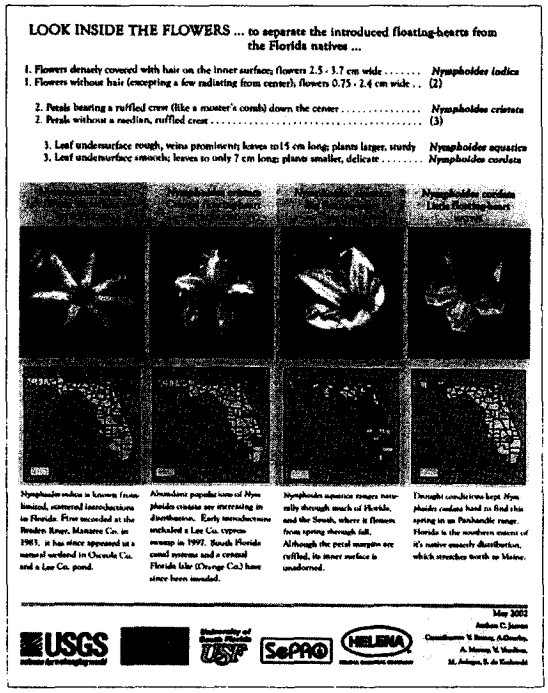
For more information, go to: http://nativeplants.for.uidaho.edu/

Know *Nymphoides*

Frequently non-native invasive plants look very similar to desirable native plants. Managers and citizens ask, "How do you tell them apart? Which should we promote and which should we destroy?"

Included with this issue of **AQUAPHYTE** is a very nice color ID flyer that demonstrates which two *Nymphoides* species in Florida are native and which two species are non-native. The flyer was written by USGS botanist, Colette Jacono. Its printing and distribution was funded by two herbicide companies: SePRO and Helena Chemical Company.





Download your own copy: **http://www.fcsc.usgs.gov/NonIndigenous_Species/nymphoides.pdf**

FROM THE DATABASE

Here is a sampling of the research articles, books and reports which have been entered into the aquatic, wetland and invasive plant database since Winter 2001.

The database contains more than 57,000 citations. To receive free bibliographies on specific plants and/or subjects, contact APIRS using the information on the back page or use the database online at http://plants.ifas.ufl.edu/

To obtain articles, contact your nearest state or university library.

Bailey, J.K., Schweitzer, J.A., Whitham, T.G.
Salt cedar negatively affects biodiversity of aquatic macroinvertebrates.
WETLANDS 21(3):442-447. 2001.

Barreto, R.W., Evans, H.C., Ellison, C.A.
The mycobiota of the weed *Lantana camara* in Brazil, with particular reference to biological control.
MYCOL. RES. 99(7):769-782. 1995.

Bartleman, A.-P., Miyanishi, K., Burn, C.R., Cote, M.M.
Development of vegetation communities in a retrogressive thaw slump near Mayo, Yukon Territory: a 10-year assessment.
ARCTIC 54(2):149-156. 2001.

Bartoszek, J.E., Schneider, T.A., Snyder, S.R.
Donor soils jumpstart revegetation of created wetlands (Ohio).
ECOL. RESTORATION 20(1):52-53. 2002.

Beckett, P.M., Armstrong, W., Armstrong, J.
Mathematical modelling of methane transport by *Phragmites*: the potential for diffusion within the roots and rhizosphere.
AQUATIC BOTANY 69(2-4):293-312. 2001.

Bennike, O., Jensen, J.B., Lemke, W.
Late quaternary records of *Najas* spp. (Najadaceae) from the southwestern Baltic region.
REV. PALEOBOT. PALYNOL. 114(3-4):259-267. 2001.

Bradley, P.
The Madagascar lace plant.
AQUATIC GARDENER 14(2):206-209. 2001.

Brown,W.T., Krasny, M.E., Schoch, N.
Volunteer monitoring of nonindigenous invasive plant species in the Adirondack Park, New York, USA.
NATURAL AREAS J. 21(2):189-196. 2001.

Buckingham, G.R.
Quarantine host range studies with *Lophyrotoma zonalis*, an Australian sawfly of interest for biological control of Melaleuca, *Melaleuca quinquenervia*, in Florida.
BIOCONTROL 46:363-386. 2001.

Burzycki, G.
The use of GIS/GPS technology to map invasive exotic plant distribution in the south Dade wetlands, southeastern Florida.
ABSTRACT, 28TH ANNUAL NATURAL AREAS ASSOC. CONF., CAPE CANAVERAL, FL, PP. 8-9. 2001.

Capers, R.S., Les, D.H.
An unusual population of *Podostemum ceratophyllum* (Podostemaceae) in a tidal Connecticut River.
RHODORA 103(914):219-223. 2001.

Castellanos, D.L., Rozas, L.P.
Nekton use of submerged aquatic vegetation, marsh, and shallow unvegetated bottom in the Atchafalaya River Delta, a Louisiana tidal freshwater ecosystem.
ESTUARIES 24(2):184-197. 2001.

Chatterjee, A., Roux, S.J.
Ceratopteris richardii: a productive model for revealing secrets of signaling and development.
J. PLANT GROWTH REGUL. 19(3):284-289. 2000.

Chikwenhere, G.P., Vestergaard, S.
Potential effects of *Beauveria bassiana* (Balsmo) Vuillemin on *Neochetina bruchi* Hustache (Coleoptera: Curculionidae), a biological control agent of water hyacinth.
BIOL. CONTROL 21:105-110. 2001.

Cooper, A., McCann, T.P., Hamill, B.
Vegetation regeneration on blanket mire after mechanized peat-cutting.
GLOBAL ECOL. & BIOGEOGR. 10(3):275-289. 2001.

Creed, J.C., Monteiro, R.L.C.
An analysis of the phenotypic variation in the seagrass *Halodule wrightii* Aschers.
LEANDRA 15:1-9. 2000.

Crow, G.E.
Utricularia myriocista (Lentibulariaceae) in Costa Rica: a new record for central America.
RHODORA 103(914):227-232. 2001.

Daane, L.L., Harjano, I., Zylstra, G.J., Haggblom, M.M.
Isolation and characterization of polycyclic aromatic hydrocarbon-degrading bacteria associated with the rhizosphere of salt marsh plants.
APPL. ENVIRON. MICROBIOL. 67(6):2683-2691. 2001.

D'Antonio, C.M., Tunison, J.T., Loh, R.K.
Variation in the impact of exotic grasses on native plant composition in relation to fire across an elevation gradient in Hawaii.
AUSTRAL ECOL. 25:507-522. 2000.

Da Silva, E.T., Asmus, M.L.
A dynamic simulation model of the widgeon grass *Ruppia maritima* and its epiphytes in the estuary of the Patos Lagoon, RS, Brazil.
ECOL. MODELLING 137(2-3):161-179. 2001.

Domning, D.P.
Sirenians, seagrasses, and cenozoic ecological change in the Caribbean.
PALAEOGEOGR., PALAEOCLIMATOL., PALAEOECOL. 166:27-50. 2001.

Duggan, I.C., Green, J.D., Thompson, K., Shiel, R.J.
The influence of macrophytes on the spatial distribution of littoral rotifers.
FRESHWATER BIOL. 46(6):777-786. 2001.

Dyckman, L.J., Hoy, J.B., Brown, G., Cook, J., et al
Invasive species: obstacles hinder federal rapid response to growing threat.
U.S. GENERAL ACCOUNTING OFFICE, REPT. CONGRESSIONAL REQUESTORS, GAO-01-724, 48 PP. 2001.

Eiswerth, M.E., Donaldson, S.G., Johnson, W.S.
Potential environmental impacts and economic damages of Eurasian watermilfoil (*Myriophyllum spicatum*) in western Nevada and northeastern California.
WEED TECHNOL. 14(3):511-518. 2000.

Eiten, L.T.
Egleria, a new genus of Cyperaceae from Brazil.
PHYTOLOGIA 9(8):481-487. 1964.

Fermor, P.M., Hedges, P.D., Gilbert, J.C., Gowing, D.J.G.
Reedbed evapotranspiration rates in England.
HYDROL. PROCESSES 15(4):621-631. 2001.

Forni, C., Chen, J., Tancioni, L., Grilli Caiola, M.
Evaluation of the fern *Azolla* for growth, nitrogen and phosphorus removal from wastewater.
WATER RES. 35(6):1592-1598. 2001.

Goergen, E., Daehler, C.C.
Reproductive ecology of a native Hawaiian grass (*Heteropogon contortus*; Poaceae) versus its invasive alien competitor (*Pennisetum setaceum*; Poaceae).
INT. J. PLANT SCI. 162(2):317-326. 2001.

Goulet, R.R., Pick, F.R.
Changes in dissolved and total Fe and Mn in a young constructed wetland: implications for retention performance.
ECOL. ENGINEERING 17:373-384. 2001.

Grenouillet, G., Pont, D.
Juvenile fishes in macrophyte beds: influence of food resources, habitat structure and body size.
J. FISH BIOL. 59(4):939-959. 2001.

Heijmans, M.M.P.D., Berendse, F., Arp, W.J., Masselink, A.K., et al
Effects of elevated carbon dioxide and increased nitrogen deposition on bog vegetation in the Netherlands.
J. ECOLOGY 89(2):268-279. 2001.

Higgins, S.I., Richardson, D.M., Cowling, R.M.
Validation of a spatial simulation model of a spreading alien plant population.
J. APPL. ECOL. 38(3):571-584. 2001.

Hinojosa-Huerta, O., Destefano, S., Shaw, W.W.
Distribution and abundance of the Yuma clapper rail (*Rallus longirostris* Yumanensis) in the Colorado River delta.
J. ARID ENVIRON. 49(1):171-182. 2001.

Horinouchi, M., Sano, M.
Effects of changes in seagrass shoot density and leaf height on the abundance of juveniles of *Acentrogobius pflaumii* in a *Zostera marina* bed.
ICHTHYOL. RES. 48(2):179-185. 2001.

Ivey, C.T., Richards, J.H.
Genotypic diversity and clonal structure of Everglades sawgrass, *Cladium jamaicense* (Cyperaceae).
INT. J. PLANT SCI. 162(6):1327-1335. 2001.

Jacono, C.C., Davern, T.R., Center, T.D.
The adventive status of *Salvinia minima* and *S. molesta* in the southern United States and the related distribution of the weevil *Cyrtobagous salviniae*.
CASTANEA 66(3):214-226. 2001.

Jager-Zurn, I.
Developmental morphology of *Podostemum munnarense* (Podostemaceae - Podostemoideae) as compared to related taxa. Part IX of the series 'Morphology of Podostemaceae'.
BOT. JAHRB. SYST. 122(3):341-355. 2000.

James, W.F., Barko, J.W., Eakin, H.L.
Macrophyte management via mechanical shredding: effects on water quality in Lake Champlain (Vermont-New York).
AQUATIC PLANT CONTROL RES. PROG. (APCRP), TECH. NOTES COLL. (ERDC TN-APCRP-MI-05), US ARMY ENGIN. RES. AND DEVELOP. CTR., VICKSBURG, MS, 14 PP. 2000.

Jiang, M., Kadono, Y.
Seasonal growth and reproductive ecology of two threatened aquatic macrophytes, *Blyxa aubertii* and *B. echinosperma* (Hydrocharitaceae), in irrigation ponds of south-western Japan.
ECOL. RES. 16(2):249-256. 2001.

Kaufman, S.R., Smouse, P.E.
Comparing indigenous and introduced populations of *Melaleuca quinquenervia* (Cav.) Blake: response of seedlings to water and pH levels.
OECOLOGIA 127(4):487-494. 2001.

Kay, S.H., Hoyle, S.T.
Mail order, the Internet, and invasive aquatic weeds.
J. AQUATIC PLANT MANAGE. 39:88-91. 2001.

Koster, D., Hubener, T.
Application of diatom indices in a planted ditch constructed for tertiary sewage treatment in Schwaan, Germany.
INTERNAT. REV. HYDROBIOL. 86(2):241-252. 2001.

Kudoh, H., Whigham, D.F.
A genetic analysis of hydrologically dispersed seeds of *Hibiscus moscheutos* (Malvaceae).
AMER. J. BOT. 88(4):588-593. 2001.

Kuo, J., Shibuno, T., Kanamoto, Z., Noro, T.
Halophila ovalis (R. Br.) Hook. F. from a submarine hot spring in southern Japan.
AQUATIC BOT. 70(4):329-335. 2001.

Kuzmichev, A.I., Krasnova, A.N.
Diminutive grasses of sandbars; history of formation and structure of floristic complex of floodplain Nanoephemeretum.
BIOLOGY OF INLAND WATERS 2:22-25. 2001. (IN RUSSIAN; ENGLISH SUMMARY)

Laubhan, M.K., Gammonley, J.H.
Density and foraging habitat selection of waterbirds breeding in the San Luis Valley of Colorado.
J. WILDL. MANAGE. 64(3):808-819. 2000.

Li, W.
Utilization of aquatic macrophytes in grass carp farming in Chinese shallow lakes.
ECOL. ENGIN. 11(1-4):61-72. 1998.

Li, Y., Norland, M.
The role of soil fertility in invasion of Brazilian pepper (*Schinus terebinthifolius*) in Everglades National Park, Florida.
SOIL SCI. 166(6):400-405. 2001.

Lockwood, J.L., Simberloff, D., McKinney, M.L., Von Holle, B.
How many, and which, plants will invade natural areas?
BIOLOGICAL INVASIONS 3:1-8. 2001.

Ludsin, S.A., Wolfe, A.D.
Biological invasion theory: Darwin's contribution from *The Origin of Species*.
BIOSCIENCE 51(9):780-789. 2001.

Lukina, G.A., Papchenkov, V.G.
Seed germination ecology of flowering rush (*Butomus umbellatus* L.) and its influence on subsequent plant development.
RUSSIAN J. ECOL. 30(3):196-198. 1999.

Luz, C.F.P., Barth, O.M.
Palynomorphs as indicators of types of vegetation in holocenic sediments from the Lagoa de Cima, north of the state of Rio de Janeiro, Brazil - Dicotyledoneae.
LEANDRA 15:11-34. 2000. (IN PORTUGUESE; ENGLISH SUMMARY)

Macia, M.J.
Economic use of totorilla (*Juncus arcticus*, Juncaceae) in Ecuador.
ECON. BOT. 55(2):236-242. 2001.

Mann, H., Proctor, V.W., Taylor, A.S.
Towards a biogeography of North American charophytes.
AUST. J. BOT. 47(3):445-458. 1999.

Martins, A.T.
Efeitos do controle de plantas daninhas aquaticas com 2,4-D sobre alguns indicadores de qualidade da aqua de mesocosmos.
THESIS, UNIVERSIDADE ESTADUAL PAULISTA, CAMPUS DE JABOTICABAL - SP, BRAZIL, 64 PP. 2001.

Masifwa, W.F., Twongo, T., Denny, P.
The impact of water hyacinth, *Eichhornia crassipes* (Mart) Solms on the abundance and diversity of aquatic macroinvertebrates along the shores of northern Lake Victoria, Uganda.
HYDROBIOLOGIA 452(1-3):79-88. 2001.

Masuda, M., Maki, M., Yahara, T.
Effects of salinity and temperature on seed germination in a Japanese endangered halophyte *Triglochin maritimum* (Juncaginaceae).
J. PLANT RES. 112(1108):457-461. 1999.

Mathur, S.M., Singh, P.
Pressure-density relationships in compression of water hyacinth.
J. INST. ENGINEERS 81:49-51. 2000.

Mineeva, N.M., Ed.
Modern ecological situation in Rybinsk and Gorky Reservoirs: the state of biological communities and perspectives of fish reproduction.
RUSSIAN ACAD. SCI., I.D. PAPANIN INST. BIOLOGY INLAND WATERS, YAROSLAVL, 284 PP. 2000. (IN RUSSIAN; ENGLISH SUMMARY)

Moreau, J., ed.
Advances in the ecology of Lake Kariba.
UNIVERSITY OF ZIMBABWE PUBL., HARARE, 271 PP. 1997.

Nagid, E.J., Canfield, D.E., Hoyer, M.V.
Wind-induced increases in trophic state characteristics of a large (27 km^2), shallow (1.5 m mean depth) Florida lake.
HYDROBIOLOGIA 455:97-110. 2001.

Nakaoka, M., Aioi, K.
Growth of seagrass *Halophila ovalis* at dugong trails compared to existing within-patch variation in a Thailand intertidal flat.
MAR. ECOL. PROG. SER. 184:97-103. 1999.

Nurminen, L., Horppila, J., Tallberg, P.
Seasonal development of the Cladoceran assemblage in a turbid lake: the role of emergent macrophytes.
ARCH. HYDROBIOL. 151(1):127-140. 2001.

Okurut, T.O., Rijs, G.B.J., van Bruggen, J.J.A.
Design and performance of experimental constructed wetlands in Uganda, planted with *Cyperus papyrus* and *Phragmites mauritianus*.
WATER SCI. TECH. 40(3):265-271. 1999.

Olliff, T., Renkin, R., McClure, C., Miller, P., et al
Managing a complex exotic vegetation program in Yellowstone National Park.
WESTERN NORTH AMER. NATURALIST 61(3):347-358. 2001.

Olofsdotter, M.
Rice - a step toward use of allelopathy.
AGRON. J. 93(1):3-8. 2001.

Osborn, J.M., El-Ghazaly, G., Cooper, R.L.
Development of the exineless pollen wall in *Callitriche truncata* (Callitrichaceae) and the evolution of underwater pollination.
PLANT SYST. EVOL. 228:81-87. 2001.

Perry, L.G., Galatowich, S.M.
Lowering nitrogen availability may control reed canarygrass in restored prairie pothole wetlands (Minnesota).
ECOLOGICAL RESTORATION 20(1):60-61. 2002.

Peterson, B.J., Heck, K.L.
Positive interactions between suspension-feeding bivalves and seagrass - a facultative mutualism.
MAR. ECOL. PROG. SER. 213:143-155. 2001.

Petty, D.G., Skogerboe, J.G., Getsinger, K.D., Foster, D.R., et al
The aquatic fate of triclopyr in whole-pond treatments.
PEST MANAGEMENT SCI. 57:764-775. 2001.

Philip, L.J., Posluszny, U., Klironomos, J.N.
The influence of mycorrhizal colonization on the vegetative growth and sexual reproductive potential of *Lythrum salicaria* L.
CAN. J. BOT. 79(4):381-388. 2001.

Prieur-Richard, A.-H., Lavorel, S.
Invasions: the perspective of diverse plant communities.
AUSTRAL ECOL. 25:1-7. 2000.

Ray, A.M., Rebertus, A.J., Ray, H.L.
Macrophyte succession in Minnesota beaver ponds.
CAN. J. BOT. 79(4):487-499. 2001.

Reichard, S.H., White, P.
Horticulture as a pathway of invasive plant introductions in the United States.
BIOSCIENCE 51(2):103-113. 2001.

Renne, I.J., Spira, T.P., Bridges, W.C.
Effects of habitat, burial, age and passage through birds on germination and establishment of Chinese tallow tree in coastal South Carolina.
J. TORREY BOT. SOC. 128(2):109-119. 2001.

Reut, M.S., Fineran, B.A.
An evaluation of the taxonomy of *Utricularia dichotoma* Labill., *U. monanthos* Hook. F., and *U. novae-zelandiae* Hook. F. (Lentibulariaceae).
NEW ZEALAND J. BOT. 37(2):243-255. 1999.

Risvold, A.M., Fonda, R.W.
Community composition and floristic relationships in montane wetlands in the north Cascades, Washington.
NORTHWEST SCI. 75(2):157-167. 2001.

Rodgers, J.A., Smith, H.T., Thayer, D.D.
Integrating nonindigenous aquatic plant control with protection of snail kite nests in Florida.
ENVIRON. MANAGE. 28(1):31-37. 2001.

Rogers, S.M.D., Beech, J., Sarma, K.S.
Tissue culture and transient gene expression studies in freshwater wetland monocots.
IN: BIOTECHNOLOGY IN AGRICULTURE AND FORESTRY 48: TRANSGENIC CROPS III, ED. Y.P.S. BAJAJ, SPRINGER-VERLAG, BERLIN, PP. 337.351. 2001.

Ross, M.S., Meeder, J.F., Sah, J.P., Ruiz, P.L., et al
The southeast saline Everglades revisited: 50 years of coastal vegetation change.
J. VEG. SCI. 11:101-112. 2000.

Rozas, L.P., Minello, T.J.
Marsh terracing as a wetland restoration tool for creating fishery habitat.
WETLANDS 21(3):327-341. 2001.

Rybicki, N.B.
Relationships between environmental variables and submersed aquatic vegetation in the Potomac River, 1985-1997.
PH. D. DISSERTATION, GEORGE MASON UNIVERSITY, FAIRFAX, VA. 2000.

Sabol, B.M., Melton, R.E., Chamberlain, R., Doering, P., Haunert, K.
Evaluation of a digital echo sounder system for detection of submersed aquatic vegetation.
ESTUARIES 25(1):133-141. 2002.

Salinas, M.J., Blanca, G., Romero, A.T.
Riparian vegetation and water chemistry in a basin under semiarid Mediterranean climate, Andarax River, Spain.
ENVIRON. MANAGE. 26(5):539-552. 2000.

Sanchez-Carrillo, S., Alvarez-Cobelas, M., Cirujano, S., Riolobos, P., et al
Rainfall-driven changes in the biomass of a semi-arid wetland.
VERH. INTERNAT. VEREIN. LIMNOL. 27:1690-1694. 2000.

Schmitz, D.C., Simberloff, D.
Needed: a national center for biological invasions.
ISSUES IN SCIENCE AND TECHNOLOGY 17(4):57-62. 2001.

Shrestha, P., Janauer, G.A.
Management of aquatic macrophyte resource: a case of Phewa Lake, Nepal.
IN: ENVIRONMENT AND AGRICULTURE: BIODIVERSITY, AGRICULTURE AND POLLUTION IN SOUTH ASIA, ED. P.K. JHA, S.B. KARMACHARYA, ET AL, ECOLOGICAL SOCIETY (ECOS), KATHMANDU, NEPAL, PP. 99-107. 2001.

Singh, A., Sharma, O.P., Bhat, T.K., Vats, S.K., et al
Fungal degradation of lantadene A, the pentacyclic triterpenoid hepatotoxin on lantana plant.
INTERNAT'L. BIODETERIORATION & BIODEGRADATION 47:239-242. 2001.

Small, J.K.
Botanical exploration in Florida in 1917.
J. NEW YORK BOTANICAL GARDEN 19(227):279-290. 1918.

Smith, R.D., Wakeley, J.S.
Hydrogeomorphic approach to assessing wetland functions: guidelines for developing regional guidebooks. Chapter 4: Developing assessment models.
US ARMY CORPS OF ENGINEERS, WETLANDS RESEARCH PROG. VICKSBURG, MS, ERDC/EL TR-01-30, 24 PP. 2001.

Steinbauer, M.J., Wanjura, W.J.
Christmas beetles (*Anoplognathus* spp., Coleoptera: Scarabaeidae) mistake peppercorn trees for eucalypts.
J. NATURAL HISTORY 36:119-125. 2002.

Stott, R., Jenkins, T., Bahgat, M., Shalaby, I.
Capacity of constructed wetlands to remove parasite eggs from wastewater in Egypt.
WATER SCI. TECH. 40(3):117-123. 1999.

Talley, T.S., Levin, L.A.
Modification of sediments and macrofauna by an invasive marsh plant.
BIOLOGICAL INVASIONS 3:51-68. 2001.

Tamura, S., Kuramochi, H., Ishizawa, K.
Involvement of calcium ion in the stimulated shoot elongation of arrowhead tubers under anaerobic conditions.
PLANT CELL PHYSIOL. 42(7):717-722. 2001.

Taylor, K., Rowland, A.P., Jones, H.E.
Molinia caerulea (L.) Moench.
J. ECOL. 89(1):126-144. 2001.

Teeter, A.M., Johnson, B.H., Berger, C., Stelling, G., et al
Hydrodynamic and sediment transport modeling with emphasis on shallow-water, vegetated areas (lakes, reservoirs, estuaries and lagoons).
HYDROBIOLOGIA 444(1-3):1-23. 2001.

Tewksbury, L., Casagrande, R., Blossey, B., Hafliger, P.
Potential for biological control of *Phragmites australis* in North America.
BIOLOGICAL CONTROL 23:191-212. 2002.

Ueno, S., Kadono, Y.
Monoecious plants of *Myriophyllum ussuriense* (Regel) Maxim. in Japan.
J. PLANT RES. 114:375-376. 2001.

Vanderpoorten, A., Lambinon, J., Tignon, M.
Morphological and molecular evidence of the confusion between *Elodea callitrichoides* and *E. nuttallii* in Belgium and northern France.
BELG. J. BOT. 133(1-2):41-52. 2000.

Van Ginkel, L.C., Bowes, G., Reiskind, J.B., Prins, H.B.A.
A CO^2-flux mechanism operating via pH-polarity in *Hydrilla verticillata* leaves with C3 and C4 photosynthesis.
PHOTOSYNTHESIS RES. 68(1):81-88. 2001.

Warren, R.S., Fell, P.E., Grimsby, J.L., Buck, E.L., et al
Rates, patterns, and impacts of *Phragmites australis* expansion and effects of experimental *Phragmites* control on vegetation, macroinvertebrates, and fish within tidelands of the lower Connecticut River.
ESTUARIES 24(1):90-107. 2001.

Watts, B.D.
The impact of highway median plantings on bird mortality.
SOUTHEAST EXOTIC PEST PLANT COUNCIL (EPPC) NEWS 7(5):11. 2001.

Weber, E.F.
The alien flora of Europe: a taxonomic and biogeographic review.
J. VEG. SCI. 8:565-572. 1997.

Wheeler, G.S., Center, T.D.
Impact of the biological control agent *Hydrellia pakistanae* (Diptera: Ephydridae) on the submersed aquatic weed *Hydrilla verticillata* (Hydrocharitaceae).
BIOLOGICAL CONTROL 21:168-181. 2001.

Worley, A.C., Barrett, S.C.H.
Evolution of floral display in *Eichhornia paniculata* (Pontederiacea): genetic correlations between flower size and number.
J. EVOL. BIOL. 14(3):469-481. 2001.

Xu, J., Yang, Y., Pu, Y., Ayad, W.G., et al
Genetic diversity in taro *(Colocasia esculenta* Schott, Araceae) in China: an ethnobotanical and genetic approach.
ECON. BOT. 55(1):14-31. 2001.

Yamada, T., Imaichi, R., Kato, M.
Developmental morphology of ovules and seeds of Nymphaeales.
AMER. J. BOT. 88(6):963-974. 2001.

Zhang, J.-X.
Feeding ecology of two wintering geese species at Poyang Lake, China.
J. FRESHWATER ECOL. 14(4):439-445. 1999.

Zulijevic, A., Thibaut, T., Elloukal, H., Meinesz, A.
Sea slug disperses the invasive *Caulerpa taxifolia.*
J. MAR. BIOL. ASSOC. U.K. 81(2):343-344. 2001.

The Collection of Aquatic and Wetland Plants of the Czech Republic

by **Lubomír Adamec** and **Stepán Husák**, Institute of Botany of the Academy of Sciences of the Czech Republic, Section of Plant Ecology, Dukelská 135, CZ-37982 Trebon, Czech Republic, adamec@butbn.cas.cz, husak@butbn.cas.cz

The Collection of Aquatic and Wetland Plants (CAWP) was started in 1976 as a living collection of Czechoslovak aquatic higher plant species as part of the Section of Plant Ecology of the Institute of Botany at the Academy of Sciences of the Czech Republic (known as the Department of Hydrobotany before 1987). Research has been conducted continuously at the Institute in the fields of ecophysiology, production ecology, geobotany, phytosociology, and taxonomy of higher aquatic and wetland plants (and also algae). It became necessary to establish a limited plant collection to aid in this research.

The range of species in the Collection has widened markedly since its establishment. In 2001, about 350 species, hybrids, or cultivars were kept in the CAWP. The dominant majority of these species (>90 %) are indigenous in the Czech Republic; the others are mainly from Central Europe. Thus, the CAWP is focused on aquatic and wetland temperate plant species of Central Europe; the proportion of subtropical species or species from other continents is marginal. Taking into account the great number of items kept in the CAWP, it is evident that it is by far the greatest collection of native aquatic and wetland plants in Europe and one of the greatest in the world.

Many dozens of native aquatic and wetland plants can usually be found in several distinguished botanical gardens in Western Europe but the collection in such gardens is mainly focused on conspicuous ornamental species. The CAWP contains both higher plants and Charophytes (stoneworts). All ecological forms of aquatic and wetland plants are represented in the collection: rooted and rootless submersed, floating-leaved, free floating, and emergent plants, perennial species as well as annuals. The CAWP contains all Czech carnivorous plant species and many bog and fen plant species. Very common, as well as critically endangered, rare plant species are part of the Collection; some of the endangered plant species are almost extinct in the Czech flora. Importantly, the CAWP also contains species which were extinct in the Czech flora in the last decades (e.g., *Aldrovanda vesiculosa, Pilularia globulifera, Typha minima*). In spite of the continuous renewal of species in the CAWP, approximately 15-30 susceptible plant species may be lacking from the species list every year. The species most difficult to keep are aquatic annual species, lemnids, or those growing mostly in cold running waters (e.g., *Ranunculus* subgenus *Batrachium* spp.). A specific section of the CAWP is represented by ephemeral plants growing in wet denuded soils. These species (e.g., *Centunculus minimus, Illecebrum verticillatum, Coleanthus subtilis, Cyperus flavescens, Juncus capitatus, J. tenageia*) belong to the most endangered taxa not only in the Flora of the Czech Republic but also in Europe and to species most rapidly vanishing from natural sites. Some of them are grown and reproduced with difficulty.

Although for practical reasons the CAWP is not open to the general public as a botanical garden, our purpose has been to make the Collection accessible to as many specialists and students as possible. Every year, the staff guides dozens of school excursions through the CAWP, including primary school pupils, inland and foreign university students and staff, and participants of the UNESCO Training Course on Limnology. Moreover, the CAWP serves as a gene pool for rare and endangered species, provides plant material for experiments and studies, comparative material for determinations and botanical illustrations, and is used for the teaching of botany and plant ecology. Also, conservation-based (i.e., rescue) cultivations of ca. 30 endangered species originated with plant specimens from the CAWP. Plants of 17 species from these cultivations have been used for reintroductions mostly to the Trebonsko Biosphere Reserve in the last six years. In addition to the CAWP, a (sub)tropical carnivorous plant collection (ca. 55 species) is situated in a heated greenhouse.

The CAWP covers an area of ca. 0.04 ha. The temperate-zone plants are grown outdoors, while the several (sub)tropical species are in a heated greenhouse. Each plant species is usually grown in plastic pots, which are put in bigger containers. Robust helophyte species (e.g., reeds, cattails, sedges) grow individually in smaller plastic containers. All plastic containers are sunken and embedded in the ground to minimize thermal fluctuations, both in summer and winter. Smaller aquatic *Utricularia* species grow in 3-l miniaquaria floating in cooling water of a big container. Their winter buds (turions) overwinter in small flasks in a refrigerator. Rooted aquatic plants growing in deeper containers (65 cm) overwinter under water. During periods of frost, ice cover in these containers may be up to 40 cm thick but the dominant majority of aquatic plants survive these conditions without being damaged. Frost-sensitive (sub)Atlantic species (e.g., *Pilularia globulifera, Littorella uniflora, Luronium natans*) are overwintered for safety in a cool compartment of a greenhouse. During the summer, seasonal shading by wooden bands protects the plants from overheating and reduces the growth of filamentous algae. Nevertheless, the growth of filamentous algae (mainly of genera *Oedogonium, Cladophora, Spirogyra*) is a crucial problem for growing submersed species. The only effective control is to repeatedly remove the mats gently and with patience by hand. On summer days, pH values in some containers may exceed 10 due to algal photosynthesis. We sometimes add ethanol (ca. 10-20 µl.l-1) or starch (ca. 20 mg.l-1) to the containers to decrease high pH by enhanced respiration. Soft tap water is used for watering the plants. In helophytes, sandy substrates are renewed every 2-3 years. One technical assistant and two curators (authors of this paper) look after the CAWP.

Using the Collection

We welcome interested colleagues to the Section of Plant Ecology at Trebon and are glad to guide them through our Collection and conservation-based cultivations. Our plant material may be offered for exchange to other plant collections or sent to colleagues

MEETINGS

EUROPEAN WEED RESEARCH SOCIETY 11TH INTERNATIONAL SYMPOSIUM ON AQUATIC WEEDS. September 2-6, 2002. Moliets et Maâ (Landes), France.

Papers are invited for the following sessions: biology and ecology of aquatic plants; relations with other abiotic and biotic components of aquatic ecosystems; invasive aquatic plants; bio-indication methods involving aquatic vegetation; management and conservation of aquatic plants; integrated management; uses of water plants. Contributions on other aspects of the biology, ecology and management of aquatic plants will also be considered. English-French simultaneous translation will be made.

Contact: Cemagref, Unité de Recherche Qualité des Eaux, 50 Avenue de Verdun, 33612 CESTAS CEDEX, France. E-mail: ewrs.2002@bordeaux.cemagref.fr

22ND INTERNATIONAL SYMPOSIUM, NORTH AMERICAN LAKE MANAGEMENT SOCIETY (NALMS). October 30 - November 1, 2002. Anchorage Hilton and Westmark Hotel, Anchorage, Alaska.

The theme of the Alaska meeting is "Staking our claim in the comprehensive management of our lakes and reservoirs." Topics in fisheries, monitoring, landscaping, impacts, legislation, limnology, remote sensing, and economic values are suggested.

Contact: Pam Leasure, Program Chair, Telephone: 727/464-4425; E-mail: pleasure@co.pinellas.fl.us NALMS web site: http://www.nalms.org

26TH ANNUAL MEETING, FLORIDA AQUATIC PLANT MANAGEMENT SOCIETY. November 13-15, 2002. Adam's Mark Resort, Daytona Beach.

Primarily for field personnel, this meeting offers presentations on all methods of aquatic plant management, herbicide updates, equipment demonstrations, and more.

Contact: John Rodgers, Program Chair, Dept. Environmental Protection, 8302 Laurel Fair Circle, Suite 140, Tampa, FL 33610; 813/744-6163; E-mail: john.rodgers@dep.state.fl.us

8TH CONFERENCE OF THE CONTRACTING PARTIES TO THE RAMSAR CONVENTION. November 18-26, 2002. Valencia, Spain.

The theme: "Wetlands: water, life, and culture". Ramsar member countries meet once every three years to assess the progress of the Convention and wetland conservation, share knowledge and experience, and plan their work of the next three years. The meeting will be held in the world-famous Science Museum Principe Felipe (designed by Santiago Calatrava). The technical sessions are: 1: Wetlands - major challenges and emerging opportunities in the new century; 2: Wetland inventory and assessment; 3: Practical steps for applying the vision for the Ramsar list of Wetlands of International Importance; 4: Managing wetlands for sustainable use: lessons learned and new perspectives; and 5: Cultural aspects of wetlands as a tool for their conservation and sustainable use.

Contact: Ramsar Convention Bureau, Rue Mauverney 28, CH-1196 Gland, Switzerland; Telephone: +41 22 999 0170; FAX: +41 22 999 0169; E-mail: ramsar@ramsar.org WWW: http://www.ramsar.org/index_cop8.htm

DETECTING & ASSESSING INVASIVE EXOTIC PLANTS: APPROACHES FOR THE FLORIDA LANDSCAPE. February 12-14, 2003. Florida International University, Koven's Conference Center, Miami.

A conference and workshop. "This workshop will bring together experts working in the field of vegetation detection, assessment and analysis to present their work, technology and methods to a blue-ribbon panel of experts in the fields of GIS, remote sensing, species detection and identification, landscape ecology and spatial analysis." Sponsored by the Noxious Exotic Weed Task Team (NEWTT), Florida International University, the South Florida Water Management District, and the US Army Corps of Engineers.

Contact: Rafaela Monchek, E-mail: rmonchek@sfrestore.org WWW: http://www.sfrestore.org/issueteams/exotic/iepda/IEPDAindex.htm

3RD IOBC GLOBAL WORKING GROUP MEETING ON BIOLOGICAL AND INTEGRATED CONTROL OF WATER HYACINTH. August 2003. Uganda.

Presented by the Working Group on Water Hyacinth of the International Organisation for Biological Control of Noxious Animals and Plants (IOBC).

Contact: Dr. James Ogwang, PO Box 7084, Kampala, Uganda; E-mail: jamesogwang@hotmail.com or Dr. Martin Hill, University of Rhodes, Zoology/Entomology, PO Box 94, Grahamstown 6140, South Africa; E-mail: m.p.hill@ru.ac.za

---

abroad for study purposes. The complete species list of the CAWP is available on request by e-mail to the curators, or online at the CAWP web site at www.butbn.cas.cz Please send us your species list.

In our species list, all species are classed within three groups. A) species bearing seeds or spores more or less regularly; it is possible to mail them in the form of seeds or spores; B) species which may be mailed in vegetative form (turions, rhizomes, tubers, bulbs, parts of clones, shoots); C) problematic species which are difficult to grow and, thus, are not always at our disposal; they may be represented e.g. by annual terophytes, which do not set seeds in the CAWP, lemnids, and some other susceptible species.

Since 1998/1999, the seeds of CAWP (ca. 120-200 items) have been listed in the *Index Seminum* which is regularly issued by the Institute of Botany at Pruhonice (see www.ibot.cas.cz).

We would prefer your visit and personal selection and transport of the plants to their mailing by post. Simply, we look forward to communication and cooperation with you!

University of Florida
Institute of Food and Agricultural Sciences
AQUATIC, WETLAND AND INVASIVE PLANT INFORMATION RETRIEVAL SYSTEM (APIRS)
Center for Aquatic and Invasive Plants
7922 N.W. 71st Street
Gainesville, Florida 32653-3071 USA
(352) 392-1799 FAX: (352) 392-3462
varamey@nersp.nerdc.ufl.edu
kpb@mail.ifas.ufl.edu
http://plants.ifas.ufl.edu

ADDRESS SERVICE REQUESTED

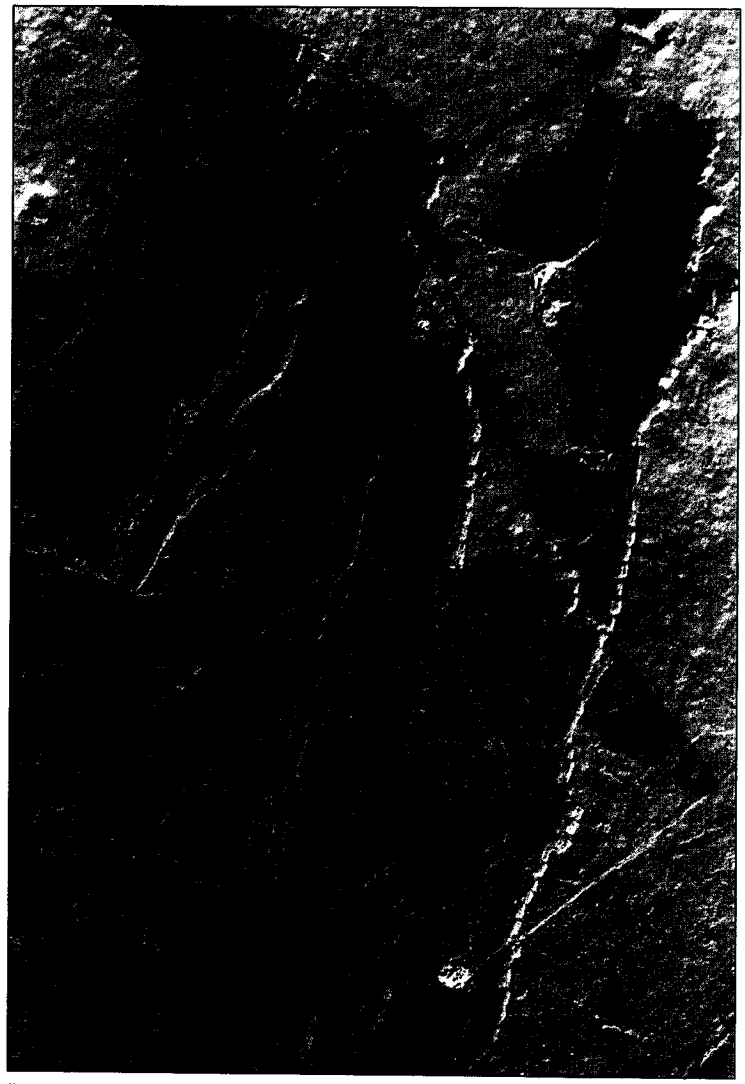
AQUAPHYTE

This is the newsletter of the Center for Aquatic and Invasive Plants and the Aquatic, Wetland and Invasive Plant Information Retrieval System (**APIRS**) of the University of Florida Institute of Food and Agricultural Sciences (IFAS). Support for the information system is provided by the Florida Department of Environmental Protection, the U.S. Army Corps of Engineers Waterways Experiment Station Aquatic Plant Control Research Program (APCRP), the St. Johns River Water Management District and UF/IFAS.

EDITORS: Victor Ramey
Karen Brown

AQUAPHYTE is sent to managers, researchers and agencies in 71 countries around the world. Comments, announcements, news items and other information relevant to aquatic and invasive plant research are solicited.

Inclusion in *AQUAPHYTE* does not constitute endorsement, nor does exclusion represent criticism, of any item, organization, individual, or institution by the University of Florida.



Photograph of the oldest, most complete fossil angiosperm on record, *Archaefructus sinensis* sp. nov., from northeastern China.

See page 1