TO CONSERVE TO EDUCATE

NATIVE PLANT SOCIETY OF NORTHEASTERN OHIO

Founding Chapter Of

THE OHIO NATIVE PLANT SOCIETY

6 Louise Drive
Chagrin Falls, Ohio 44022
(216) 338-6622

On the Fringe

THE JOURNAL OF THE OHIO NATIVE PLANT SOCIETY

Volume No. 5 | **May/June 1987** | **Number 3**

***** ANNUAL DINNER — NOVEMBER 13, 1987 *****

PROGRAMS AND EVENTS:

May 2 (Saturday) - **10:00 a.m.** - Conkle's Hollow State Nature Preserve. Two hour hike for Wildflowers of the Hollow.

May 3 (Sunday) - **2:00 p.m.** - Conkle's Hollow State Nature Preserve. Program on plants as "Medicinals, Remedies, Legends."

May 3 (Sunday) - **1:30 p.m.** - Eagle Creek State Nature Preserve. Spring Wildflower hike.

May 3 (Sunday) - **2:00 p.m.** - Fowler's Woods State Nature Preserve. Wildflower Walk, a rich woodland.

May 3 (Sunday) - **Dayton Chapter** - **1:30 p.m.** - Wildflower walk at Gabry's Woods in Miami County with Scott Huston, Director of PIC Dist. Meet at preserve parking lot.

May 5 (Saturday) - **Wilderness Center** - **1:30 p.m.** Trip to Salt Fork State Park. Meet at Wilderness Center.

✓**May 9** (Saturday) - **Cleveland Chapter** - **10:00 a.m.** - Trip to Enlow Creek Preserve, Pennsylvania. **Call 338-6622 by May 5th if interested.**

May 9 (Saturday) - **Columbus Chapter** - **9:00 a.m.** Field trip to Fowler's Woods State Nature Preserve. Meet at Otterbein College.

May 9 & 10 (Saturday & Sunday) - **Cincinnati Chapter** - Weekend at Lake Catherine State Nature Preserve, Jackson. Call for details if interested.

May 9 (Saturday) - **2:00 p.m.** - Fowler's Woods State Nature Preserve. Wildflower Walk. **See Columbus Chapter May 9.**

May 9 (Saturday) - **2:00 p.m.** - Kyle Woods State Nature Preserve Wildflower Walk.

May 9 (Saturday) - **1:30 p.m.** - Adams Lake Prairie State Nature Preserve Wildflower Walk: shooting stars, hoary, puccoon, etc.

May 16 (Saturday) - **Cleveland Chapter** - **12:00 p.m.** - Field identification course at Happy Days Visitor Center, Cuyahoga Nature Park. Dr. Gail Corbett will instruct in the techniques of identifying plants in the field with the use of various books. Walk follows.

May 16 (Saturday) - **10:30 a.m.** - Eagle Creek State Nature Preserve. Trees of Eagle Creek, identify and lore.

May 15, 16, 17 (Friday, Saturday, Sunday) - Toledo Metroparks. Series of walks and lectures on wildflowers of area, including Oak Openings. This weekend is geared to getting people interested in the Toledo Chapter and will be a highly informative time.

May 16 (Saturday) - **Wilderness Center Chapter.** - **2:00 p.m.** - Field trip to Wilderness Center Zoar property.

May 16 (Saturday) - **Athens Chapter** - **11:30 a.m.** - Field trip to Wahkeena Nature Preserve, 8 species of orchids, 26 species of ferns, 69 species of birds.

May 17 (Sunday) - **Columbus Chapter** - **9:00 a.m.** - Field trip to Shawnee State Forest, "little Smokies of Ohio."

May 18 (Monday) - **Columbus Chapter** - **7:30 p.m.** - Slides of "Wildflowers of Ohio," with discussions of photographic techniques. Sharon Woods Metro Park.

May 18 (Monday) - **Dayton Chapter** - **7:30 p.m.** - Lecture on geological settings for Ohio plants by Dr. Jane Forsythe of Bowling Green State Univ. Cox Arboretum.

May 24 (Sunday) - **2:00 p.m.** - Jackson Bog State Nature Preserve. Spring Bog Walk, an unusual fen.

May 30 (Saturday) - **Cincinnati Chapter** - Trip to Adams County with Bill Culbertson. A rare dry prairie area harboring many rare and unusual plants. A trip not to be missed.

May 30-31 (Saturday & Sunday) - **Wilderness Center Chapter** - Weekend field trip to Sandusky Bay Area to visit Erie Sand Barrens, Sheldon Marsh, Old Woman Creek, and Resthaven Wildlife Area. Contact Bobbie Lucas 645-0302.

June 4 (Thursday) - **Cleveland Chapter** - **7:30 p.m.** - Dr. Jeanne Willis of Otterbein College will lecture on the Black Hand Gorge of Ohio, it's plants, geology, and fauna. Holden Arboretum.

June 6 (Saturday) - **10:30 a.m.** - Eagle Creek State Nature Preserve. Horsetails, ferns and clubmosses, a hike focusing on identification.

June 7 (Sunday) - **Dayton Chapter** - **8:00 a.m.** - Field trip to Lake Katherine to explore ferns and mosses. For more info call 614/286-2487.

June 7 (Sunday) - **1:30 p.m.** - Kyle Woods State Nature Preserve. Hike to view the giant trees of the preserve.

June 13 (Saturday) - **Cincinnati Chapter** - Field trip to Rock Bridge, Wolfe County, Kentucky.

June 13 (Saturday) - **Wilderness Center Chapter** - **1:30 p.m.** - Field trip to Hemlock Hollow. Meet at Wilderness Center.

June 15 (Monday) - **Dayton Chapter** - **7:30 p.m.** - Program on Land Stewardship, Managing Nature Preserves for All Living Things. Cox Arboretum.

June 20 (Saturday) - **Cleveland Chapter** - **9:30 a.m.** - Field trip to Columbiana County to see the unusual plants of this area. Call 338-6622 for directions.

June 27 (Saturday) - **Wilderness Center Chapter** - **1:30 p.m.** - Trip to Doughty Gorge. Meet at Wilderness Center.

Athens, Columbus and Toledo did not have a summer schedule at press time. If you are in the area and interested call appropriate person listed below.

Athens	-	Ingrid Chorba	-	614/592-2543	Eve.
Cleveland	-	Tom Sampliner	-	216/932-3720	Eve.
Cincinnati	-	Jim Innis	-	513/385-0670	Eve.
Columbus	-	Jim Stahl	-	614/882-5084	Eve.
Dayton	-	Ellen Fox	-	513/897-8139	Eve.
Toledo Organizer	-	Denise Gehring	-	419/535-3058	Work
Wilderness Center	-	Glenna Sheaffer	-	419/289-6137	Eve.

* * * * *

An exciting trip is being offered this summer to study the natural history (plants included) of the Denali Parks of Alaska. Travel is by train and river rafts on this 12 day expedition. College credit available. $450 total cost. For detailed information, write instructor, John Wenger, P.O. Box 240171, Anchorage, AK 99524-0171 (phone) 907/562-5723.

* * * * *

EDITOR'S COMMENT:

Note the change in our Masthead! The bottom line states that this is no longer a newsletter, but "The Journal of the Ohio Native Plant Society." Dr. Melampy's article is the first publication of some of his research, and Dr. Willis' article on Black Hand Gorge is a fairly complete flora of that area. We have plants to continue publication of University authors from various areas of the state and hope that you will benefit from the information we publish. Read the bluebell article while in London last summer and thought the readers might want to know how an Englishman feels about spring in England. Have a good summer and enjoy "Ohio - The Heart of It All."

ON THE EDGE OF HILL COUNTRY
by Dr. Jeanne Willis

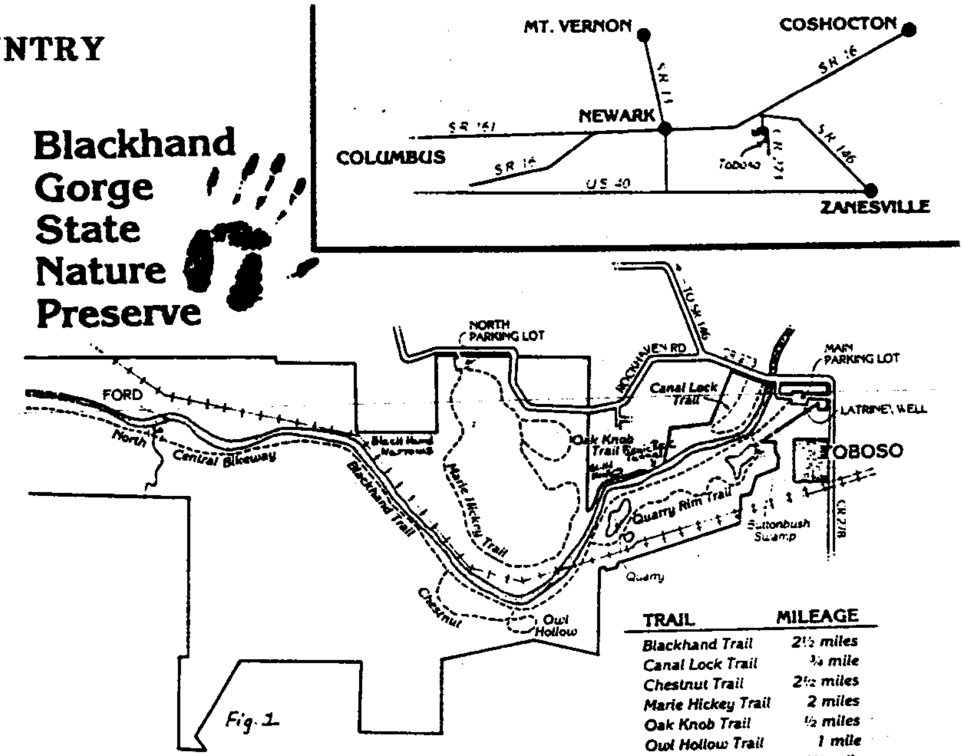

Fig. 1

Blackhand Gorge State Nature Preserve[1] in Licking County, approximately fifteen miles east of Newark, (Fig. 1) is a diverse and interesting area situated very near the boundary between the glaciated and unglaciated Appalachian plateau. The vegetation has representative species which are from farther east in The Appalachians; west in prairie land; from the north; and less well represented is the south.

While the soils which are derived from the bedrock of the area (Blackhand Conglomeritic Sandstone) are generally acid, there is some alkalinity in the area in outwash materials from glaciation.

The Licking River, which flows in an easternly direction through the area, is one of several streams in Ohio which flows out of plains areas into hill country, a consequence of glacial reversal of such streams. There is no "fall line" because water does not fall over resistant strata of rocks as it does, for example, leaving the piedmont to go down on The Atlantic coastal plain east of The Appalachians.

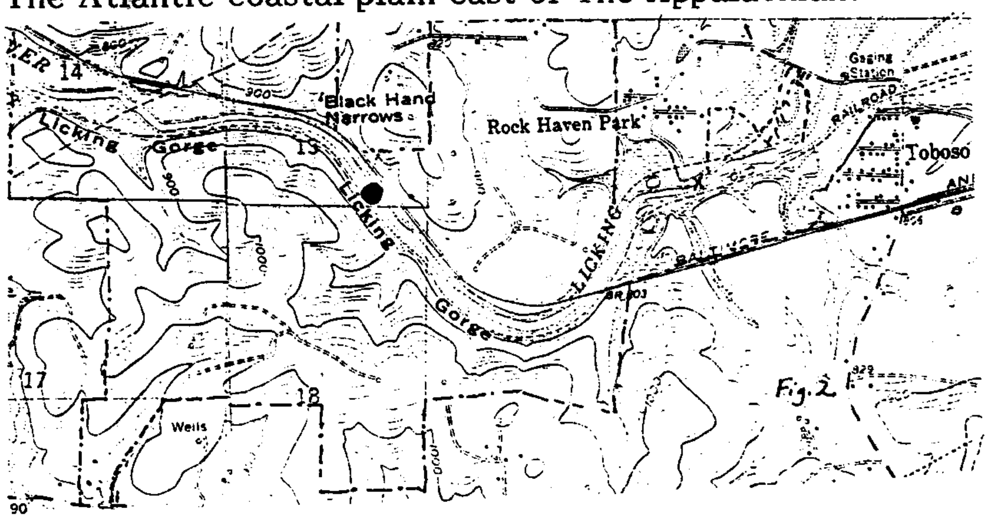

Fig. 2

Areas open to the public encompass just under one thousand acres and are important for their educational value in geological, botanical and ornithological studies as well as for their esthetic value. Since Wisconsin glacial time the Licking (called the Pataskala River by the Indians) has cut a winding course (Fig. 2)

1 Blackhand is spelled as one word when referring to the nature preserve; otherwise, it retains the two words with geologic formations, etc.

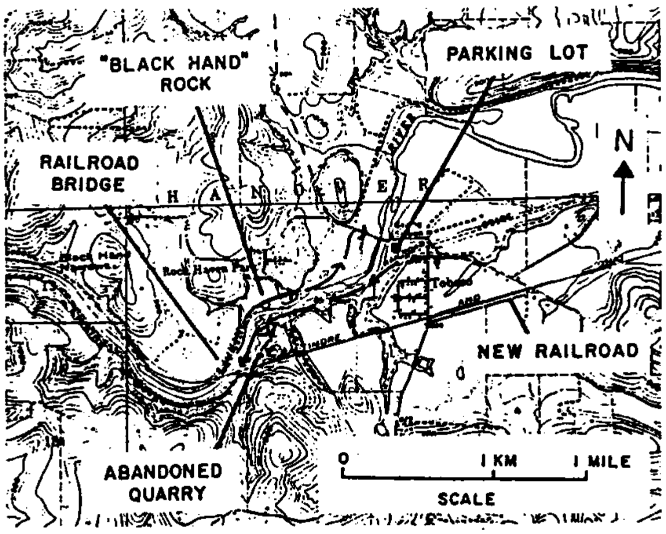

Fig.3

Sketch map of eastern part of Black Hand Gorge showing traverse route as well as some natural and cultural features of the area.

through the preserve for about two miles forming a narrow, picturesque gorge in the Black Hand sandstone. The sedimentary rock is so named because of a twice life-size, hand-shaped petroglyph found by the earliest settlers. It was supposedly chiseled by the prehistoric Hopewell Indians into the cliff-face of Blackhand Rock (Fig. 3). Eventually a dark-colored lichen filled in the hand and the eastwardly pointing fingers. Several folk stories are to be found in the literature as to the meaning of the symbol. A prominent one is that it was sacred, marking the boundary of a territory where no man was to raise his hand against another.

Around 1828 when the Ohio Canal was begun, The Licking River, through the "narrows" in Blackhand Gorge, was converted to slack-water and made a part of the canal by constructing a dam several hundred yards to the east. It was necessary to blast away sandstone from the cliff-face of Blackhand rock in order to make a tow-path for mules powering the canal boats. In doing so this historic petroglyph was removed.

Black Hand Sandstone is of Lower Mississippian age. According to Bork and Malcuit (1979), deltaic lobes prograded northwestward from river channels, carrying coarse clastic sediments from the Pocono alluvial plain of western Pennsylvania. Strong, longshore currents continuously reworked the sediments at the mouth of the channel into a bar deposit, as evidenced by the nature of the crossbedding found in this conglomeritic sandstone. The total thickness of exposed sandstone is about seventy feet (twenty meters) but wells drilled in the area descend through five times that amount before reaching the underlying shale (Fig. 4).

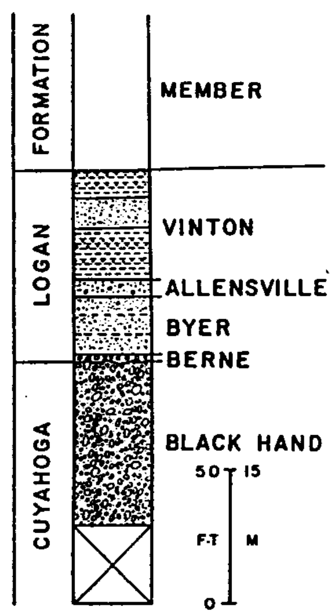

Fig.4

Stratigraphic column for Black Hand Gorge area

A pre-glacial river known as the Cambridge flowed westward to drain the area (Fig. 5). During Wisconsin glaciation the leading edge of the glacier advanced just to the west of the bedrock hills of the preserve. Glacial meltwater and river water accumulated, forming Lake Brushy Fork. Ultimately water spilled over a low divide and carved a new course to the east, thus reversing the direction of the stream and causing it to flow through Blackhand Gorge. The Licking River then became a tributary to the Muskingham which ultimately joined the Ohio River at Marietta.

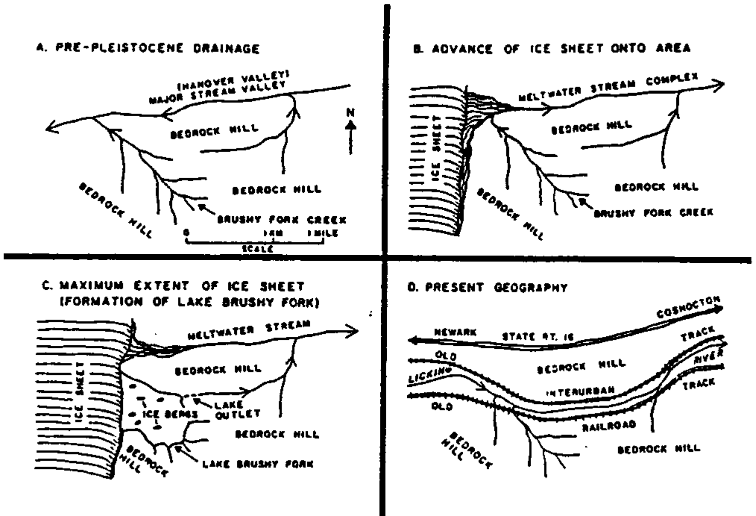

Fig. 5

Diagrammatic sketches showing three stages in a model for the evolution of Black Hand Gorge, as well as a sketch of the present geography of the gorge area.

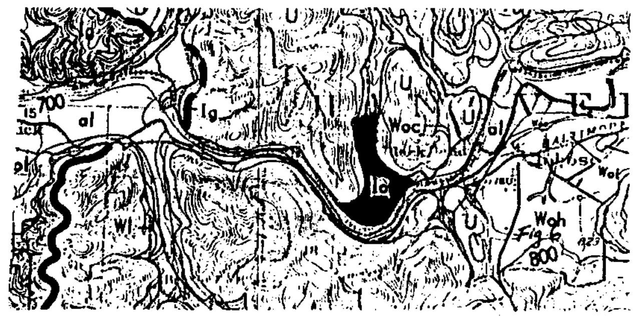

Fig. 6

Some soil of the preserve was influenced by Pleistocene glaciation. That of the general area of the Marie Hickey Trail (Fig. 1) is actually a tongue of outwash terrace of Illinoian Age (Fig. 6). It is presently designated as the Alford silt loam. An area south of the river at the main entrance to the preserve is an outwash terrace, specifically the Vanatta (high terrace) of Wisconsin Age. Today it is occupied primarily by the Stonelick loam (occasionally flooded). Unglaciated hills and their small valley dissections mostly have soils such as subdivisions of the Brownsville channery silt loam, Coshocton silt loam and Chili loam. Slopes of 25-70% show a Hazelton-Rock outcrop complex and along the Licking River is a band of recent stream alluvium.

There have been, and still are a number of intrusions into the preserve. On the south side are the quarries of a former glass company. The Baltimore and Ohio Railroad has a track which cuts through the preserve crossing a trestle (Fig. 3) just east of the "narrows." It is rumored that this line is soon to be abandoned. At the main entrance to the preserve on county road 273 begins a section of the North Central Bike Path which is blacktopped. It extends for four and one-half miles through the picturesque sandstone gorge partly along Blackhand Trail (Fig. 1) and partly along the old Central Ohio Railroad grade (Fig. 2) to the vicinity of Claylick to the west.

The Licking River and nearby surrounding areas were, as previously reported, intruded in the early nineteenth century by the building of the Ohio Canal. An old towpath with its giant building stones and strap iron ties can be viewed at the base of Black Hand Rock (Fig. 3) from either side of the river. Remnants of an old canal lock and river dam are to be found in the vicinity of Canal Lock Trail (Fig. 1). The north side of the preserve was also intruded by the Columbus and Zanesville Electric Railroad (Interurban) which stopped at stone steps in a cliff-face to transport local people, and at Picnic Rock so that visitors on a holiday could disembark. Although the tracks are gone a tunnel (Fig. 1) under Picnic Rock remains.[2] It is deliciously cool in the tunnel on the warmest summer days. At the west end of the tunnel Dr. Robert Malcuit and I discovered one of the few traces of animal fossils in the sandstones of the gorge (Trilobite tracks - Cruziana sp).

Present day intrusions to the river include canoeing from commercial liveries to the west.

Finally there are areas throughout penetrated by dirt roads leading to oil wells and storage tanks. One of these was the site of a "spill" in March of 1987. A pipeline and visitor trails are also present.

The diverse vegetation of the preserve is due in part to its location on a glacial boundary. Besides having a mixture of plants representative of the oak-hickory and mixed mesophytic forest (Gordon, 1969), the flood plain of the Licking River develops some aspects of an elm-ash swamp forest toward the eastern end and farther on out of the preserve. Additionally there are isolates such as hemlock communities from the north or Appalachian areas. In these areas and along the dry south facing cliff tops there are many similarities with outcrops of the Black Hand Sandstone in the Hocking hills. The terrain is not so rugged here but has a low pH, extremes of sun and wind and often erophytic or oxophytic conditions. Lichens, mosses, bluets, and several sedges and grasses are found nearest the edge. Farther back, low blueberry, huckleberry, trailing arbutus, partridge berry, wintergreen, and mountain laurel grow under oaks and Virginia pines. Sometimes moss-pink accompanies the preceding species.

This is the edge of hill country, Ohio's oldest topography. It has acid sandstone bedrock. Still we see that glacial outwash and stream sediments may add some alkalinity in places. Bedrock hilltop reach the 1060' contour line. The oak-hickory communities have a loose, open canopy allowing moderate amounts of sunlight to reach the forest floor. They have good drainage, acidic soil and a lot of leaf cover since organic matter decomposes slowly here. Some of the herbaceous understory species found in this fairly severe habitat are dogwood, sassafras, some serviceberry, bluets, firepink, pussy toes, beggar ticks, greenbrier, rattlesnake-plantain, and wood rush.

In moist areas on the south side of the river we find, for example, in the woods just west of the quarries, oaks (black, white and red), basswood, redbud, prickly ash, dogwood, slippery elm, black cherry, maples (sugar and red), buckeye, hornbean, pignut, shagbark and bittersweet hickory, white and green ash, beech, and tulip tree. In the hills farther to the west are black walnut, cucumber tree, chestnut (small) with hemlocks on the cliff-faces and in ravines. Along Blackhand Trail and the river yellow birch is common as are ninebark, redbud, viburnum, witch-hazel, sumac, honeysuckle, hydrangea, sycamore, river birch, box elder, cottonwood and black willow. Higher on the wooded slopes spring flora includes hepaticas, spring beauty, bloodroot, squirrel corn, dutchman's breeches, violets, trilliums, jack-in-the-pulpit,

[2] Although Black Hand and Picnic Rock (with the tunnel and also called Council Rock by local people) are not technically within the confines of the preserve, visits are allowed by the owners. Care should be taken not to destroy their trust.

and anemonies. These are followed later in the season by wild ginger, showy orchids, wild blue phlox, moccasin flower, foam flower, Solomon's seal, geraniums, may apple and baneberry, to name a few which are typical of this type of community.

There are several special areas with indicative species: e.g., buttonbush swamp with bullhead lily, broadleaf arrowhead, dodder, swamp milkweed, jewelweed (both pale and spotted), cattails and buttonbush. The vegetation also changes considerably at the west end of Blackhand Trail where a bike path leads out onto the floodplain. Water plantain and Canada lily are to be found at the ford (Fig. 1). Water hemlock, pokeberry, parsnip (meadow and wild), milkweeds, ruellia, corn salad, Joe-Pye-weeds, composite, running strawberry, lions-foot and many other types are found in abundance at the western end of the trail.

Some evidence exists of microclimates when comparing cold shaded pockets with habitats on high ledges on south facing slopes. Much more work needs to be done in this area before anything very definitive could be stated.

Some of the species of perhaps some special interest are:

Orchids

1. Large Yellow Lady's-slipper
2. Pink Lady's-slipper
3. Showy Orchid
4. Whorled Pogonia
5. Slender Ladies'-tresses
6. Nodding Ladies'-tresses
7. Rattlesnake-plantain
8. Autumn Coral-root
9. Striped Coral-root
10. Adder's Mouth
11. Large-leaved Twayblad
12. Bog Twayblad
13. Pipsissewa

Other interesting species include:

1. Indian cucumber-root
2. Trailing arbutus
3. Round lobed hepatica
4. American chestnut
5. Ginseng
6. Yellow birch
7. Lycopodiums & selaginella
8. Gooseberries
9. Spotted wintergreen
10. Mountain Laurel
11. Partridge berry
12. Prairie coneflower

There are at least twenty-three species of ferns and fern allies including horsetail, scouring rush, shining club moss and two ground pines. Liverworts were once common on the old canal locks and are to be found around the waterfalls of intermittent streams. Fungi are seasonally present in good diversity and include representatives of many of the common forms.

It probably should be mentioned that there are five species of woodpeckers, four species of flycathers, a phoebe, one species of pewee, three species of hawks, as well as kildeer, doves, cuckoo, mallards, crows, jays, two species of wrens, catbirds, brown thrashers, robins, wood thrush, two species of swallows, tufted titmice, kingfishers, chimney swift and ruby throated humming birds that nest in the preserve.

A list of some of the wildflowers follows. This is by no means complete. Many have been deleted because they are too "weedy," common, or otherwise, uninteresting to the general public.

1. Bellwort
2. Large-flowered Bellwort
3. Ramp
4. White and Yellow Troutlily
5. Star-of-Bethlehem
6. False Solomon's Seal
7. Canada Mayflower
8. True Solomon's Seal
9. Giant Solomon's Seal
10. Cucumber Root
11. Toad Trillium
12. Drooping Trillium
13. Large-flowered Trillium
14. Blue-eyed Grass
15. Jack-in-the-Pulpit
16. Orchids (listed previously)
17. Bastard toadflax
18. Wild Ginger
19. Fire Pink
20. Bouncing-bet
21. Deptford Pink
22. Buttercups (swamp, tall, hooked)
23. Early Meadowrue
24. Rue Anemone
25. Hepatica (round & sharp-lobed)
26. Marsh marigold
27. May Apple
28. Blue Cohosh
29. Bloodroot
30. Celandine
31. Dutchman's Breeches
32. Squirrel Corn
33. Cut-leaved toothwort
34. Purple Bitter Cress
35. Spring Cress
36. Stonecrop
37. Early Saxifrage
38. Alumroot
39. Bishop's-cap
40. Wild Strawberry
41. Indian Strawberry
42. Common Cinquefoil
43. White Avens
44. Common Agrimony
45. Wild Rose
46. Wild Geranium
47. Cranesbill
48. Violets (Marsh Blue, Common Sweet White, Smooth Yellow, Canada, Creamy, Long-spurred)
49. Sweet Cicely
50. Harbinger-of-Spring
51. Golden Alexanders
52. Mountain Laurel
53. Trailing Arbutus
54. Huckleberry
55. Deerberry
56. Low Blueberry
57. Highbush Blueberry
58. Graveyard Myrtle
59. Venus'-looking-glass
60. Butter-and-eggs
61. Blue-eyed Mary
62. Figwort
63. Daisy Fleabane (Philadelphia)
64. Pussy Toes
65. Ox-eye Daisy
66. Colt's-foot
67. Golden Ragwort
68. Bluebells
69. Dogwood (flowering, silky & gray)

Later in the spring and through the summer the following forms appear:

1. Narrow Leaf Cat-tail
2. Water Plantain
3. Common Arrowhead
4. Asiatic Dayflower
5. Spiderwort
6. Canada Lily
7. Orchids (listed previously)
8. Pokeweed
9. Campion (White Bladder, Starry)
10. Corn Cockle
11. Spatterdock
12. Tall Meadow Rue
13. Thimble Flower
14. Virgin's Bower
15. Columbine
16. Sicklepod
17. Witch-hazel
18. Ninebark
19. Meadowsweet
20. Goat's Beard (white)
21. Bowman's Root
22. American Ipecac
23. Wild Senna
24. Many Bush & Hop Clovers, etc.
25. Milkwort
26. Running Strawberry Bush
27. Spotted Jewelweed
28. Touch-me-not
29. Virginia Creeper
30. Summer Grape
31. Cheeses
32. St. John's-wort (common & shrubby)
33. Common Evening Primrose
34. Enchanters Nightshade
35. Ginseng
36. Black Snakeroot
37. Water Hemlock
38. Honewort
39. Parsnip (meadow & wild)
40. Wild Carrot
41. Pipsissewa
42. Spotted Wintergreen
43. Indian Pipe
44. Pine Sap
45. Wintergreen
46. Loosestrife (whorled & fringed)
47. Moneywort
48. Rosepink
49. Spreading dogbane
50. Indian Hemp
51. Butterfly Weed
52. Milkweed (swamp, four-leaved, poke, and common
53. Common Morning Glory
54. Wild Potato Vine
55. Common Dodder
56. Jacob's-ladder
57. Moss Pink
58. Wild Blue Phlox
59. Appendaged Water-leaf
60. White Vervain
61. Blue Vervain
62. Skullcap (hairy & marsh)
63. Yellow Hyssop
64. Catnip
65. Ground Ivy
66. Self-heal
67. Motherwort
68. Henbit
69. Purple Henbit
70. Woundwort
71. Wild Bergamot
72. Downy Woodmint
73. Spearmint
74. Peppermint
75. Richweed
76. Mullein
77. Beardtongue (Foxglove & Hairy)
78. Monkey-flower (also winged)
79. Culver's Root
80. False-foxglove (smooth & downy)
81. Wood-betony
82. Beechdrops
83. Squawroot
84. Ruellia
85. Lopseed
86. Bedstraw (common & fragrant)
87. Wild Licorice
88. Partridge Berry
89. Buttonbush
90. Bluets
91. Summer Bluets
92. Honeysuckle
93. Maple-leaved Arrow-wood
94. Common Elderberry
95. Corn Salad
96. Teasel
97. Tall Bellflower
98. Great Blue Lobelia
99. Indian Tobacco
100. Tall Ironweed
101. Joe-Pye-Weed (spotted & hollow)
102. Upland Boneset
103. White Snakeroot
104. Wreath Golden Rod
105. Silver-rod
106. Goldenrod (Early, Flat-top, White Woodland
107. Asters (Large-leaved, Lowrie's, New England, Crooked-stem, Hairy White, Starved, White Top)
108. Cup-plant
109. Rosinweed
110. Tall Coneflower
111. Black-eyed Susan
112. Sunflower (Helianthus divaricatus and hirsutis)
113. Woodland Sunflower
114. Wing-stem
115. Tall Tickseed

116. Tickseed sunflower
117. Sneezeweed
118. Yarrow
119. Pale Indian-plantain
120. Burdock
121. Thistle (bull & pasture)
122. Chicory
123. Dwarf dandelion
124. Yellow Goat's-beard
125. Lion's-foot
126. Hawkweed
127. Rattlesnakeweed
128. Hairy Hawkweed

Shrubs and trees include:

1. Canada Yew
2. Hemlock
3. Scrub Pine
4. Pitch Pine
5. ~~Black Willow~~
6. Big-tooth Aspen
7. Cottonwood
8. Black Walnut
9. Hickory (Shagbark, Big Shellbark, Mockernut & Pignut)
10. Hop-hornbeam
11. Ironwood
12. Yellow Birch
13. River Birch
14. Common Alder
15. Beech
16. Chestnut (small)
17. Oak (white, black, chestnut, red & shingle)
18. Slippery Elm
19. Cucumber Tree
20. Tulip Tree
21. Sassafras
22. Spicebush
23. Witch-hazel
24. Sycamore
25. Ninebark
26. Serviceberry
27. Hawthorn
28. Wild Black Cherry
29. Honey-locust
30. Redbud
31. Black-locust
32. Prickly Ash
33. Hop-tree
34. Sumac (staghorn, smooth, dwarf)
35. Running Strawberry-bush
36. Bladdernut
37. Maple (sugar, red & silver)
38. Box Elder
39. Ohio Buckeye
40. New Jersey Tea
41. Summer Grape
42. Silver-leaf Grape
43. Basswood
44. Leatherwood
45. Devel's-walking-stick
46. Dogwood (flowering, rough-leaved & silky)
47. Mountain Laurel
48. Huckleberry
49. Deerberry
50. Low Blueberry
51. Highbush Blueberry
52. Ash (white & green)
53. Catalpa
54. Honeysuckle
55. Maple-leaved Arrow-wood
56. Common Elderberry

Dr. Jeanne Willis is Chairman of the Biology Department at Otterbein College in Westerville, and President of the Columbus Chapter of Ohio Native Plant Society. One of her major interests is the Black Hand Gorge, where she has conducted many years of study. Her PhD is in paleobotany and she is currently involved in research into the propagation of rare Madagascar plants.

* * * * *

BIBLIOGRAPHY

Beatley, J.C. 1959. The primeval forests of a periglacial area in The Allegheny Plateau ———. Ohio Biol. Surv. Bull. N.S. 1(1); 182 p.

Bork, Kennard B. and Robert Malcuit. 1985. Guidebook: Lower Carboniferous clastic sequence of central Ohio. Miscellaneous Pub. No. 227. Institute of Polar Studies. O.S.U.; 31 p.

Braun, E.L. 1950. Deciduous forests of eastern North America. The Blakiston Co., Phila. Pa.; 596 p.

Cranfill, Ray. 1980. Ferns and fern allies of Kentucky. Kentucky Nature Preserves Commission Sci. and Tech. Ser. No. 1; 284 p.

Cusick, Allison W. and Gene M. Silberhorn. 1977. The vascular plants of unglaciated Ohio. Ohio Biol. Surv. Bull. N.S. 5(4); 153 p.

Fernald, M.L. (Ed.) 1950. Gray's manual of botany. 8th Ed. American Book Co., N.Y.; 1 XIV + 1632 p.

Forsyth, Jane L. Glacial map of Licking County Rept. of Invest. No. 59. State of Ohio, Dept. of Nat. Resources, Div. of Geol.

Gordon, R.B. 1969. The natural vegetation of Ohio in pioneer days. Ohio Biol. Surv. Bull. N.S. 3(2); 113 p.

Griggs, R.F. 1914. A botanical survey of the Sugar Grove region. Ohio Biol. Surv. Bull. 3:248-340.

Lafferty, Michael B. (Ed.) 1979. Ohio's Natural Heritage. The Ohio Academy of Science. Cols. O.; 324 p.

U.S.D.A. Soil Maps. Licking County. Nos. 45, 1983 and 54, 1979.

Weishaupt, C.G. 1971. Vascular plants of Ohio. 3d Ed. Kendall/Hunt Pub. Co., Dubuque, Iowa; 292 p.

* * * * *

ALMOST ANOTHER BLUEBELL LINE by Miles Kington

Having helped make television programmes about railways, and being cursed with a penchant for trains and stations generally, I find myself accused from time to time of being a train buff, which is one of those deadly accusations like being called a jazz fan, or opera enthusiast, or sports follower, that anyone in their right mind should reject, even when true. And yet it is certainly true that I spent years of my youth beside a railway line in Wales, and who but a train buff in the making would do that?

I'll tell you who. A botanist. I realize now, looking back, that for 98% of that time there was never a train to be seen. The spitting of steam was a luxury; most of the time you wouldn't have the faintest idea you were anywhere near a railway line, because all you could hear was the singing of birds and the sighing of the wind in the trees. (It was a very pretty stretch of line, just where the Cheshire plains stop and the Welsh hills start.) So to stave off boredom I used to ramble up through the woods or down to the valley of the River Alyn, idly studying what lay beneath my feet and even, eventually, buying a flower guide to go along with the train-spotting manuals.

Yes, if it hadn't been for the Great Western Railway, I probably wouldn't have picked up a working knowledge of wild flowers. Up in the woods there were great acres of bluebells at the right time of year, and celandines, and wood anemones, and blackberries later on. Down in the wetter land by the river there were kingcups, which for a while I thought were buttercups that had done some weight-lifting; there were cowslips, there were primroses and, the ones I liked best, the pale lady's smock which I used to pick to take home to Mum, until I realized that nothing wilts as fast as a freshly picked lady's smock. Except a violet.

I'd forgotten about all this until a couple of months ago, when idle curiosity took me down to the latest InterCity railway station in London. At long last British Rail has just started making use of the line which goes right through London, north to

(Continued on Page 19)

MATE COMPATIBILITY AND MATE CHOICE IN PLANTS by Dr. Michael Melampy

Introduction

Living organisms display incredible variety in their modes of reproduction. We can divide these modes into two categories: asexual and sexual. Asexual reproduction results in new organisms that are genetically identical to the parent. Examples of asexual reproduction include binary fission of bacteria cells and the establishment of new strawberry plants via the production of runners. Sexual reproduction involves the union of genetic material from two different organisms to produce offspring that are genetically different from each other and their parents. The advantages and disadvantages of asexual and sexual modes of reproduction are subjects of much current research and debate (Maynard Smith 1978, Bell 1982). In this paper, I intend to focus on one small part of this debate, specifically the role that mate choice has in determining the success of sexual reproduction in higher plants.

My choice of topic may immediately bring to mind two questions: what does mate choice have to do with the success of sexual reproduction and how do plants choose their mates? The first question can be answered by considering the implications of that basic characteristic of sexual reproduction, the union of genetic material from two different organisms. The quality of offspring that result from this union should depend on the quality of the genetic material that each parent contributes. The experiences of plant and animal breeders certainly support this notion. Through careful selection of breeding stock, breeders can control the quality of domesticated organisms. Darwin (1859) recognized this and used his knowledge of the principles of breeding to construct his theory of natural selection. Studies of natural populations, particularly animal populations, indicate that mate selection under natural circumstances is important in determining offspring quality and reproductive success (Bateson 1983). However, because plants are usually sessile organisms with no obvious mechanisms for selecting mates, mate selection among sexual plants has traditionally received relatively little attention. Fortunately, this lack of attention is being rectified, and in the last few years major theoretical and empirical studies concerning plant mate choice have been published (e.g., Bertin 1982, Willson and Burley 1983). In what follows, I will provide an overview of some of these studies in an attempt to convince you that mate choice does occur among plants and that it is important for the reproductive success of many sexual plants. Most of the studies that I will cite are of angiosperms; however, the patterns revealed by these studies may apply to other plant groups.

Mating Compatibility

In angiosperms, the sperm and egg producing structures, sometimes referred to as male and female gametophytes, are often found together in the same flower. Such flowers are hermaphroditic, and it would seem that they should be capable of self-fertilization. Indeed, in some species, e.g., the common bean (*Phaseolus vulgaris*) or wild oats (*Avena fatua*), self-fertilization does occur (for other examples, see Frankel and Galun 1977). Such species are "self-compatible." In other species, e.g., dutchman's breeches (Dicentra cucullaria) (Schemske et al. 1978) or alfalfa (Medicago sativa) (Nettancourt 1977), self-fertilization does not occur; thus these species are "self-incompatible." Obviously it matters a great deal whether the pollen landing on the stigma of a self-incompatible plant was produced by that plant or another plant. If a stigma receives pollen from an anther in the same flower or from another flower on the same plant, no fertilization will occur and no seeds will be produced. The pollen must come from another plant if fertilization and seed production are to occur in a self-incompatible plant.

The existence of both self-compatible and self-incompatible plants signifies that mate choice may have very different consequences for different plant species. Why this should be so is a very interesting question, and one that we have not completely answered. Ecologists have attempted to answer the question by comparing the environments of self-compatible and self-incompatible plants in an attempt to discern differences that might indicate what environmental conditions favor each compatibility system. One pattern that has emerged from this comparison is that self-compatible plants often inhabit sites that have been recently disturbed; communities of plants that have not been disturbed for a long time often have a relatively high proportion of self-incompatible plants (Baker 1965, but see Jain 1976 for a different perspective). The ability to self-fertilize may be quite valuable to plants that colonize disturbed sites since other plants of the same species may not exist there, especially if the disturbance (fire, landslide, bulldozer, etc.) was very recent. A self-compatible plant will be able to reproduce and start a new population in the absence of other plants of the same species. Today, we live in a landscape dominated by disturbed habitats, so colonizing plants or "weeds" seem to occur everywhere. However, prior to human settlement, prime weed habitat may have been much less extensive and much more ephemeral.

If self-compatibility is good for weeds, why is it not good for other plants? At least a couple of tentative answers can be provided for this question. First, self-compatibility may result in a decrease of the genetic quality of offspring. Plants as well as other organisms may carry genes that cause defects. Since most organisms carry two copies of any particular gene, it is possible for an individual to carry a defective gene without suffering ill effects. A "heterozygous" individual will have two different copies of the gene in question: one may be normal and produce no ill effect whereas the other may be defective. If the normal copy masks the ill effects of the defective copy, the individual does not suffer. However, if the individual were to carry two defective copies of the gene, it would suffer ill effects. Such an individual would be "homozygous" for the defective copy of the gene. A heterozygous individual that carries a defective copy of the gene stands a 25% chance of producing defective offspring if it self-fertilizes (see fig. 1). By avoiding self-fertilization and mating with other individuals, the probability of producing defective offspring drops. Thus natural selection should favor organisms that avoid self-fertilization by being self-incompatible except in cases where the advantages of self-fertilization outweigh the costs of producing genetically defective offspring.

Disturbed habitats seem to provide conditions in which the advantages of self-fertilization can outweigh the costs.

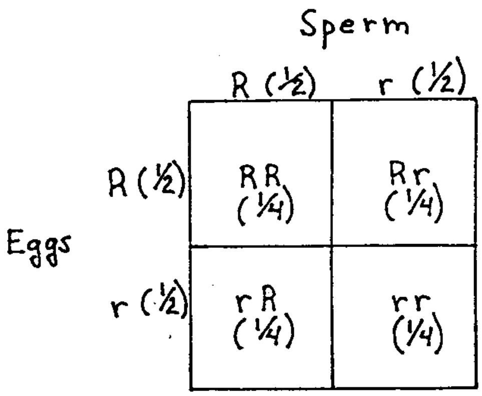

Fig. 1

The consequences of self-fertilization for a heterozygote. This heterozygote carriers 2 copies, R and r, of a particular gene. The r copy is defective and causes abnormalities in the homozygous (rr) state. Half of the heterozygote's sperm and half of it's eggs will carry the r copy; the other half of each will carry the R copy. Assuming random union of the gametes, the offspring will have the genotypes indicated inside the boxes. The numbers in parentheses indicte proportional representation.

Although self-fertilization should lower the quality of offspring, self-fertilizing plants do not always show signs of suffering from genetic defects. Species such as wild oats (Avena sp.) are predominantly self-fertilizing yet they continue to produce perfectly viable offspring (Allard et al. 1968). Presumably, natural selection operates to eliminate individuals with genetic defects (Lewontin 1974), thus reducing the frequency of defective genes in populations of self-fertilizing species. Individuals without defective genes can self-fertilize without producing defective offspring. But why doesn't natural selection rid all species of defective genes? Species that are self-incompatible or that are self-compatible but do not self-fertilize very often (collectively known as "outcrossing" species) will not produce individuals that are homozygous for defective genes at nearly the rate that self-fertilizing species will. In outcrossing species, many defective genes will be masked in heterozygous individuals, and natural selection will not be able to eliminate them. Self-compatible plants that experience little self-fertilization [for a review of mechanisms other than self-incompatibility that help to avoid self-fertilization, see Frankel and Galun (1977)] are likely to experience negative effects from enforced self-fertilization (Wright 1977).

A second explanation for the existence of both self-compatible and self-incompatible plants concerns the need for producing new genotypes. The term "genotype" refers to the collection of genes that an individual organism carries. The individual's genes interact with environmental factors to determine the individual's phenotype or observable characteristics, whether they be morphological, physiological, or behavioral. A genotype that results in a good phenotype for a particular set of environmental conditions may result in a poor phenotype under different environmental conditions. Therefore, a change in environmental conditions may make it possible for a new genotype to displace the genotype that was best suited to the old conditions. In changing environments, organisms that have the capability to produce offspring with a variety of genotypes may have an advantage over organisms that lack such a capability. Even plants that are predominantly self-fertilized can produce genotypically diverse offspring, assuming the parent plants carry different copies (are heterozygous) for at least one gene. However, offspring that result from crossing different individuals are likely to represent a greater variety of genotypes than offspring resulting from self-fertilization. This is because the diversity of genes contained in two individuals is likely to be much greater than the diversity contained in one individual. Remember, although any individual may carry only two copies of a gene, a population may contain many different copies of the gene. Thus the union of genetic material from different individuals may produce a tremendous array of new genotypes. Many of these new genotypes may not be well adapted to a new environment, but a large diversity of genotypes helps to ensure that at least a few will be able to adapt. G.C. Williams (1975) drew an analogy between an organism producing a diverse array of genotypes and a person buying lottery tickets. To maximize his or her chances of winning the lottery, a person will buy as many different lottery numbers as possible; buying multiple copies of the same number would be a waste of money. In a sense, a plant that lives in a changing environment may be maximizing its chances of winning an evolutionary lottery by mating with as many other plants as possible. However, mating with another plant does not guarantee high quality offspring. Mating with a plant that carries inferior genes might be worse than self-fertilization. If potential mates are not of equal quality, plants should benefit from the ability to select the highest quality mate available.

Not All Mates Are Equal

We know that many animals are capable of choosing mates (Bateson 1983), and the theory of sexual selection (Darwin 1871) was initially formulated to explain the evolution of secondary sexual traits in animals as a consequence of mate selection. That plants growing in natural populations vary in quality is well known (Stebbins 1950); therefore, the concept of mate choice that was developed for animals should theoretically apply to plants. However, until recently, we had little evidence that plants can actively select mates so as to maximize the number of high quality offspring that they produce.

A number of studies published within the last ten years demonstrate that plants have sophisticated mechanisms for mate choice. Pollinations between plants separated by varying distances may alter the number of seeds produced. For example, in *Delphinium nelsonii* seed production per flower is maximized by pollination between plants separated by less than 10 meters (Price and Waser 1979). In *Ipomopsis aggregata*, the optimum pollination distance seems to be between 1 and 100 meters (Waser and Price 1983). Waser and Price (1983) attributed these patterns to inbreeding depression when pollination occurred over short distances and to "outbreeding" depression when pollination occurred over long distances. Inbreeding depression is a well known phenomenon that results from the expression of deleterious genes in the offspring of genetically related individuals (Spiess 1977). Plants separated by short distances are likely to be genetic relatives that carry the same deleterious genes which can be passed on in the homozygous state to their offspring. Outbreeding involves mating between individuals that are not closely related. Plants separated by long distances are not likely to be closely related and may be genetically quite different (Levin and Kerster 1974, Schaal 1975). Outbred offspring from parent plants that are too different from a genetic standpoint may receive genes that do not function well together, resulting in deviations from the "adaptive norm" (Spiess 1977). Extreme outbreeding may depress reproductive success just as extreme inbreeding may do, hence the term "outbreeding depression."

The extent to which outbreeding depression occurs in natural plant populations is not known. My own research with Palicourea riparis, a tropical rainforest shrub, indicates that outbreeding depression does not occur. In fact, I found no correlation between seed production and the distance between pollen recipient and donor (Melampy, unpublished). However, its apparent existence in some species suggests that mating relationships among plants in natural populations are much more complex than previously suspected.

Other studies are confirming the complexity of plant mating relationships. Research on trumpet creeper, Campsis radicans, indicates that the compatibility between pollen donor and pollen recipient may vary dramatically even within small populations (Bertin 1982). Trumpet creeper "x" may be a very poor pollen donor for trumpet creeper "y" but a very good donor for creeper "z". Other species are known to show similar patterns. For example, Pfahler (1967) in a study of corn showed that different pollen donors are selected by different pollen recipients when mixtures of pollen from different donors were applied to the stigmas of different recipients.

What mechanisms permit a plant to control the pollen it receives or to choose among different pollen types that land on its stigmas? Mechanisms such as flower number, timing of flower production, attractiveness to pollinators of nectar rewards, and length of stigma receptivity affect the array of pollen types that a flower receives (Janzen 1977). Once pollen has reached the stigma, genetic interactions between tissues of the pollen grain and the stigma or between the pollen tube and the style or events that occur after the pollen tube has penetrated the ovary will determine which sperm nucleus will actually fuse with the egg nucleus (Nettancourt 1977, Willson and Burley 1983). Even after fertilization occurs, the selective process may continue. Many plants initiate more seeds and fruits than they mature, and the possibility exists that selective abortion of seeds and fruits occurs (Stephenson and Bertin 1983).

To date we have only limited information as to the consequences of mate selectivity among plants; however, the information that is available suggests that mate selectivity tends to increase offspring quality. Price and Waser (1979) found that seeds produced as a result of pollinations between plants separated by the "optimal" distance were superior with respect to germination and seedling growth compared to seeds produced by pollinations over less than optimal distances. Pollen competition experiments have been designed to study the effects on offspring quality of intense competition among pollen grains to fertilize available eggs (Mulcahy and Mulcahy 1975, Mulcahy et al. 1975). These experiments have generally shown that intense pollen competition enhances the vigor of seedlings. Studies of selective seed and fruit abortion indicate that plants can discriminate among offspring and abort them on the basis of genetic quality. For example, in the milkweed Asclepias speciosa the pattern of fruit abortion favors fruits sired by pollen donors that tended to produce fruits with more and larger seeds (Bookman 1983).

Much remains to be learned concerning mate choice in plants. Many little understood plant characteristics, such as double fertilization in angiosperms, may prove to have significant roles in mate assessment (Willson and Burley 1983). At every step in the process of mate choice, we are discovering that plants are indeed very sophisticated organisms.

Conclusion. Though appearing to have less flexibility in the realm of mate choice than animals, recent investigations are revealing that complex mechanisms for mate choice do exist in plants and that plant mate choice can have a significant impact on offspring quality. Thus the evolution of plant reproductive traits should not be viewed as a simple process in comparison to what has occurred in animals. Plant evolution is subject to the same forces, including sexual selection, that affect animal evolution. Despite their apparent sessile nature, plants interact with other plants to a very great extent, and plant characteristics must be interpreted with that in mind. We do a great disservice to our children and our students when we portray plants as nothing more than green machines that photosynthesize to produce carbohydrates for animals. The intricacies of plant sexual behavior should be enough to convince anyone that plants are of tremendous interest in their own right.

Michael Melampy is an Assistant Professor of Biology at Baldwin-Wallace College in Berea. He spent time in the Peace Corps in Columbia, S. America, and taught in Puerto Rico.

* * * * *

LITERATURE CITED

Allard, R.W., A.L. Kahler, and P.L. Workman. 1968. The genetics of inbreeding populations. Advances in Genetics 14:55-131.

Baker, H.G. 1965. Characteristics and modes of origin of weeds. In: H.G. Baker, ed., Genetics of Colonizing Species, pp. 147-72, Academic Press, New York.

Bateson, P., ed. 1983. Mate Choice. Cambridge University Press, New York.

Bell, G. 1982. The Masterpiece of Nature: The Evolution and Genetics of Sexuality. University of California Press, Berkeley, Calif.

Bertin, R.I. 1982. Paternity and fruit production in trumpet creeper (Campsis radicans). American Naturalist 119:694-709.

Bookman, S.S. 1984. Evidence for selective fruit production in Asclepias. Evolution 38:72-86.

Darwin, C. 1859. On the Origin of Species. John Murray, London.

_______. 1871. The Descent of Man and Selection in Relation to Sex. John Murray, London.

Frankel, R. and E. Galun. 1977. Pollination Mechanisms, Reproduction, and Plant Breeding. Springer-Verlag, New York.

Jain, S.K. 1976. The evolution of inbreeding in plants. Annual Review of Ecology and Systematics 7:469-95.

Janzen, D.H. 1977. A note on optimal mate selection by plants. American Naturalist 111:365-71.

Levin, D.A. and H.W. Kerster. 1974. Gene flow in seed plants. Evolutionary Biology 7:139-220.

Lewontin, R.C. 1974. The Genetic Basis of Evolutionary Change. Columbia University Press, New York.

Maynard Smith, J. 1978. The Evolution of Sex. Cambridge University Press, New York.

Mulcahy, D.L. and G.B. Mulcahy. 1975. The influence of gametophytic competition on sporophytic quality in Dianthus chinensis. Theoretical and Applied Genetics 46:277-80.

Nettancourt, D. de. 1977. Incompatibility in Angiosperms. Springer-Verlag, New York.

Pfahler, P.L. 1967. Fertilization ability of maize pollen grains. II. Pollen genotype, female sporophyte and pollen storage interactions. Genetics 57:513-21.

Price, M.V. and N.M. Waser. 1979. Pollen dispersal and optimal outcrossing in Delphinium nelsonii. Nature 277:294-96.

Schaal, B.A. 1975. Population structure and local differentiation in Liatris cylindracea. American Naturalist 109:511-28.

Schemske, D.W., M.F. Willson, M.N. Melampy, L.J. Miller, L. Verner, K.M. Schemske, and L.B. Best. 1978. Flowering ecology of some spring woodland herbs. Ecology 59:351-66.

Spiess, E.B. 1977. Genes in Populations. John Wiley and Sons, New York.

Stebbins, G.L. 1950. Variation and Evolution in Plants. Columbia University Press, New York.

Stephenson, A.G. and R.I. Bertin. 1983. Male competition, female choice, and sexual selection in plants. In: L. Real, ed., Pollination Biology, pp. 110-49, Academic Press, New York.

Waser, N.M. and M.V. Price. 1983. Optimal and actual outcrossing in plants. In: C.E. Jones and R.J. Little, eds., Handbook of Experimental Pollination Biology, pp. 341-59, Van Nostrand Reinhold, New York.

Williams, G.C. 1975. Sex and Evolution. Princeton University Press, Princeton, New Jersey.

Willson, M.F. and N. Burley. 1983. Mate Choice in Plants. Princeton University Press, Princeton, New Jersey.

Wright, S. 1977. Evolution and the Genetics of Populations, Vol. 3: Experimental Results and Evolutionary Deductions. University of Chicago Press, Chicago, Illinois.

*****

(Continued from Page 11)

south, so you can now go direct from Brighton to Liverpool, or is it Dover to Manchester? Anyway, if you want to get off in London, you stop at Kensington Olympia. It's not exactly Euston or Victoria, facility-wise; in fact, it's more like an old-style country station, especially if you look north into the mysterious green cutting which heads up to Willesden, Watford and the north.

It's also like a country station in that trains pull through only every half hour or so, stopping briefly for an exchange of hostages and then sliding off again. Waiting aimlessly for a train to arrive, I wandered curiously up through the large car park which now occupies most of the old station, and bingo! I found myself in a nature reserve again. There's a large patch there of what developers call waste land or what you and I would call a wild-flower sanctuary, so isolated that you can't hear any noise of traffic, only the singing of birds and the sighing of wind in the trees...

It was childhood revisited. Mark you, they haven't got the range of flowers that was on offer in my childhood, but they have got some very handsome speedwell, and flourishing buddleia with the accompanying butterflies, and herb robert, and the classy purple and yellow blooms of the woody nightshade, which I always thought a most under-rated flower, probably because it was poisonous, and old man's beard, and something which I think is called mimulus, though I shall have to look that up. And what they have got most of is blackberries, great sheaves of juicy, shiny, bulging blackberries, not the blackberries which turn out to be hairy, pippy, leathery imitation blackberries, but the real McCoy, suitable for taking home and converting into black lustrous syrup like North Sea oil.

Mark you, when I first found them they were still at the red stage, adolescent O-level blackberries, so although I was tempted to write a nostalgia-revisited piece then and there, I thought it best to wait until they had ripened. Now they have, and I have picked as many blackberries as I can handle, so I don't mind mentioning my discovery in print, even at the risk of finding a **No Journalists or Train Buffs Admitted** notice next time I go back. I just want to get one thing straight. I am not a train buff. I am, if anything, a wildflower nut. That's what railways are really all about, even in the middle of West London.

This has been reprinted from the London Times, Tuesday, September 16, 1986.

NATIVE PLANT SOCIETY OF NORTHEASTERN OHIO

Founding Chapter Of

THE OHIO NATIVE PLANT SOCIETY

6 Louise Drive Chagrin Falls, Ohio 44022

NON-PROFIT
ORGANIZATION
U.S. Postage
PAID
Chagrin Falls, OH
Permit No. 11

Tom Sampliner
2472 Overlook Rd. Suite #8
Cleveland Hts.,OH 44106

ADDRESS CORRECTION REQUESTED

Memberships are **DUE FOR RENEWAL** on January 1, 1987. Please continue to support your Society and renew at the **highest** possible category. Those of you who send us Sustaining and Patron memberships are enabling us to go on with our worthwhile projects. An active membership just about pays for the newsletter costs. However, economics aside, we need **EACH** of your memberships and each year we get stronger and better. The 1987 Program and Field Trips schedule will be worthwhile.

Please enroll me as a member of the NATIVE PLANT SOCIETY OF NORTHEASTERN OHIO.

☐ ACTIVE.........$ 7.50
☐ FAMILY $15.00
☐ SUSTAINING ...$25.00
☐ PATRON........$50.00

Dalibarda repens

Membership runs from January through December and is not pro-rated.

Make checks payable to: NATIVE PLANT SOCIETY
6 Louise Drive, Chagrin Falls, Ohio 44022

Name: ______________________ Phone: __________

Address: ______________________

City/State: ______________________ Zip: __________